MINISTRY OF ENVIRONMENT WATERS AND FORESTS

NATIONAL ENVIRONMENTAL PROTECTION AGENCY

INDICATORS REPORT YEAR 2021

EXECUTIVE SUMMARY

The report of indicators for the year 2021 is a selection of the indicators found in the Report on the State of the Environment in Romania for the year 2021 (published on the ANPM website: www.anpm.ro), elaborated with data of public interest provided by the institutions mentioned in the report or obtained from relevant European or international environmental organizations' websites. The report provides assessments of the state of the environment, scenarios regarding its evolution, information on the actions being undertaken and what must be done or can be done to improve it, in the light of the 37 Core Set Indicators (CSI) established by the European Environmental Agency (AEM/EEA) taken over and supplemented with other 34 specific indicators, through OMMAP no. 618/30.03.2015, for the most correct characterization of the 12 thematic areas analyzed in the report. Therefore, the current report aims to describe, as close as possible to the European model, the way in which environmental policies are implemented and how they evolve, the trends in this field and the forecast of the impact at the level of Romania.

Thanks everyone!

Development team, Bucharest 2022

Translated by, Elena Emilia Neacșu-

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CONTENTS

SELECTIVE LIST OF ABBREVIATIONS AND ACRONYMS

AGA	Annual Growth Analysis
WBA	Water Basin Administration
DSWBA	Dobrogea-Seaside Water Basin Administration
NCA	Navigable Canal Administration
EEA	European Environment Agency
EFA	Environmental Fund Administration
CASHF	County Association of Sports Hunters and Fishermen
MA LIOP	The Management Authority for the Large Infrastructure Operational Program
MA OPAC	Managing Authority of the Operational Program Administrative Capacity
NARW	National Administration of Romanian Waters"
NACREA	National Agency for Cadastre and Real Estate Advertising
NALI	National Agency for Land Improvements
NMA	National Meteorological Administration
NAFA	National Agency for Fisheries and Aquaculture
NACP	National Authority for Consumer Protection
NEPA	National Environmental Protection Agency
NRACSPU	National Regulatory Authority for Community Services of Public Utilities
NAHCSP	National Agency for Hazardous Chemical Substances and Preparations
NSVFSA	National Sanitary, Veterinary and Food Safety Authority
APSFR	Areas with Potentially Significant Flood Risk
EPA	Environmental Protection Agency
AOT40	Accumulated Ozone exposure over a Threshold of 40 ppb (=80 μg/m^3)
RWA	Romanian Water Association
SYR	Statistical Yearbook of Romania
G	(Ecological status) good
HB	Hydrographic basin
BAT	Best Available Techniques
CDSTU	Creation of the Database of Soil - Terrain Units
EBRD	European Bank for Reconstruction and Development
Bio	Biological elements
BATRD	Best Available Techniques Reference Documents
WB	Water Body
AWB	Artificial water body
CAD	Chemical Agents Directive
CANE	Classification of Activities in the National Economy
CAFE	Clean Air For Europe
HMWB	Heavily modified water body
CBC	Cross Border Cooperation
BOC	Biochemical oxygen content at 5 days
CGAP	Code of Good Agricultural Practices
COC-pbm	Chemical oxygen content – potassium bichromate method
CDC	Center for Disease Control
CDM	Clean Development Mechanism
DBSC	The Danube-Black Sea Canal

CE	Council of Europe
EEC	European Economic Community
ESC	Economic and Social Cohesion
ETP	Electro-thermal power plant
CFC	Chlorofluorocarbons
TCC	Temperate continental climate
WTCC	Warm temperate continental climate
CITSWFF	Convention on International Trade in Species of Wild Flora and Fauna
CIS WFD	Common Implementation Strategy for the Water Framework Directive
CLP	Classification, Labeling and Packaging
MAC	Maximum Admissible Concentration
CMIP	Climate Model Intercomparison Project
CMD	Carcinogens and Mutagens Directive
CMRTS	Carcinogenic, Mutagenic and Reproductive Toxic Substances
NCCNA	National Commission for the Control of Nuclear Activities
NOEDC	National Oceanographic and Environmental Data Center (within INCDM Grigore Antipa – Constanța)
NCMRCE	National Center for Monitoring Risks in the Community Environment
NCHPPP	National Commission for Homologation of Plant Protection Products
NBPC	National Biocide Products Commission
NCCZ	National Committee of the Coastal Zone
EC	The European Commission
CCSTC	The Competence Center for Space Technologies in Constanța
VOC	Volatile Organic Compounds
NMVOC	Non-Methane Volatile Organic Compounds
PAMNC	Porta Albă-Midia Năvodari Canal
CPR	Common Provisions Regulation (EU)
CPFEU	Catch per fishing effort unit
SCP/SIP	The action plan regarding sustainable consumption and production/ (and) sustainable industrial policy
CBS	Commission on Biological Safety
DSWD	Dobrogea Seaside Waters Directorate
CDARD	County Directorate for Agriculture and Rural Development
WFD	Water Framework Directive (Directive 2000/60/EC)
GDECIMIES	General Directorate of the European Commission for the Internal Market, Industry, Entrepreneurship and SMEs
CMD	Carcinogens and mutagens directive
MESFD	Marine Environment Strategy Framework Directive
DDT	1,1,1 – Trichloro – 2,2 – bis (4 chlorophenyl) ethane
CAD-MARD	County agricultural directorates - Ministry of Agriculture and Rural Development
WEEE	Waste of Electrical and Electronic Equipment
CTCC	Cool temperate continental climate
DMC	Domestic Material Consumption
DIM	Direct inputs of materials
PH	Public Health

DPSIR	Driver-Pressure-State-Impact-Response – Human Activity-Pressure-State-Impact-Response
EEE	Electrical and electronic equipment
ECA	European Chemicals Agency
EEA	European Environment Agency
EFSA	European Food Safety Authority
PPE	Personal Protective Equipment
EMAS	Eco-Management and Audit Scheme - Community Environmental Management and Audit Scheme
ES	European standard
ENSO	El Niño-Southern Oscillation
EQS	Environmental Quality Standard
E-PETR	European Pollutant Emission and Transfer Register
ESS SDI	Population connected to wastewater treatment systems
EA-SHW	European Agency for Safety and Health at Work
EU TEPI WP-5	Purified water – Collected water
EUROSTAT	Statistical Commission of the European Union
Eurostat ETE	Population connected to urban wastewater treatment plants
ENIS	European Nature Information System
VG	(ecological condition) very good
PB	Phytobenthos
CF	Cohesion Fund
GPCE	General physico-chemical elements
EAFRD	European Agricultural Fund for Rural Development
EFRD	European Fund for Regional Development
PP	Phytoplankton
RF	Rural fund
UF	Urban fund
SF	Suburban fund
CGAEC	Code for Good Agricultural and Environmental Conditions
GEF	Global Environment Facility
NEG	National Environmental Guard
GHG	Greenhouse Gas
GHG	Greenhouse gases
GIS	Geographic Information System
H	Mountain climate
GD	Government decision
PAH	Polyaromatic hydrocarbons
HCB	Hexachlorobenzene
HCFCs	Hydrochlorofluorocarbons
HCH	Hexachlorocyclohexane
HFC	Hydrofluorocarbons
I	Industrial
ICP	International Cooperative Programme
RIPA	Research Institute for Pedology and Agrochemistry
NRDI-PAEP	National Research-Development Institute for Pedology, Agrochemistry and Environmental Protection

ICPDR	International Commission for the Protection of the Danube River
NRDI	National Research and Development Institute
NIS	National Institute of Statistics
IED	The Industrial Emissions Directive
ITE	International Trading of Emissions
LCP	Large Combustion Plants
SME	Small and Medium Enterprises
IMP	Integrated Maritime Policy
DD-NIRD	The "Danube Delta" National Institute for Research and Development
KT	Kilo tons
NMRDI GA	National Marine Research and Development Institute Grigore Antipa
NRDI-MGG-GEOECOMAR	National Research-Development Institute for Marine Geology and Geo-ecology - GEOECOMAR Bucharest
NRDI EPB	National Research and Development Institute for Environmental Protection Bucharest
NIGGE	National Inventory of Greenhouse Gas Emissions
NIHWM	National Institute of Hydrology and Water Management
NIS	National Institute of Statics
IUCN	International Union for Conservation of Nature
IPCC	Intergovernmental Panel on Climate Change
PICP	Prevention and Integrated Control of Pollution
PASI	Pre-Accession Structural Instrument
IOS	International Organization for Standardization
SIVTR	State Institute for Varieties Testing and Registration
THI	Temperature-humidity index
IUCNR	International Union for the Conservation of Nature and its Resources
JI	Joint implementation
LCP	Large Combustion Plant
EDL	Emission Derivative Limits
ER	Equivalent residents
NRLER	National Reference Laboratory for Environmental Radioactivity
APEDV	Air pollutant emissions data viewer (LRTAP Convention)
LULUCF	Land use, land use change and forests
MARD	Ministry of Agriculture and Rural Development
IMCZ	Integrated Management of the Coastal Zone
ME	Ministry of the Environment
AA	Annual average (arithmetic)
CBMSP-BS-RB	Cross-border maritime spatial planning in the Black Sea – Romania and Bulgaria
MBP	"Man and the Biosphere" Program
MWF	Ministry of Waters and Forests
MEWF	Ministry of Environment, Waters and Forests
MRDPA	Ministry of Regional Development and Public Administration
MEF	Ministry of European Funds
MLWA	Marine Litter Watch App
MNERS	Modeling Nutrient Emissions in River Systems
MH	Ministry of Health
MSFD	Marine Strategy Framework Directive

TSM	Total suspended matter
MZB	Macrozoobenthos (benthic macroinvertebrates)
N	NUTRIENTS
NAO	The North Atlantic Oscillation
NAP	National Allocation Plans
NR	Not rated
NT	Total nitrogen
PLLVW	Pollutant loading limit values of wastewater
NAUI	National Association of Underwater Instructors
NWRM	Natural Water Retention Measures
CB	Control body
OECD	Organization for Economic Cooperation and Development
OECD CEI	Population connected to wastewater treatment plants – OECD indicator
OECD KEI	Degrees of connection to wastewater treatment plants – OECD indicator
COPAS	County Office of Pedological and Agrochemical Studies
OM	Order of the Minister
GEO	The Government's Emergency Ordinance
D O	Dissolved oxygen
SDO	Substances that destroy the ozone layer
NGO	Non-governmental organization
UN	United Nations
OPAS	Office of Pedological and Agrochemical Studies
IWUO	Irrigation water user organizations
LEAP	Local Environmental Action Plan
AT	Alert threshold
HBMP	Hydrographic Basin Management Plan
PADI	Professional Association of Diving Instructors
PCB	Polychlorinated biphenyls
GEP	Good ecological potential
MoEP	Moderate ecological potential
MaxEP	Maximum ecological potential
PET	Polyethylene terephthalate
PFC	Perfluorocarbons
IT	Information threshold
GDP	Gross domestic product
WMP	The watershed management plan
NAPEP	The National Action Plan for Environmental Protection
NDP	The National Development Plan
NRDP	National Rural Development Program
NWMP	The National Waste Management Plan
NPRMIIR	The National Program for the Rehabilitation of the Main Irrigation Infrastructure in Romania
NMP	The National Management Plan
NRP	National Reform Program
TAOP	Technical Assistance Operational Program
ACOP	Administrative Capacity Operational Program
LIOP	Large Infrastructure Operational Program

POPs	Persistent Organic Pollutants
SOP	Sectoral Operational Programme
PPPMFE	Plans for the Prevention, Protection and Mitigation of Flood Effects
RWMP	Regional Waste Management Plan
SP	Specific pollutants
MSP	Maritime Spatial Planning
GMHPs	Genetically modified high plants
TP	Total phosphorus
STP	Short term pollution
Q	Flow rate m^3/s
DDBR	Danube Delta Biosphere Reserve
RBLM	Risk-Based Land Management
EQR	Ecological quality report
REACH	The system of registration, evaluation and authorization of chemical substances
AR	Arranged Regime
NR	Natural Regime
ERPE	European Register of Pollutant Emissions
NAQMN	National Air Quality Monitoring Network
NNMRE	National Network for Monitoring the Radioactivity of the Environment
CSR	Country Specific Recommendations
RAU	Register of Aquaculture Units
NSSD	National Strategy for Sustainable Development
SCA	Special Conservation Areas
ICMS	International Chemicals Management Strategy
EPARD	European Program for Agriculture and Rural Development
SCI	Sites of Community Importance
PSDN	Program on the sustainable development network
SDG	Sustainable Development Goals
ES	Ecological status
SEVESO	Control of major accidents involving dangerous substances
SF6	Sulfur Hexafluoride
NWER	National warning/alarm system for environmental radioactivity
NSELAGHGE	National System for Estimating the Level of Anthropogenic Greenhouse Gas Emissions
NSEIMAQ	The National System for the Evaluation and Integrated Management of Air Quality
NWMS	National Waste Management Strategy
NPC	National Petroleum Company
NSFA	National Strategy for Fisheries and Aquaculture
ASAP	Areas of Special Avifaunistic Protection
RS	Romanian standard
LLC	Limited liability company
SHW	Safety and Health at Work
UQHL	The upper quasi-homogeneous layer
ERSS	Environmental Radioactivity Surveillance Strategy
PTS	Permanent Technical Secretariat
SWOT	Strengths Weaknesses Opportunities Threats – organizational diagnosis method

T	Transport
EU	European Union
UNDP	The United Nations Development Program
UNESCO	The United Nations Educational, Scientific and Cultural Organization
UNFCCC	The United Nations Framework Convention on Climate Change
UV	Ultraviolet Rays
V	Total volume m^3
LV	Limit value
ELV	Emission Limit Values
ELV	End-of-life vehicles
WQ	Water Quality / Model for water quality forecasting
WEI	Water Exploitation Index
WFEA	World Forum for Ecological Acoustics
WWF	World Wide Fund for Nature
WISE	The Water Information System for Europe
LSA	Large supply area
NVA	Nitrate Vulnerable Areas

LIST OF SPECIFIC INDICATORS FOR ROMANIA

***Source**: Guide for elaboration of the Annual Report on the State of the Environment according to the requirements of the European State of the Environment Report (SOER) - OMMAP no. 618/30.03.2015*

***Note**: Indicators that cannot be found in the report could not be processed due to lack of data*

AIR POLLUTION

- RO 01 CSI Indicator 01 – Emissions of acidifying substances
- RO 02 CSI Indicator 02 – Ozone precursor emissions
- RO 03 CSI Indicator 03 – Primary particle emissions and secondary particle precursors
- RO 04 CSI Indicator 04 – Exceeding the air quality limit values in urban areas
- RO 05 CSI Indicator 05 – Exposure of ecosystems to acidification, eutrophication and ozone

BIODIVERSITY

- RO 07 CSI Indicator 07 – Species of European interest
- RO 08 CSI Indicator 08 – Designated protected areas
- RO 09 CSI Indicator 09 – Species diversity

CLIMATE CHANGE

- RO 06 CSI Indicator 06 – Production and consumption of substances leading to the destruction of the ozone layer
- RO 10 CSI Indicator 10 – Greenhouse gas emissions trend
- RO 11 CSI Indicator 11 – Greenhouse gas emission projections
- RO 12 CSI Indicator 12 – Global, european and national level temperature
- RO 13 CSI Indicator 13 - Atmospheric concentrations of greenhouse gases

LAND AND SOIL

- RO 14 CSI Indicator 14 – Land occupancy
- RO 15 CSI Indicator 15 – Recorded progress in the management of contaminated sites

WASTE

- RO 16 CSI Indicator 16 – Municipal waste generation
- RO 17 CSI Indicator 17 – Generation and recycling of packaging waste

WATER

- RO 18 CSI Indicator 18 – Use of fresh water resources
- RO 19 CSI Indicator 19 – Oxygen-consuming substances in rivers
- RO 20 CSI Indicator 20 – Nutrients in water
- RO 21 CSI Indicator 21 – Nutrients in transitional, coastal and marine waters
- RO 22 CSI Indicator 22 – Bathing water quality
- RO 23 CSI Indicator 23 – Chlorophyll A from transitional, coastal and marine waters
- RO 24 CSI Indicator 24 – Urban wastewater treatment

AGRICULTURE

- RO 25 CSI Indicator 25 – Gross balance of nutrients
- RO 26 CSI Indicator 26 – Area intended for organic farming

ENERGY

- RO 27 CSI Indicator 27 – Final energy consumption by sector type
- RO 28 CSI Indicator 28 – Primary energy intensity
- RO 29 CSI Indicator 29 – Primary energy consumption by fuel type -
- RO 30 CSI Indicator 30 – Primary energy consumption produced from renewable energy sources
- RO 31 CSI Indicator 31 – Electricity consumption produced from renewable energy sources

FISHING

- RO 32 CSI Indicator 32 – State of marine fish stocks
- RO 33 CSI Indicator 33 – Aquaculture production
- RO 34 CSI Indicator 34 – Fishing fleet capacity

TRANSPORT

- RO 35 CSI Indicator 35 – Passenger transport demand
- RO 36 CSI Indicator 36 – Freight transport demand
- RO 37 CSI Indicator 37 – Use of alternative and cleaner fuels

AIR POLLUTION

- RO 38 APE Indicator 05 – Heavy metal emissions
- RO 39 APE Indicator 06 – Emissions of persistent organic pollutants

BIODIVERSITY

- RO 40 SEBI Indicator 05 – Habitats of European interest in Romania
- RO 41 SEBI Indicator 07 – Nationally designated protected natural areas
- RO 42 SEBI Indicator 08 – Protected areas of community interest designated under the Habitats and Birds Directive
- RO 43 SEBI Indicator 10 – Invasive alien species
- RO 44 SEBI Indicator 13 – Fragmentation of natural and semi-natural areas
- RO 45 SEBI Indicator 17 – Forest: forest fund, timber growth and harvesting
- RO 46 SEBI Indicator 18 – Forest: dead wood (dry)

CLIMATE CHANGE

- RO 47 CLIM Indicator 02 – Rainfall average
- RO 48 CLIM Indicator 04 – Extreme precipitation
- RO 49 CLIM 08 Indicator – Degree of snow layer
- RO 50 CLIM Indicator 12– Sea level rise at global, European and national level
- RO 51 CLIM Indicator 13–Increase in sea water temperature
- RO 52 CLIM Indicator 16 – Watercourse flow rates
- RO 53 CLIM Indicator 17 – Floods
- RO 54 CLIM Indicator 18 – Hydrological drought
- RO 55 CLIM Indicator 27 – Soil organic carbon
- RO 56 CLIM Indicator 30 – Growing season of agricultural crops
- RO 57 CLIM Indicator 32 – Productivity of agricultural crops due to lack of water resources
- RO 58 CLIM Indicator 34 – Areas occupied by forests
- RO 59 CLIM Indicator 35 – Risk of forest fires
- RO 60 CLIM Indicator 36 – Extreme temperatures and health
- RO 61 CLIM Indicator 46 – Flooding and health
- RO 62 CLIM Indicator 47 – Number of degree-days for heating

WASTE

- RO 63 Waste Indicator 003 – Electrical and electronic equipment waste

WATER

- RO 64 WHS Indicator 01 – Pesticides in groundwater
- RO 65 WHS Indicator 02 – Hazardous substances in watercourses
- RO 66 WHS Indicator 03 – Hazardous substances in lakes
- RO 67 WEC Indicator 04 – Watercourse classification schemes

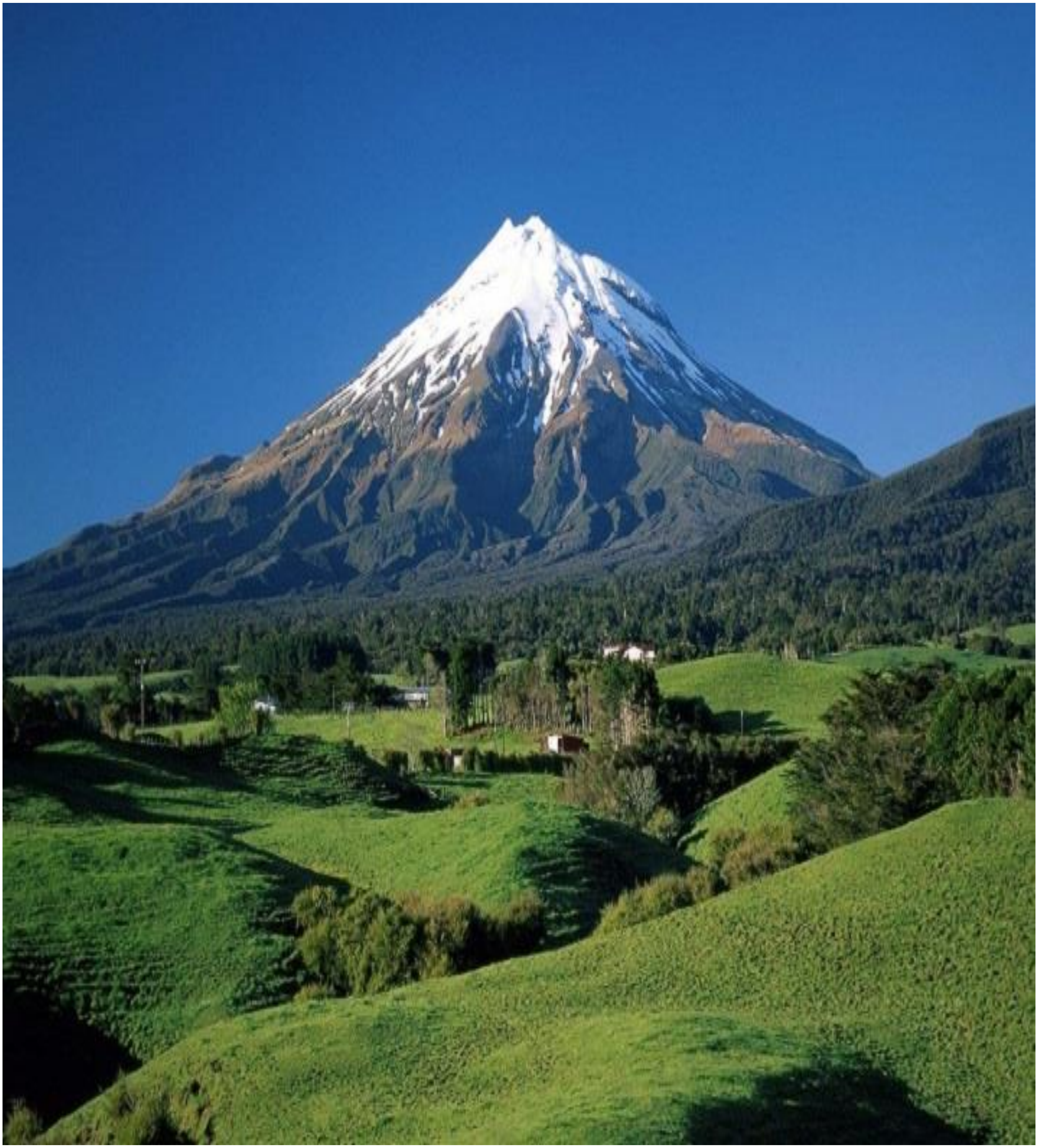
TRANSPORT

- RO 68 Indicator TERM Indicator 08 – Land occupancy through transport infrastructure

- RO 69 TERM Indicator 11 – End-of-life vehicles

SUSTAINABLE CONSUMPTION AND PRODUCTION

- RO 70 SCP033 Indicator – Number of EMAS and ISO 14001 certified organizations
- RO 71 SCP Indicator - Number of products and services labelled with the European Eco-label



I. ENVIRONMENTAL AIR QUALITY AND POLLUTION

ENVIRONMENTAL AIR QUALITY STATUS

The ambient air quality can be highlighted by choosing some indicators to characterize this environmental factor. The confidence level of these indicators depends on the quality of the data used, which can be:

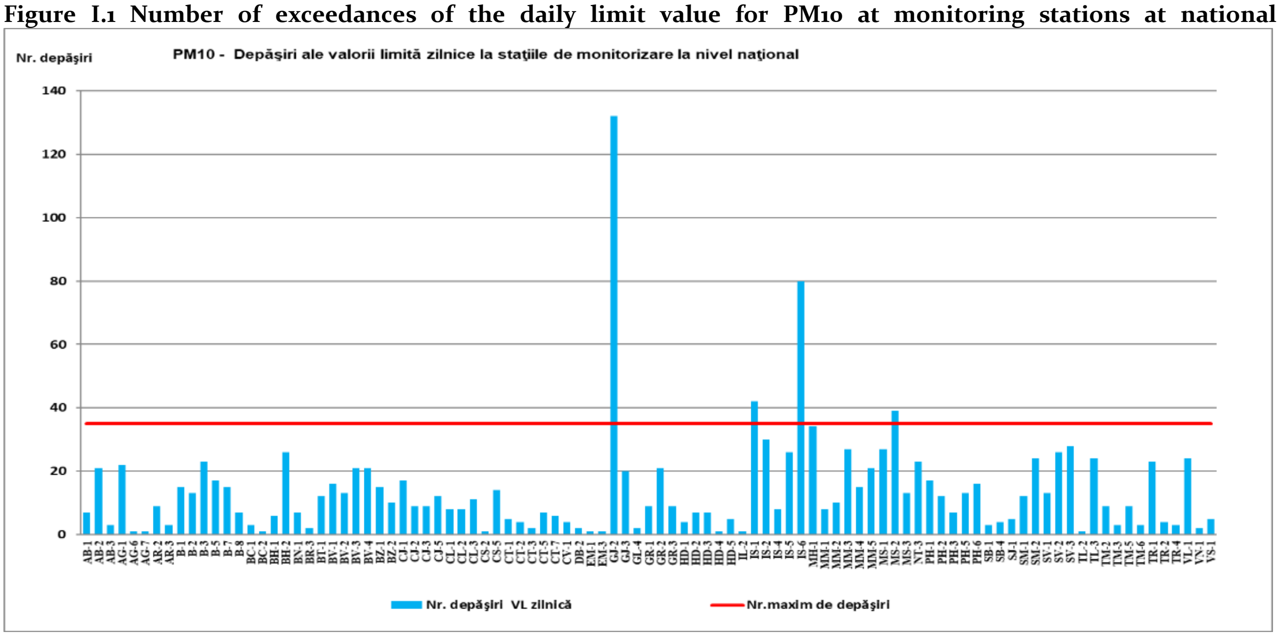
- available data from air quality monitoring networks;
- results of studies, inventories, forecasts;
- available data and results reported or obtained through studies at European level;
- scenarios, strategies, programs, objectives, targets at national and European level that monitor air quality and pollution.

Exceeding the limit values and target values regarding ambient air quality in urban areas

RO 04
Indicator code Romania: RO 04 EEA indicator code: CSI 04
TITLE: **EXCEEDING THE AIR QUALITY LIMIT VALUES IN URBAN AREAS**
DEFINITION: The percentage of the urban population potentially exposed to concentrations of pollutants in the surrounding air that exceed the limit value for the protection of human health.

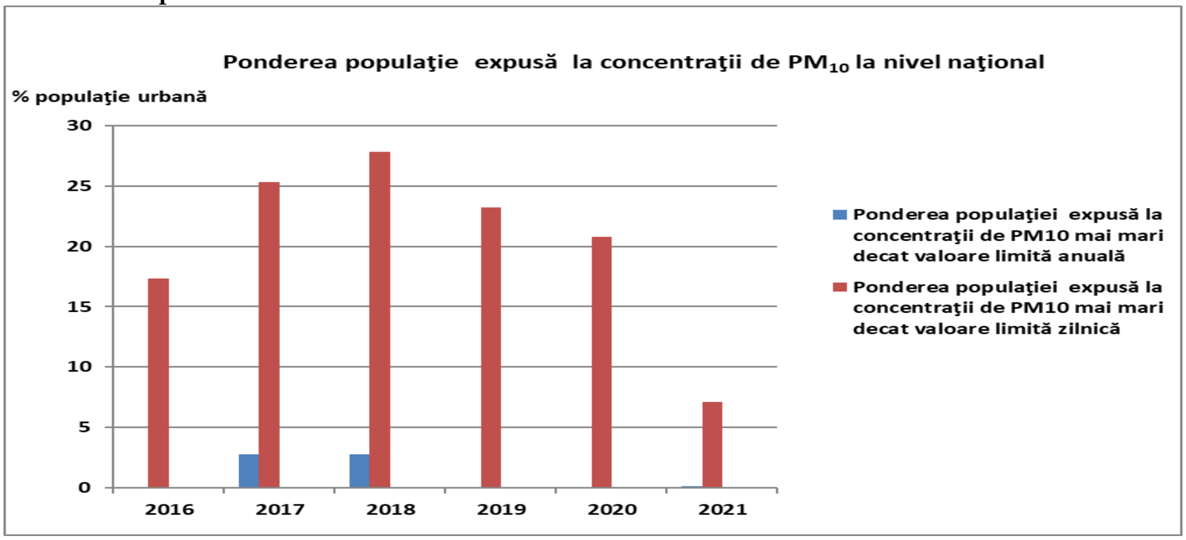
The quality of life is closely correlated with and dependent on the quality of air. The pace of economic, demographic, and institutional development necessitates the implementation of well-thought-out and well-documented measures to control hazardous air pollution phenomena, in order to guide socio-economic-financial mechanisms for the benefit of humanity.
The exposure of the population's bodies to certain pollutants, known to have storage qualities in specific organs, represents another important aspect of the influence of environmental pollution on health. This can be analyzed through the percentage of potentially exposed urban population to pollutant concentrations in the surrounding air that exceed the limit value for human health protection.

Figure I.1 Number of exceedances of the daily limit value for PM10 at monitoring stations at national level in 2021



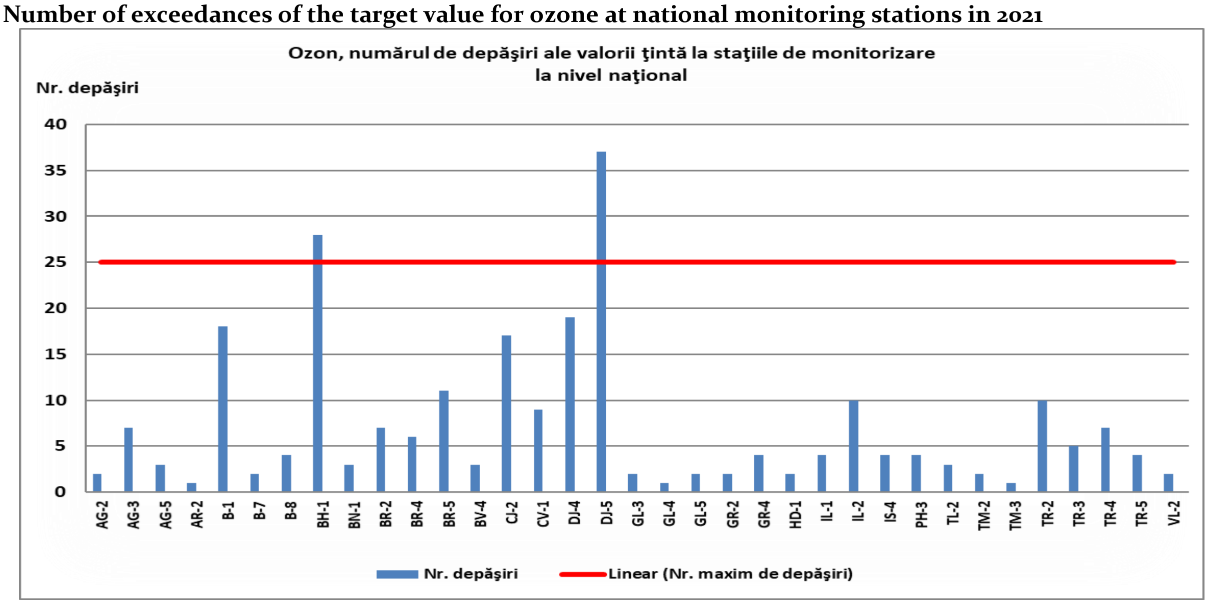
Source: NEPA

Figure I.2 Share of population at national level potentially exposed to PM10 concentrations exceeding the limit value set for human protection in the period 2016-2021



Source: NEPA

Figure I.3 Number of exceedances of the target value for ozone at national monitoring stations in 2021



Source: NEPA

The awearness of these environmental pollution effects on health has led to the need for establishing measures to protect the environment, taking into account the data regarding the number of exceedances of the limit/target values recorded at national level.

Effects of ambient air pollution on health

The increasing demands for electrical and thermal energy, as well as products from industries such as chemical, metallurgical, cement, and road and air transportation, are causes for the worsening air pollution due to the rising concentration of pollutants in the air (such as SO_2, NO_x, O_3, fine particle emissions, etc.) or the entry of harmful compounds into the atmosphere (radioactive elements, synthetic organic substances, etc.). Air pollution has unpleasant and often severe consequences on human health and the environment in various forms: hindering vegetation development, reducing the value and agricultural production, impairing visibility, releasing harmful smoke, vapors, etc., affecting buildings, infrastructure, and increasingly miniaturized, compact, technologically advanced materials, electrical and electronic devices that are highly sensitive to air pollution, exacerbating their wear and degradation.

Effects of ambient air pollution on ecosystems

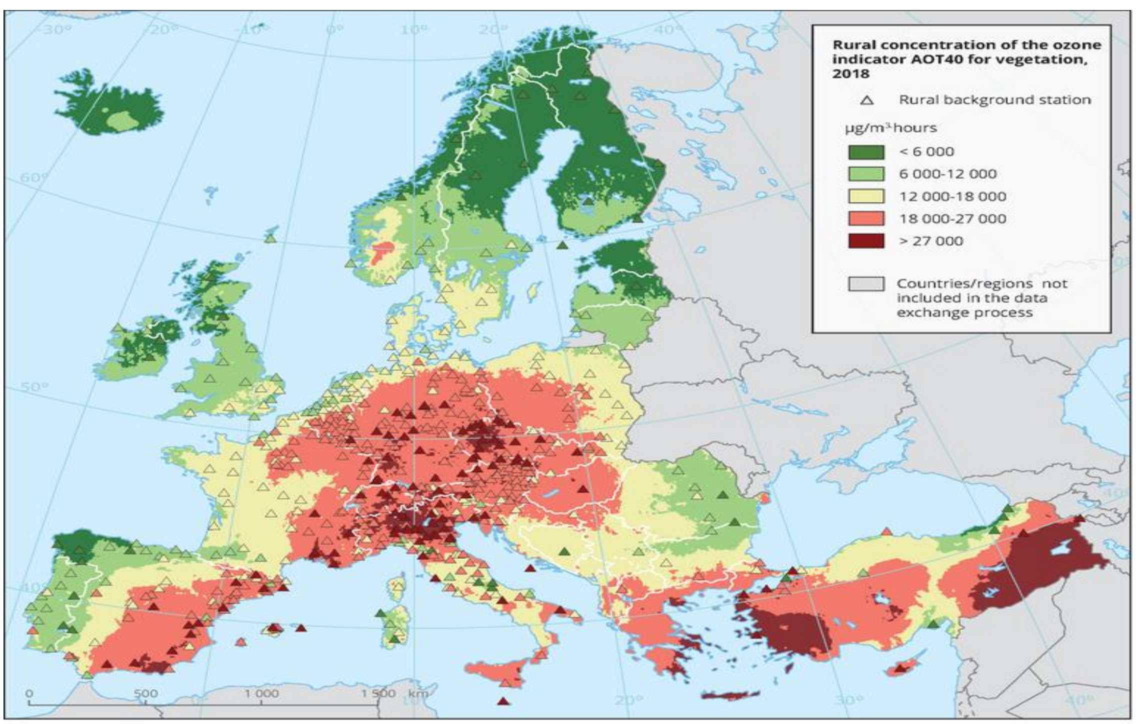
Ambient air pollution affects ecosystems negatively influencing the development of fauna and flora, which are sometimes much more sensitive than the human body to the action of various pollutants. The effects of atmospheric pollutants are diverse depending on their nature:

- acid gases (carbon monoxide, sulfur dioxide, nitrogen oxides) in combination with water from precipitation produce acid rain that affects vegetation;
- nitrogen and sulfur compounds contribute to the formation of smog, which prevents normal photosynthesis and animal respiration;
- halogen derivatives cause burns in plants and the disease called fluorosis in animals (deformation of bones and loss of teeth);
- particles reduce atmospheric transparency affecting photosynthesis and they also affect animals causing respiratory diseases similar to those of humans.

RO 05
Indicator code Romania: RO 05 EEA indicator code: CSI 05
TITLE: **EXPOSURE OF ECOSYSTEMS TO ACIDIFICATION, EUTROPHISATION AND OZONE**
DEFINITION: The indicator shows the ecosystems or cultivated areas that are subject to depositions or atmospheric concentrations of pollutants that exceed the so-called "critical thresholds" or concentration for a certain ecosystem or cultivated area. At the same time, this indicator shows the state of change in acidification, eutrophication and ozone levels for the environment. The risk for each location is estimated by reference to the "critical level", which represents a quantitative estimate of exposure to pollutants below which no harmful and significant long-term effects occur, given current knowledge.

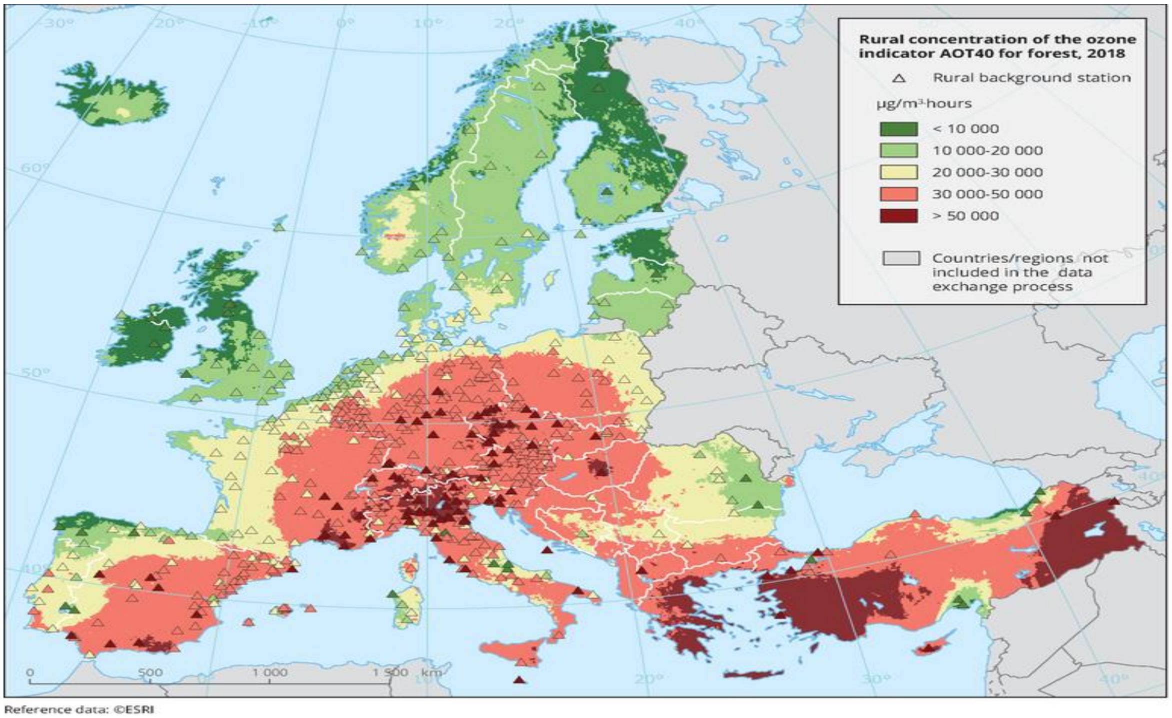
Figure I.4 Exposure of areas with vegetation and forests to ozone concentrations AOT40

Vegetation



https://www.eea.europa.eu/data-and-maps/figures/rural-concentration-map-of-the-ozone-indicator-aot40-for-crops-year-14/120149-map11-1-rural-concentration.eps/image_large

Forests



https://www.eea.europa.eu/data-and-maps/figures/rural-concentration-of-the-ozone-6/120150-map11-2-rural-concentration.eps/image_large

Effects of ambient air pollution on soil and vegetation

Pollutants emitted into the atmosphere are subject to dilution and sedimentation processes, conditioned by their properties and the conditions of the atmospheric environment in which they enter. Suspensions have a lower stability in the atmosphere than gases and a lower diffusion capacity, inversely proportional to their mass and size, so they have a lower capacity to dilute in the air compared to gases, instead they sediment more easily. The main effects of ambient air pollution on soil and vegetation are eutrophication (generated by nitrogen compounds from the atmosphere through sedimentation and deposition through precipitation) and acidification (generated by acid rain, which has as its source acidic gases: CO_2, SO_2, NO_x).

EMISSIONS OF ATMOSPHERIC POLLUTANTS AND THE MAIN SOURCES OF EMISSIONS

The level of polluting substances emissions released into the atmosphere can be significantly reduced by implementing environmental policies and strategies such as:

- greater use of renewable energy sources (wind, solar, hydro, geothermal, biomass);
- replacement of classic fuels with alternative fuels (biodiesel, ethanol);
- use of installations and equipment with high energy efficiency (low consumption, high yields);
- carrying out a program of afforestation and creation of green spaces (absorption of CO_2, retention of fine dust, release of oxygen into the atmosphere).

The estimation of emissions for each type of air pollutant is based on indicators, assumptions, and activity data, as well as on the elimination efficiency of the reduction measures and the degree/dimension in which these measures are applied:
Three groups of measures have been identified to reduce air pollutant emissions, namely:

- *Autonomous measures* which represent changes resulting from human activities (e.g. lifestyle changes), stimulated by control and command approaches (e.g. legal traffic restrictions) or economic incentives (e.g. pollution taxes, emissions trading schemes , etc.).
- *Structural measures* which supply the same level of (energy) services to the consumer, but with less polluting activities. This group includes fuel substitution (e.g. switching from coal to natural gas) and energy efficiency/energy conservation improvements.
- *Technical measures* developed to capture emissions at source before they enter the atmosphere, emission reductions achieved through these options do not change the structure of energy systems or agricultural activities.

Energy

Final energy consumption by sector type

RO 27
Indicator code Romania: RO 27 EEA indicator code: CSI 27
TITLE: **FINAL ENERGY CONSUMPTION BY SECTOR TYPE**
DEFINITION: The indicator shows the ecosystems or cultivated areas that are subject to depositions or atmospheric concentrations of pollutants that exceed the so-called "critical thresholds" or concentration for a certain ecosystem or cultivated area. At the same time, this indicator shows the state of change in acidification, eutrophication and ozone levels for the environment. The risk for each location is estimated by reference to the "critical level", which represents a quantitative estimate of exposure to pollutants below which no harmful and significant long-term effects occur, given current knowledge.

Table I.1 Energy resources, in structure and by main types

	2019	2020	2020 versus 2019	
	thousand toe	thousand toe	(±)thousand toe	%
ENERGY RESOURCES - TOTAL	**44116**	**41389**	**-2727**	93.8
- Primary energy production (including recovered energy)	**24535**	22351	**-2148**	91.1
- Import	**15910**	14014	**-1896**	88.1
- Stock at the beginning of the year	**3671**	5024	**+1353**	136.9
• from primary energy resources:				
- coal (excluding coke)	4790	3304	-1486	69.0
- crude oil[2])	12971	11413	-1558	88.0
- usable natural gas[3])	11546	11394	-152	98.7
- imported coke	501	419	-82	83.6
- imported petroleum products	3263	3507	+244	107.5
- hydroelectric, wind, solar photovoltaic and nuclear heat	4960	4986	+26	100.5

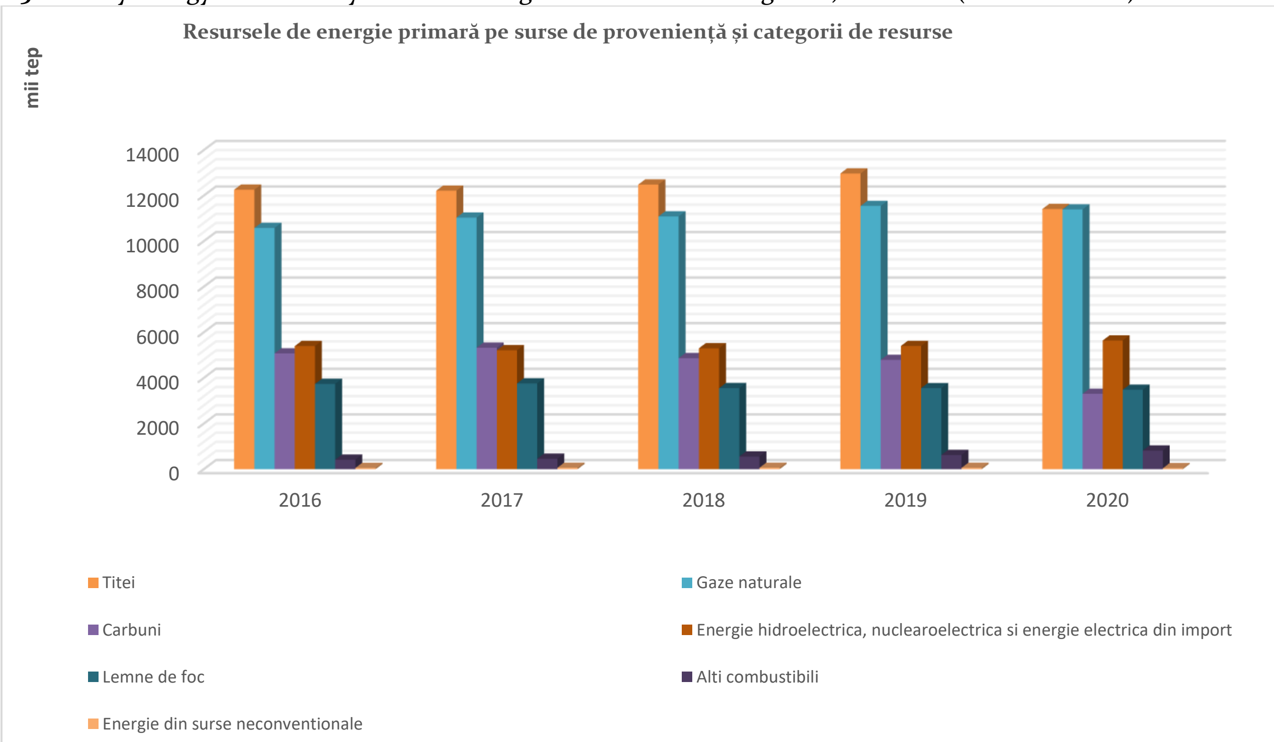
1) Conventional fuel with a calorific value of 10,000 kcal/kg; 2) including gasoline and ethane from extraction scaffolds; 3) exclusively gasoline and ethane from extraction scaffolds. (cf. INSE, Energy Balance 2020, https://insse.ro/cms/ro/tags/balanta-energetica-si-structura-utilajului-energetic)

Resources and consumption of primary energy by fuel type

RO 29
Indicator code Romania: RO 29 EEA indicator code: CSI 29
TITLE: **PRIMARY ENERGY CONSUMPTION BY FUEL TYPE**
DEFINITION: The amount of energy required to meet gross domestic energy consumption from solid fuels, crude oil, natural gas, firewood, nuclear and renewable sources and a smaller component of "other" sources (industrial waste and net electricity imports) of a country.

Primary energy resources in 2020 were 40,016 thousand tons of oil equivalent, down by 2,685 thousand toe (-6.7%) compared to the previous year. Figure I.5 shows the evolution of primary energy resources from the following types of fuels: coal, natural gas, crude oil, firewood (including biomass), other fuels, energy, energy from non-conventional sources. The majority share of primary energy production from crude oil and natural gas is observed.

Figure I.5 Primary energy resources by sources of origin and resource categories, 2016-2020 (thousands toe)



Source:http://www.insse.ro (TEMPO_IND107A_14_8_2021)

The primary energy production in the year 2020, amounting to 22,351 thousand tons of oil equivalent (toe), decreased by 2,184 thousand toe compared to the year 2019, due to a decline in production across all types of primary energy sources. Particularly noteworthy is the significant decrease in coal production (-34.0%) and usable natural gas production (-10.7%).

Gross domestic consumption of primary energy total was 32171 thousand toe in 2020, down 2.5% compared to 2019 (-84 thousand toe).

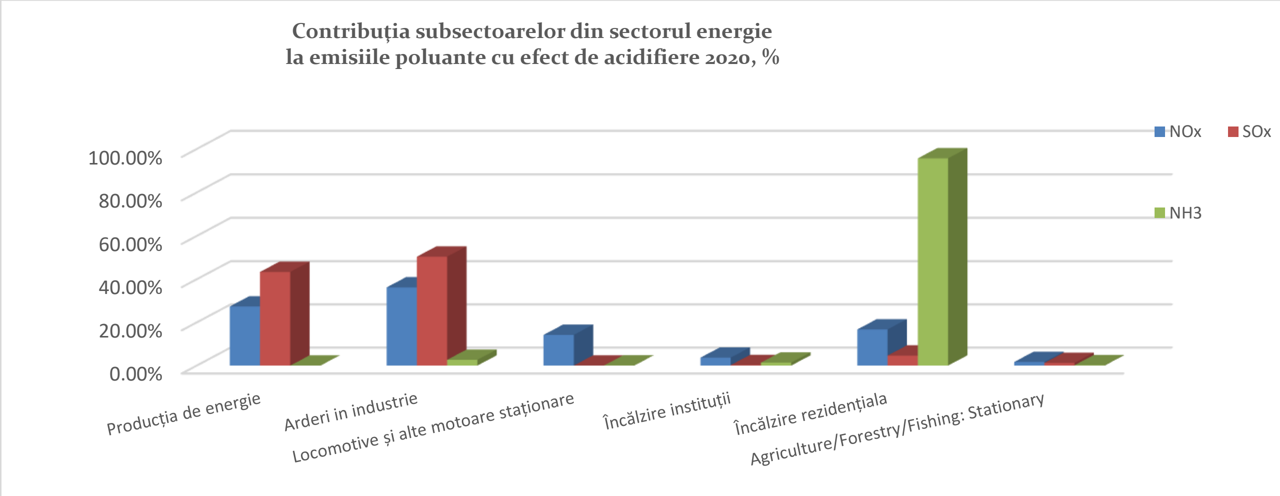
Source: National Institute of Statistics

Emissions of acidifying substances

RO 01
Indicator code Romania: RO 01 EEA indicator code: CSI 01
TITLE: **EMISSIONS OF ACIDIFYING SUBSTANCES**
DEFINITION: The indicator follows the trends of anthropogenic emissions of acidifying substances: nitrogen oxides (NOx), ammonia (NH_3) and sulfur oxides (SOx, SO_2), for each of them taking into account its acidifying potential. The indicator also provides information on changes in emissions from the main source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; the commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Acidification is the process of changing the natural chemical character of a component of the environment due to the presence in the atmosphere of halogenated chemical compounds that cause a series of chemical reactions in the atmosphere, leading to changes in the pH of the air, precipitation and even the soil, with the formation of the corresponding acids. Gases with an acidifying effect on the atmosphere are: sulfur dioxide, nitrogen dioxide and ammonia. These pollutants come mainly from human activities: the burning of fossil fuels (coal, oil, natural gas), metallurgy, agriculture, road traffic. The main source of ammonia is represented by agriculture, specifically the management of manure and enteric fermentation from livestock farming, as well as the use of nitrogen-based fertilizers. The graph illustrates the contribution of activity subsectors within the energy sector to the pollutant emissions of nitrogen oxides (NOX), ammonia (NH_3), and sulfur oxides (SOX, SO_2), relative to the total emissions from the energy sector.

FFigure I.6 **The contributions of the subsectors' activity in the energy sector, in 2020, to the emissions of polluting substances with an acidifying effect (%, NOx, SOx, and HN3)**



Source: Romania's Informative Inventory Report 2022

From the analysis of data regarding the contribution of subsectors within the energy sector to pollutant emissions with acidification effects from this sector during the reporting period, a proportion of 95.70% of ammonia from residential heating activity is observed, with high values of SO2 and NOx proportions in energy production and industrial combustion activities (Figure I.6). In relation to the national total, the share of emissions from the energy sector is 40.8% for NOx, 97.2% for SO2, and 5.9% for NH3.

Emissions of ozone precursors

RO 02
Indicator code Romania: RO 02 EEA indicator code: CSI 02
TITLE: **EMISSIONS OF OZONE PRECURSORS**
DEFINITION: The indicator tracks trends in anthropogenic emissions of ozone precursor pollutants: nitrogen oxides (NOx), carbon monoxide (CO), methane (CH4) and non-methane volatile organic compounds (VOCs) from the sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; the commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Particular attention must be paid to the control of pollution sources that emit volatile organic compounds (VOCs) mainly from the organic chemical synthesis industry because, together with suspended particles, the main components of smog and nitrogen oxides, in the presence of light, contributes to the formation of tropospheric ozone. *Tropospheric ozone* is a highly oxidizing, highly reactive, foul-smelling gas that causes respiratory problems, concentrates in the stratosphere, and provides protection against life-damaging UV radiation.

Ground-level ozone behaves as a component of "*photochemical smog*". It is formed by means of a reaction involving in particular volatile organic compounds and nitrogen oxides.

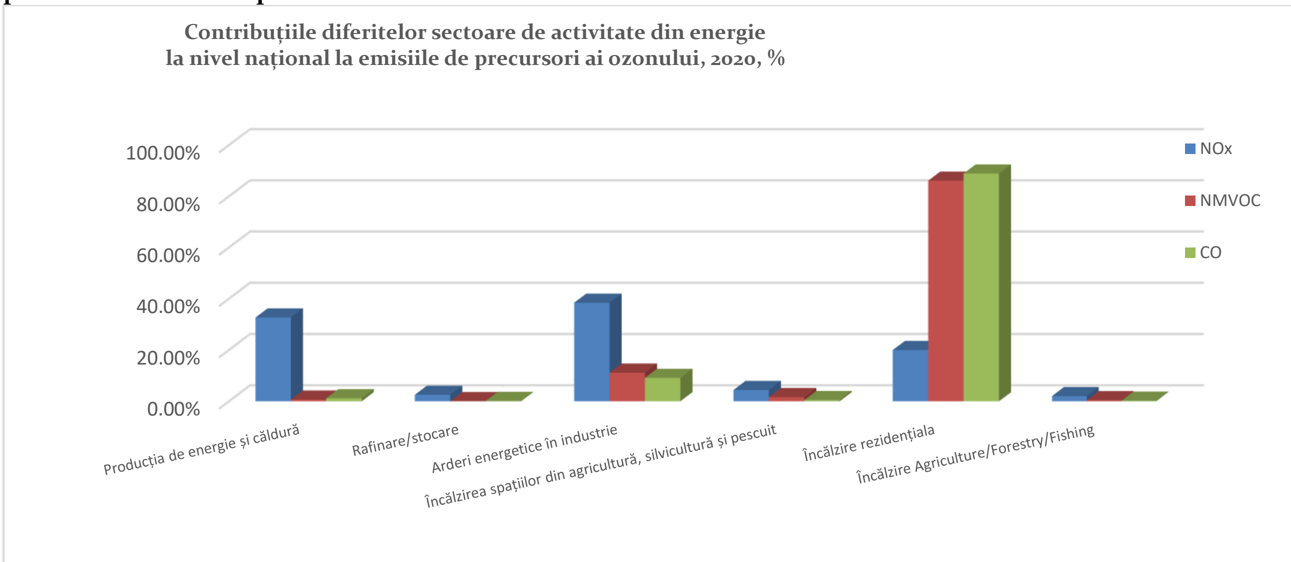
Ozone is responsible for damage to vegetation by atrophying some tree species in urban areas. In the spring-summer period, when the daylight interval is long, photochemical reactions in the atmosphere are accelerated, which results in increased ozone concentrations, especially during very hot days (with temperatures above 30°C). In addition, increased tropospheric ozone concentrations can impact crops and buildings.

Volatile organic compounds is one of the main precursors of ozone, which is a natural constituent of the atmosphere. In the context of the existence of other pollutants such as nitrogen oxides, sulfur oxides, ozone becomes a generator of smog and a series of negative effects on the climate system, as well as on the productivity of ecosystems and human health. As such, the areas most affected by tropospheric ozone pollution are the urban ones, the precursor pollutants being generated mainly by industrial activities and road traffic.

VOC pollution is widespread in many industrial facilities in the chemical and metallurgical industries, but also in fossil fuel burners or waste incinerators.

Nitrogen oxides are formed in the combustion process when fuels are burned at high temperatures, but most often they are the result of road traffic, industrial activities, electricity production. Nitrogen oxides are responsible for the formation of smog, acid rain, water quality deterioration, the greenhouse effect, and reduced visibility in urban areas.

Figure I.7 Contributions of subsectors of activity in the energy sector, in 2020, to emissions of pollutants discharged into the atmosphere and considered precursors of ozone



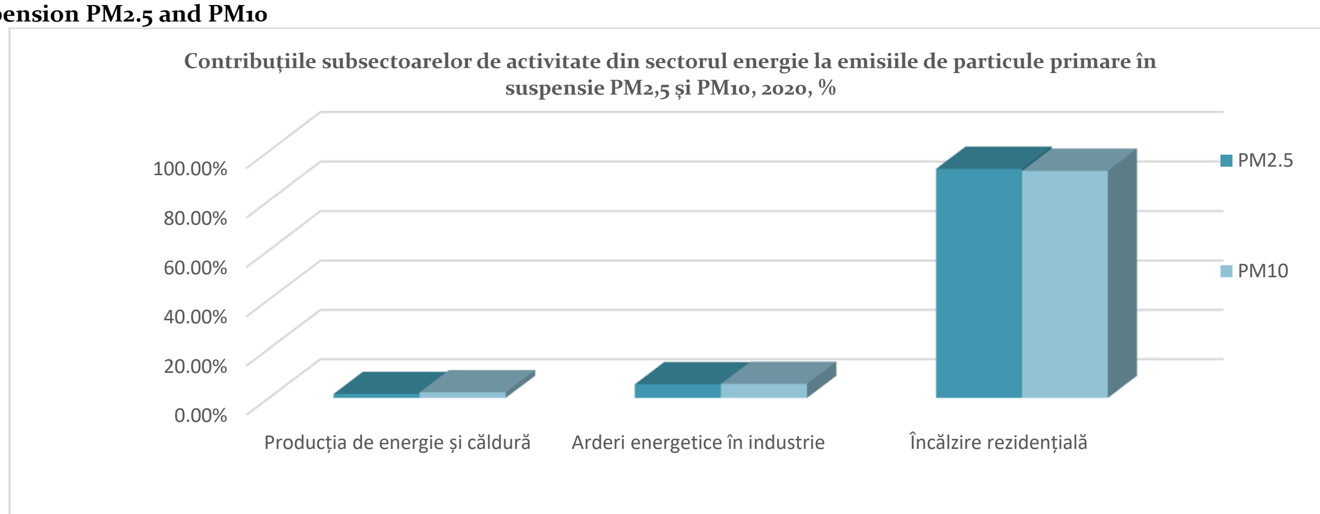
Source: Romania's Informative Inventory Report 2022

Emissions of primary particles in suspension

RO 03
Indicator code Romania: RO 03 EEA indicator code: CSI 03
TITLE: **EMISSIONS OF PRIMARY PARTICLES AND SECONDARY PARTICLE PRECURSORS**
DEFINITION: This indicator shows the trends in emissions of primary particles with a diameter smaller than 2.5 µm (PM2.5) and respectively 10 µm (PM10) and secondary particle precursors (nitrogen oxides (NOx), ammonia (NH_3) and carbon dioxide sulfur (SO_2), from anthropogenic sources, by source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste other sources.

The contribution of the sub-sectors of activity in the energy sector to the anthropogenic emissions of primary particles with a diameter smaller than 2.5 µm (PM2.5) and 10 µm (PM10) is graphically represented, in relation to the total emissions from the energy sector.

Figure I.8 The contributions of the activity subsectors in the energy sector, in 2020, to the emissions of primary particles in suspension PM2.5 and PM10



Source: Romania's Informative Inventory Report 2022

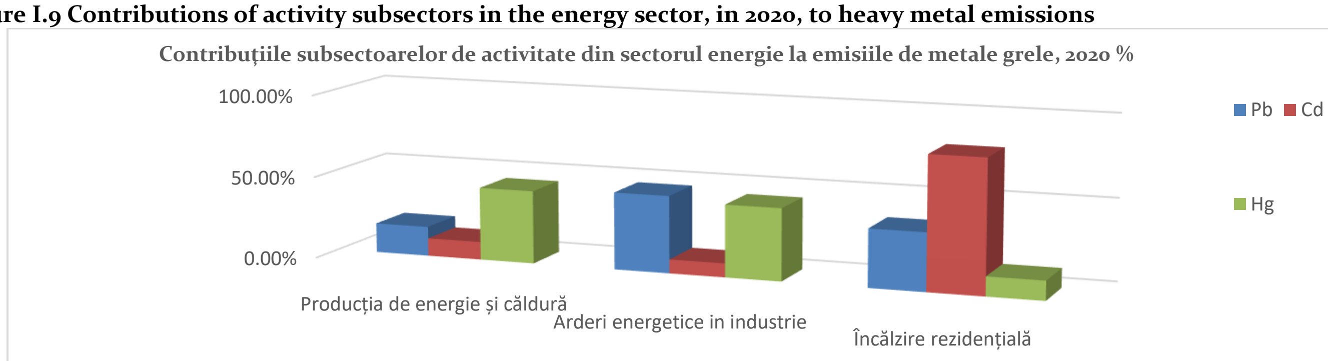
Heavy metal emissions

RO 38
Indicator code Romania: RO 38 EEA indicator code: APE 05
TITLE: **HEAVY METAL EMISSIONS**
DEFINITION: Trends of anthropogenic heavy metals emissions by sectors of activity: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

Heavy metals (mercury, lead, cadmium, etc.) are compounds that cannot be degraded naturally, have a long retention time in the environment, and are dangerous in the long term because they can accumulate in the food chain. Heavy metals can come from stationary and mobile sources: fuel and waste combustion processes, technological processes in heavy non-ferrous metallurgy and road traffic. Heavy metals can cause muscular, nervous, digestive disorders, general states of apathy. They can affect the process of plant development, preventing the normal development of photosynthesis, respiration or transpiration.

From the statistical data, heavy metal emissions show a decrease compared to those recorded in recent years. The largest share of mercury emissions in a percentage of more than 60% comes from combustion in the production of energy and heat. To these are added sectors such as: production processes, waste treatment and storage and, to a very small extent, other activities, respectively: non-industrial combustion plants and road transport.

Figure I.9 Contributions of activity subsectors in the energy sector, in 2020, to heavy metal emissions

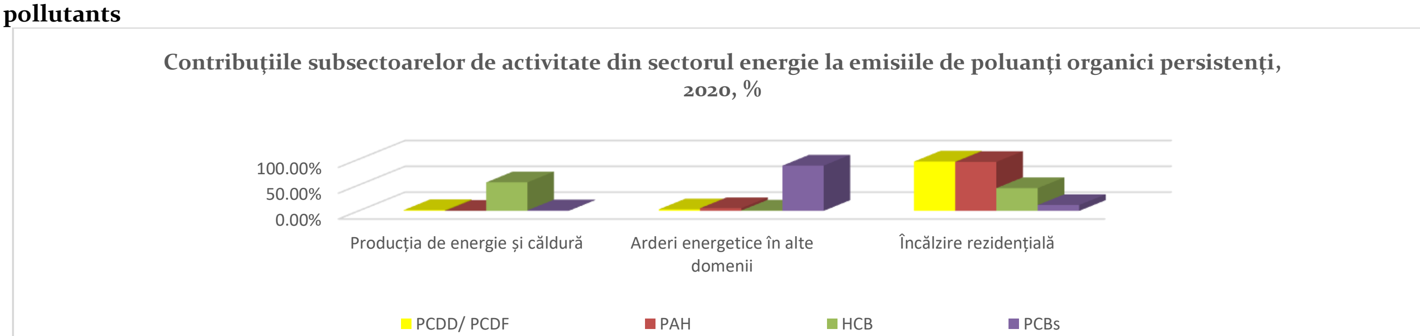


Source: Romania's Informative Inventory Report 2022

Emissions of persistent organic pollutants

RO 39
Indicator code Romania: RO 39 EEA indicator code: APE 06
TITLE: **EMISSIONS OF PERSISTENT ORGANIC POLLUTANTS**
DEFINITION: Trends in anthropogenic emissions of persistent organic pollutants, of polycyclic aromatic hydrocarbons (PAH), by activity sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

Figure I.10 The contributions of the activity subsectors in the energy sector, in 2020, to the emissions of persistent organic pollutants



Source: Romania's Informative Inventory Report 2022

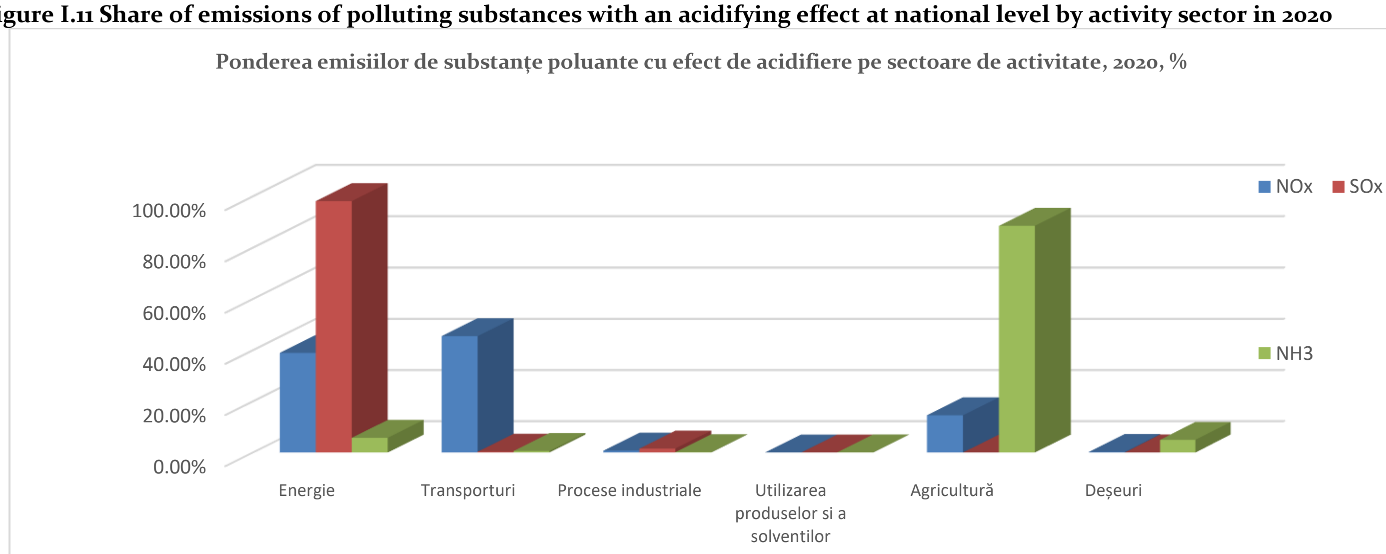
From the analysis of the data presented regarding the contribution of the subsectors to the emissions of persistent organic pollutants from the energy sector, it can be seen that the major share is residential heating, with values over 90% in the case of PCDD/PCDF dibenzofurans and PAH aromatic hydrocarbons.

Industry

Emissions of acidifying substances

RO 01
Indicator code Romania: RO 01 EEA indicator code: CSI 01
TITLE: **EMISSIONS OF ACIDIFYING SUBSTANCES**
DEFINITION: The indicator follows the trends of anthropogenic emissions of acidifying substances: nitrogen oxides (NOx), ammonia (NH3) and sulfur oxides (SOx, SO2), for each of them taking into account its acidifying potential. The indicator also provides information on changes in emissions from the main source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; the commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Figure I.11 Share of emissions of polluting substances with an acidifying effect at national level by activity sector in 2020



Source: Romania's Informative Inventory Report 2022

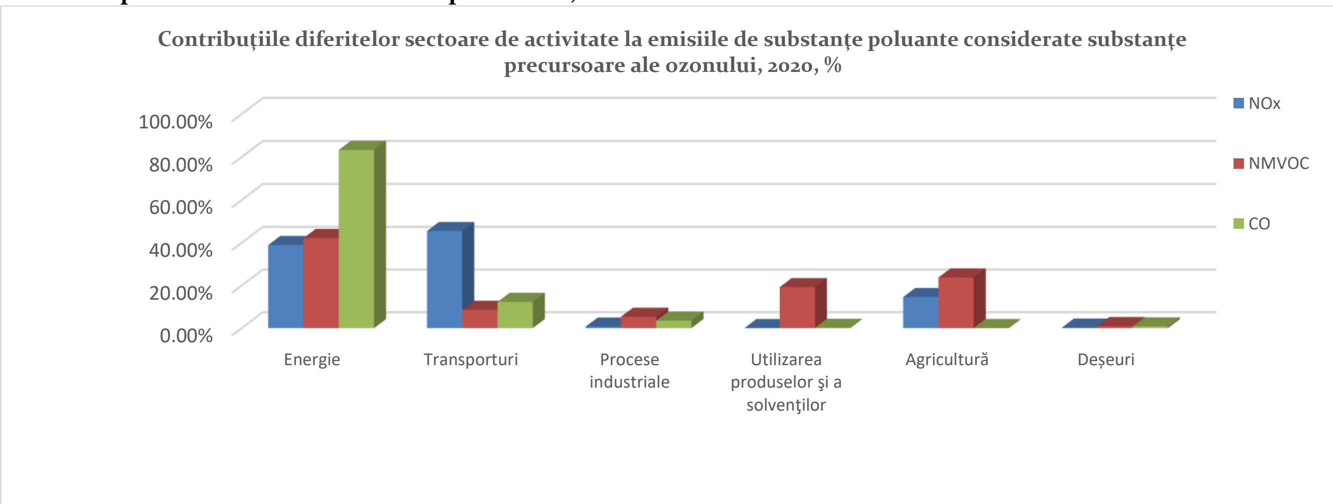
Emissions of ozone precursors

RO 02
Indicator code Romania: RO 02 EEA indicator code: CSI 02
TITLE: **EMISSIONS OF OZONE PRECURSORS**
DEFINITION: The indicator tracks trends in anthropogenic emissions of ozone precursor pollutants: nitrogen oxides (NOx), carbon monoxide (CO), methane (CH4) and non-methane volatile organic compounds (VOCs) from the sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; the commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Ozone is the allotropic form of oxygen. In the atmosphere, it can be formed naturally as a result of electric discharges and under the action of sunlight, and artificially, as a result of the reactions of some harmful substances, originating from terrestrial pollution sources.
Ozone formed in the lower troposphere is the main pollutant in industrialized cities. Tropospheric ozone is formed from nitrogen oxides (especially nitrogen dioxide), volatile organic compounds (VOCs), carbon monoxide in the presence of sunlight, as the energy source of chemical reactions.
Toxic smog is produced by the chemical interaction between pollutant emissions and solar radiation. The most common

product of this reaction is ozone. During peak hours, in urban areas, the atmospheric concentration of nitrogen oxides and hydrocarbons increases rapidly due to heavy traffic. At the same time, the amount of nitrogen dioxide in the atmosphere decreases due to the fact that sunlight leads to its decomposition into nitrogen oxide and oxygen atoms. Oxygen atoms combined with molecular oxygen form ozone. Hydrocarbons oxidize and react with nitrogen oxide to produce nitrogen dioxide.

Figure I.12 Contributions of the activity sectors at national level, in 2020 to the emissions of polluting substances discharged into the atmosphere and considered ozone precursors, %



Source: Romania's Informative Inventory Report 2022

Emissions of primary particles and secondary particle precursors

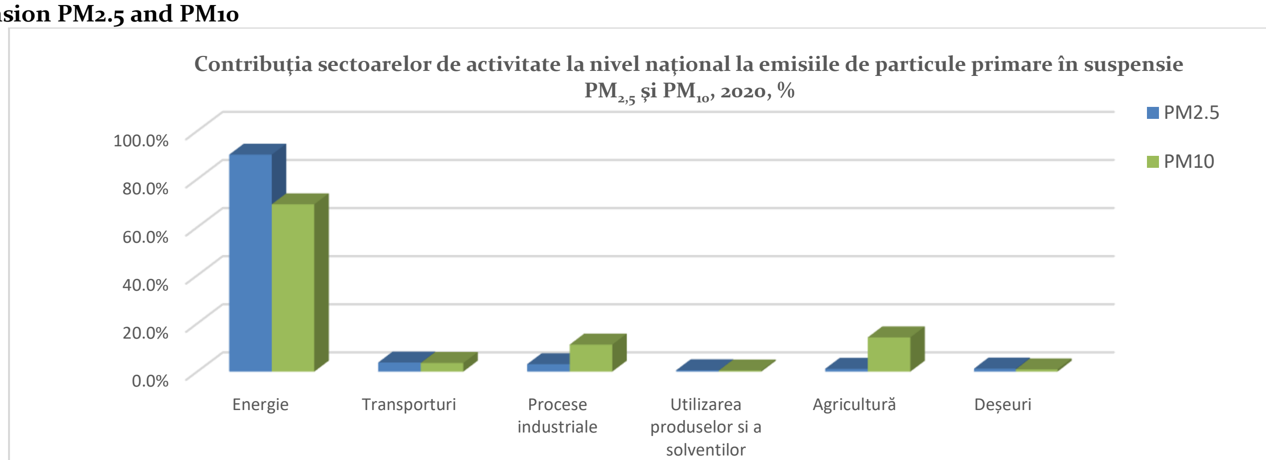
RO 03

Indicator code Romania: RO 03
EEA indicator code: CSI 03

TITLE: **EMISSIONS OF PRIMARY PARTICLES AND SECONDARY PARTICLE PRECURSORS**

DEFINITION: This indicator shows the trends in emissions of primary particles with a diameter smaller than 2.5 µm (PM2.5) and respectively 10 µm (PM10) and secondary particle precursors (nitrogen oxides (NOx), ammonia (NH3) and carbon dioxide sulfur (SO2), from anthropogenic sources, by source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste other sources.

Figure I.13 The contribution of the activity sectors at the national level in 2020, to the emissions of primary particles in suspension PM2.5 and PM10



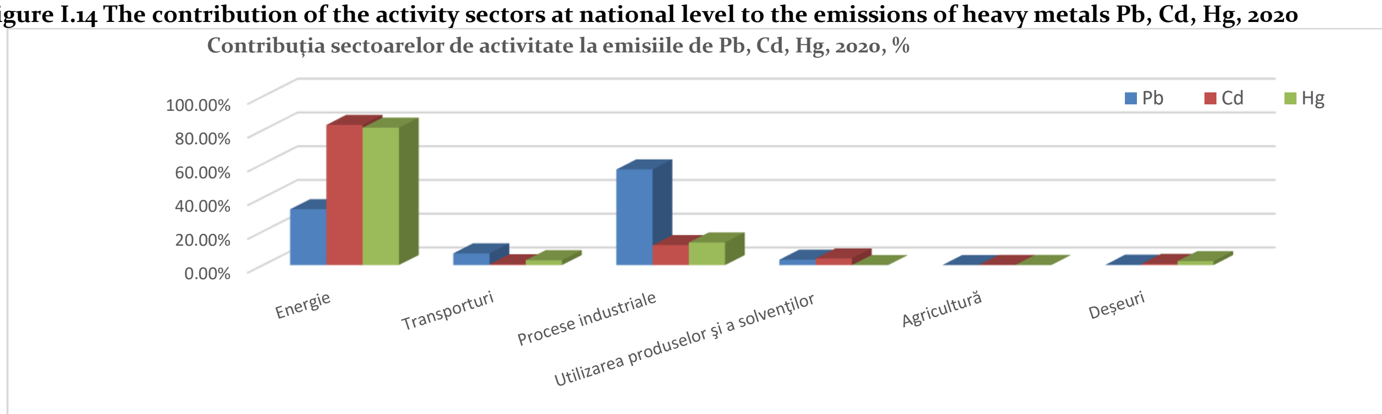
Source: Romania's Informative Inventory Report 2022

Comparing the values presented for different sectors of activity at the national level, it is found that the share of the energy sector is the highest in emissions of primary particles in suspension (90.2% PM2.5, respectively 69% PM10), the majority in this sector being the emissions of dusts generated in the residential heating activity. The agriculture and industrial processes sectors stand out with much lower weights for PM10 emissions (14.2% and 11.2%, respectively).

Heavy metal emissions

RO 38
Indicator code Romania: RO 38 EEA indicator code: APE 05
TITLE: **HEAVY METAL EMISSIONS**
DEFINITION: Trends of anthropogenic heavy metals emissions by sectors of activity: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

Figure I.14 The contribution of the activity sectors at national level to the emissions of heavy metals Pb, Cd, Hg, 2020

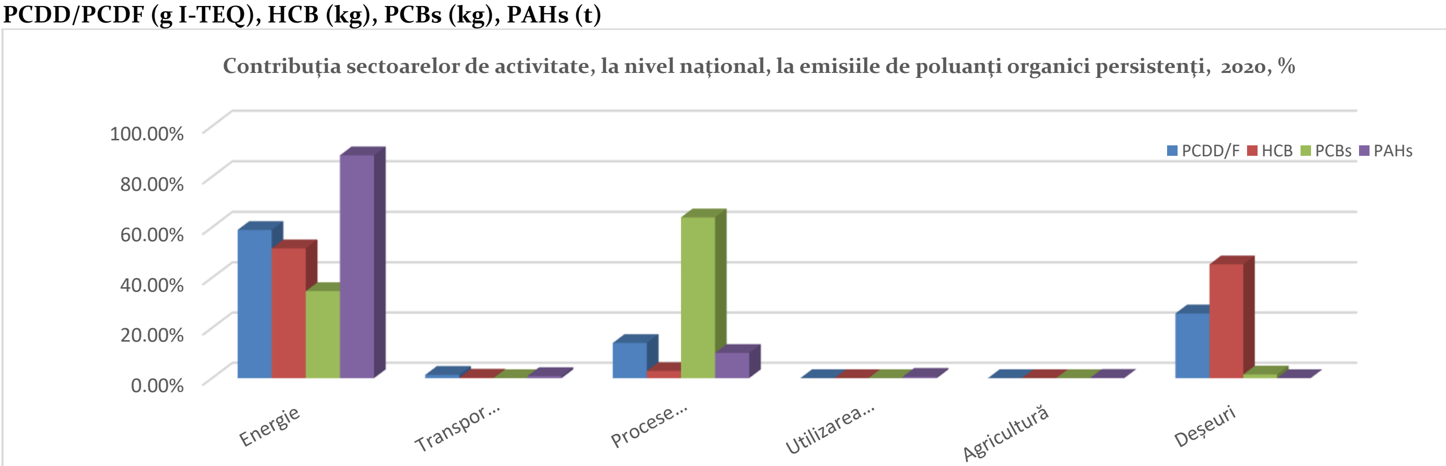


Source: Romania's Informative Inventory Report 2022

Emissions of persistent organic pollutants

RO 39
Indicator code Romania: RO 39 EEA indicator code: APE 06
TITLE: **EMISSIONS OF PERSISTENT ORGANIC POLLUTANTS**
DEFINITION: Trends in anthropogenic emissions of persistent organic pollutants, polycyclic aromatic hydrocarbons (PAHs), by sectors of activity: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

Figure I.15 The contribution of the activity sectors at national level in 2020, to the emissions of persistent organic pollutants PCDD/PCDF (g I-TEQ), HCB (kg), PCBs (kg), PAHs (t)



Source: Romania's Informative Inventory Report 2022

Industrial emissions

Industry

Industrial activities play a significant role in a country's economic well-being while also contributing to sustainable development. However, industrial activities can also have a significant impact on the environment. The industrial strategy for sustainable development aims to stimulate competitiveness, pursuing stable and lasting economic growth while protecting the environment. Air emissions generated by the largest industrial installations represent a considerable portion of total atmospheric pollutant emissions. Additionally, these industrial activities have a significant impact on environmental factors such as water, soil, and waste generation. The possibility of controlling industrial installations to minimize emissions, waste generation, and energy consumption has been the subject of legislative reform at the European Union level, ultimately leading to the introduction of **Directive 2010/75/EU on industrial emissions (IED Directive) in 2010**.
The Directive 2010/75/EU on Industrial Emissions (Integrated Pollution Prevention and Control) (reform) aims to prevent and control integrated pollution resulting from industrial activities by establishing conditions for prevention and, where not feasible, for the reduction of air, water, and soil emissions, as well as waste generation, to achieve a high level of environmental protection as a whole. It is also essential to use energy efficiently, prevent accidents and incidents, and limit their consequences as much as possible.
To prevent, reduce, and eliminate pollution from industrial activities, in line with the principles of the polluter pays, precautionary decision-making in the environmental context, and pollution prevention, which closely align with the concept of sustainable development, the IED Directive has established a general framework for controlling industrial activities. This ensures efficient management of natural resources, prioritizes measures taken directly at the source, and considers the economic situation, local environmental conditions, geographical location, and technical characteristics of the installation when necessary.
Additionally, the ***IED Directive promotes public access to information, public participation, and access to justice concerning the procedure for issuing integrated environmental permits***.
As a Member State of the European Union, Romania has implemented at the national level the Pollutant Release and Transfer Register (PRTR) in accordance with the provisions of Regulation (EC) No. 166/2006 of the European Parliament and of the Council on the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC (EPRTR Regulation). The EPRTR Regulation establishes a registry of pollutant emissions and transfers at the community level (referred to as the "European PRTR/EPRTR") in the form of a publicly accessible electronic database and sets out its operating rules. The purpose is to implement the UNECE Protocol on Pollutant Release and Transfer Registers, facilitate public participation in environmental decision-making, and contribute to the prevention and reduction of environmental pollution.
The Industrial Emissions Directive (IED) 2010/75/EU replaces the following seven directives, thus incorporating in a single clear and coherent legislative instrument a set of common rules for the authorization and control of industrial installations based on an integrated approach and application of the best available techniques:

- Directive 2008/1/EC on integrated pollution prevention and control (IPPC);
- Directive 2001/80/EC on the limitation of atmospheric emissions of certain pollutants from large combustion plants (LCP);
- Directive 2000/76/EC on waste incineration;
- Directive 1999/13/EC regarding the reduction of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations;
- Directive 78/176/EC on waste from the titanium dioxide industry;
- Directive 82/883/CE regarding the methods of supervision and control of areas where there are emissions from the titanium dioxide industry;
- Directive 92/112/CE on procedures for harmonising programmes for the reduction with a view to elimination of pollution caused by waste from the titanium dioxide industry.

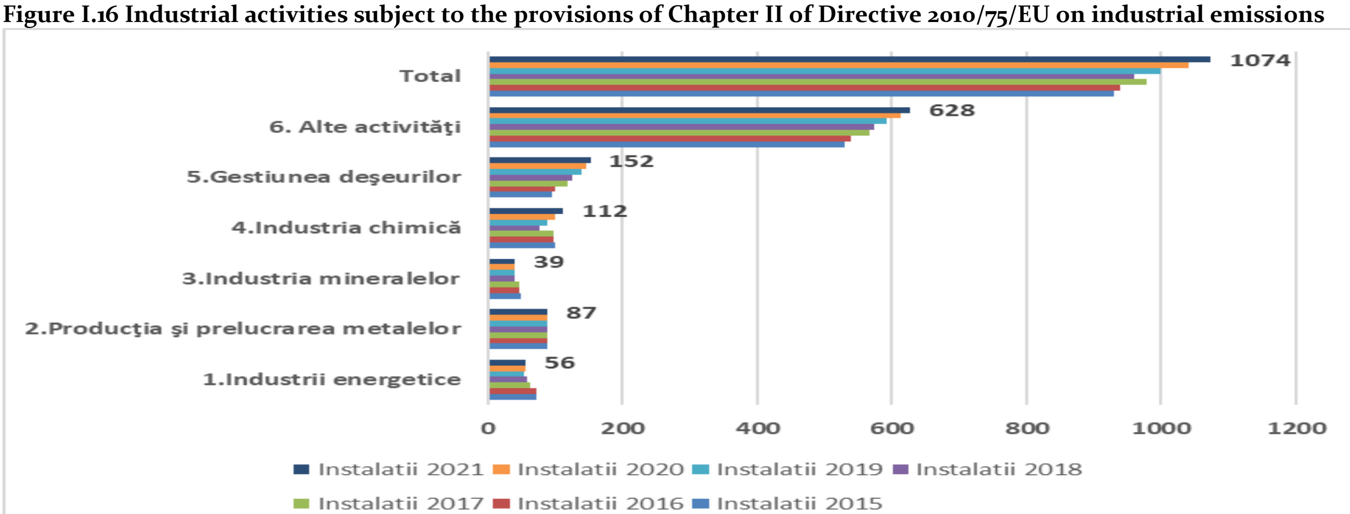
Romania transposed the provisions of the IED Directive through Law no. 278/2013 on industrial emissions, with subsequent amendments and additions, which entered into force on 01.12.2013.
Chapter II of the new directive contains provisions applicable to the activities provided in Annex 1 and which reach, as the case may be, the capacity thresholds established in that annex. Regarding the activities listed in Annex 1, the provisions of Directive 2010/75/EU on industrial emissions are based on several principles, namely:

- integrated approach that takes into account the environmental performance of the entire installation, including air, water and soil emissions, waste generation, use of raw materials, energy efficiency, noise, accident prevention, as well as restoring the site to a satisfactory state in the moment of closure, in order to ensure a high level of environmental protection considered as a whole;

- the application of the Best Available Techniques (BAT) in the operation of industrial installations, as well as the establishment of authorization conditions and emission limit values (ELV) for pollutants in compliance with the BAT Conclusions (documents adopted by the European Commission through Implementation Decisions, which contain information on the level of emissions associated with the Best Available Techniques);
- flexibility in establishing authorization conditions by the competent authorities for environmental protection;
- verifying the compliance of industrial installations by implementing a system of environmental inspections and inspection plans including site verification at least once every 1 or 3 years;
- public participation in the decision-making process of issuing integrated environmental authorizations and informing them about the environmental performance of industrial installations.

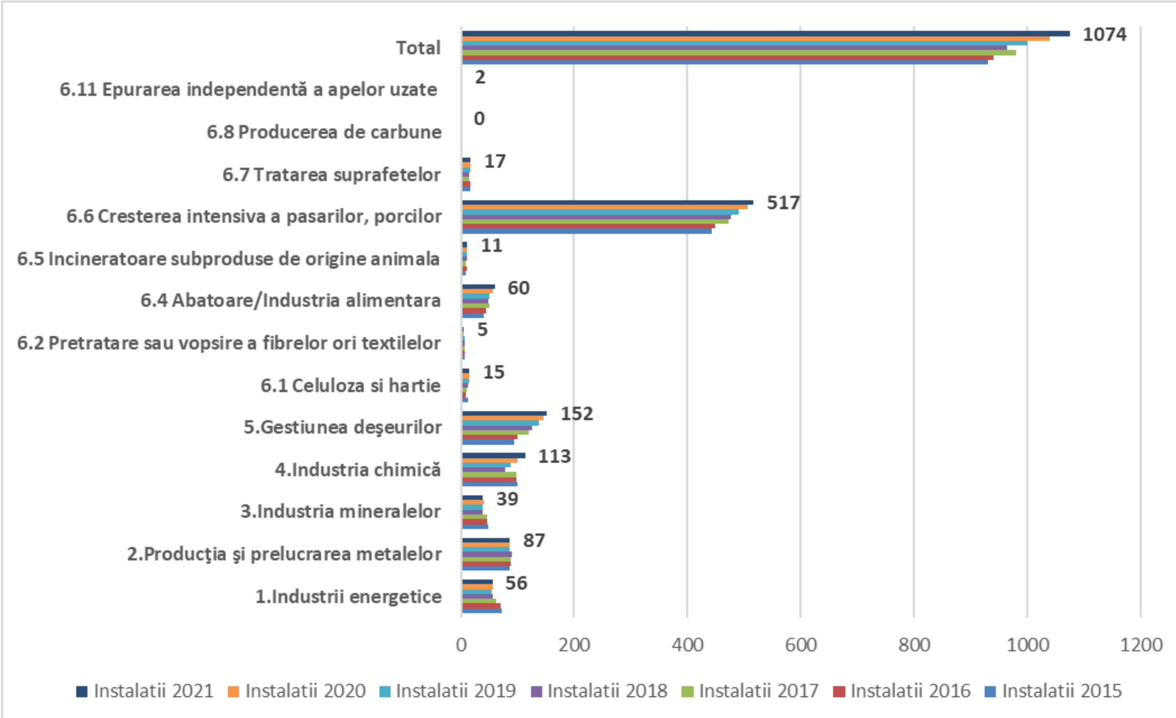
The most important ***categories of industrial activities provided by Annex 1 of Directive 2010/75/EU represented in Romania are the following: Thermal energy industry, Cement industry, Oil and natural gas refining industry, Chemical and petrochemical industry, Metallurgical industry***. The main environmental factor possibly affected is the air due to the emissions resulting from the preparation of the raw material, the final processing of the products, the transport and storage of the raw material and auxiliary products. Also, the non-ferrous **metallurgy** industry has a possible significant impact on the environment through emissions of pollutants into the atmosphere (combustion gases and dust), through the discharge of technological waste water, waste storage, etc. The construction materials industry is represented by important units for the production of cement, lime, refractory bricks, etc., activities that cause the generation of large amounts of dust, as well as gas emissions (especially CO_2, SO_2, etc.). The chemical industry is represented by the installations for the production of basic organic and inorganic chemical substances, chemical fertilizers, phytosanitary products, basic pharmaceutical products and explosives. These activities are associated with the generation of emissions from the storage of chemicals used as raw materials and products, with potentially significant impact on air, soil and groundwater. The food industry holds an important place in the economy of many regions, being represented by food production facilities, beverages and milk from raw materials of animal and plant origin. This type of activity can have a significant impact on the environment through emissions of pollutants into the atmosphere, emissions of substances from refrigeration installations, through the discharge of technological wastewater with a high organic load, the production of solid waste specific to these types of activity. That is why the operators have paid increased attention to the elimination of these problems by building treatment stations, purchasing ecological incinerators for waste of animal origin, etc. The intensive breeding of animals is represented by poultry or pig farms, which generate large amounts of pollutants and droppings and which can mainly affect the air (through ammonia emissions and other gases that generate olfactory discomfort), soil and water (generally from the storage of manure and its spreading on agricultural land as organic fertilizer). The machine building industry with a possible significant impact on the environment through the metal waste resulting from series production and the specific pollutants resulting from the treatment with organic solvents of metal surfaces, objects or products manufactured within this industry. Light industry is represented by pretreatment factories (operations such as washing, bleaching, mercerization) or fiber or textile dyeing, activities that generate waste and wastewater. The machine building industry with a possible significant impact on the environment through the metal waste resulting from series production and the specific pollutants resulting from the treatment with organic solvents of metal surfaces, objects or products manufactured within this industry. Light industry is represented by pretreatment factories (operations such as washing, bleaching, mercerization) or fiber or textile dyeing, activities that generate waste and wastewater.

Figure I.16 Industrial activities subject to the provisions of Chapter II of Directive 2010/75/EU on industrial emissions



Source: NEPA

Figure I.17 The situation of authorized installations by industrial sector at national level



Source: NEPA

Chapter III of Directive 2010/75/EU on Industrial Emissions (IED)

Chapter III of Law no. 278/2013 on industrial emissions, with subsequent amendments and supplements, contains special provisions applicable from January 1, 2016, for combustion plants whose total nominal thermal power is equal to or greater than 50 MW, regardless of the type of fuel used (solid, liquid, or gaseous). According to the provisions of Article 30 paragraph (3), integrated environmental permits issued for installations that include authorized combustion plants before the entry into force of the law (December 1, 2013), or whose operators have submitted a complete authorization request before this date, provided that such installations are commissioned no later than January 7, 2014, include conditions to ensure that air emissions from these installations do not exceed the emission limit values specified in Part 1 of Annex No. 5 of the law.

Integrated environmental authorizations issued to installations that contain combustion plants that do not fall under the provisions of paragraph (3), respectively those put into operation after January 7, 2014, provide conditions to ensure that air emissions from these installations do not exceed the emission limit values provided in part 2 of Annex no. 5 of the law. The emission limit values provided in part 2 of annex no. 5 are much more restrictive than those provided in part 1.

Until January 1, 2016, the provisions of Directive 2001/80/EC (LCP) were applied to combustion plants with a nominal thermal power of more than 50 MW, which referred to the limitation of air emissions of certain pollutants, mainly SO2, NOx and powders. Directive 2001/80/EC (LCP) regarding the limitation of atmospheric emissions of certain pollutants from large combustion plants was transposed into Romanian legislation by Government Decision no. 541/2003 regarding the establishment of measures to limit air emissions of certain pollutants from large combustion plants, which was repealed by Government Decision no. 440/2010. Starting from 01.01.2016, the latter was repealed by Law no. 278/2013 on industrial emissions, with subsequent amendments and additions. In accordance with Art. 10 of the law on the categories of activities mentioned in annex no. 1, the provisions of Chapter II are applicable to them, and one of the categories is the one mentioned in point 1.1 - Combustion of fuels in installations with a total nominal thermal power equal to or greater than 50 MW.

At national level, out of a total of 82 functional combustion plants, 32 combustion plants, until June 30, 2020, benefited from an exemption according to Article 32 of the law, from complying with the emission limit values specified in Article 30 paragraph (3), and desulfurization rates specified in Article 31, provided that they implement the measures outlined in the National Transition Plan (NTP) and adhere to the emission limit values for sulfur dioxide, nitrogen oxides, and powders applicable as of December 31, 2015, as well as contribute to the national emission ceilings established in the NTP. Additionally, 22 combustion plants benefit from an exemption, during the period from January 1, 2016, to December 31, 2023,

according to Article 33 of the law, from complying with the emission limit values specified in Article 30 paragraph (3) and desulfurization rates specified in Article 31, with the right to operate for a maximum of 17,500 hours. Moreover, 8 combustion plants benefit from an exemption, during the period from January 1, 2016, to December 31, 2022, according to Article 35, from complying with the emission limit values specified in Article 30 paragraphs (3) and (4), and desulfurization rates specified in Article 31, provided that at least 50% of the useful thermal energy production, as a 5-year moving average, is distributed in the form of steam or hot water to a public district heating network.
The main purpose of Chapter III - Special provisions for combustion plants in Directive 2010/75/EU on industrial emissions is to reduce pollutants resulting from large combustion plants, especially emissions of sulfur dioxide and nitrogen oxides that have an acidifying effect on the environment. The thermal energy sector contributes to air pollution with significant amounts of sulfur dioxide, carbon monoxide, carbon dioxide, nitrogen oxides and powders. Reducing the impact of energy systems on the environment is achieved by: rehabilitating and modernizing large combustion installations, changing the fuel used. The reduction of SOx emissions in the energy sector is achieved mainly by abandoning the use of fuels with a high sulfur content (coal or fuel oil) and the use of fuels with a low sulfur content (natural gas). Energy is essential for economic and social well-being, yet the production and consumption of energy exerts considerable pressure on the environment, such as contributing to climate change, degrading the environment and producing adverse effects on human health.
In 2020, 66 combustion plants operated at national level. The main fuels used in these installations are: natural gas, fuel oil, lignite and coal, but biomass, petroleum coke and refinery gas are also used in a small number of installations. The values of the annual emissions (tons/year) of specific pollutants from combustion installations, recorded in 2020, are as follows:

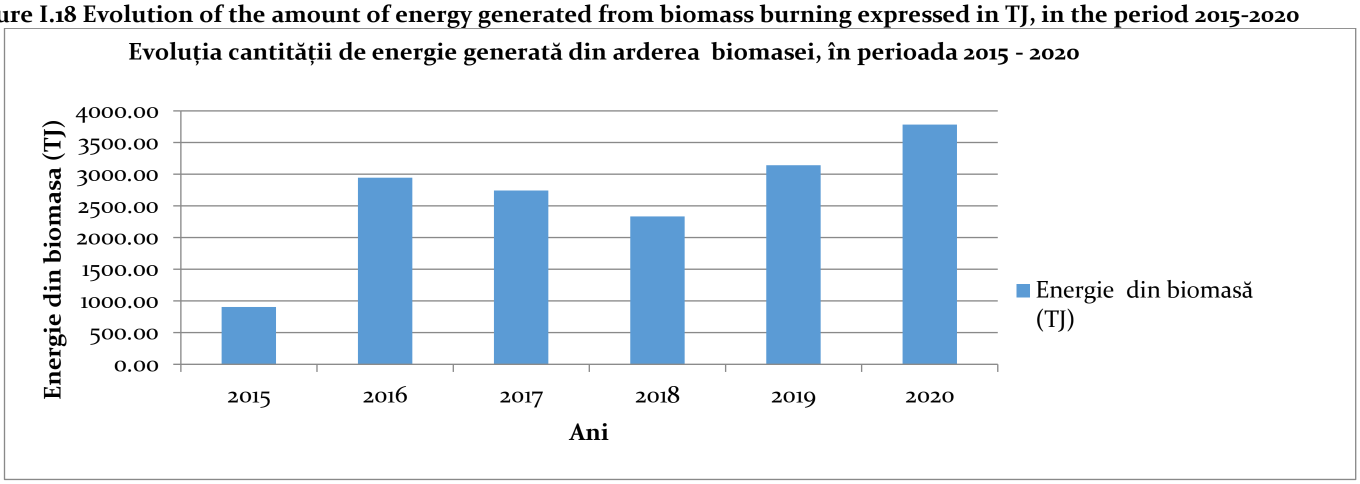
- 23302.261 t sulfur dioxide;
- 18237.135 t nitrogen oxides;
- 2059,466 t of powders.

Table I.2 Evolution of the amount of energy generated from biomass burning expressed in TJ, in the period 2015 – 2020

Years	2015	2016	2017	2018	2019	2020
Energy from biomass (TJ)	907,396	2944,463	2744.66	2334,859	3142.38	3783.43

Source: NEPA

Figure I.18 Evolution of the amount of energy generated from biomass burning expressed in TJ, in the period 2015-2020



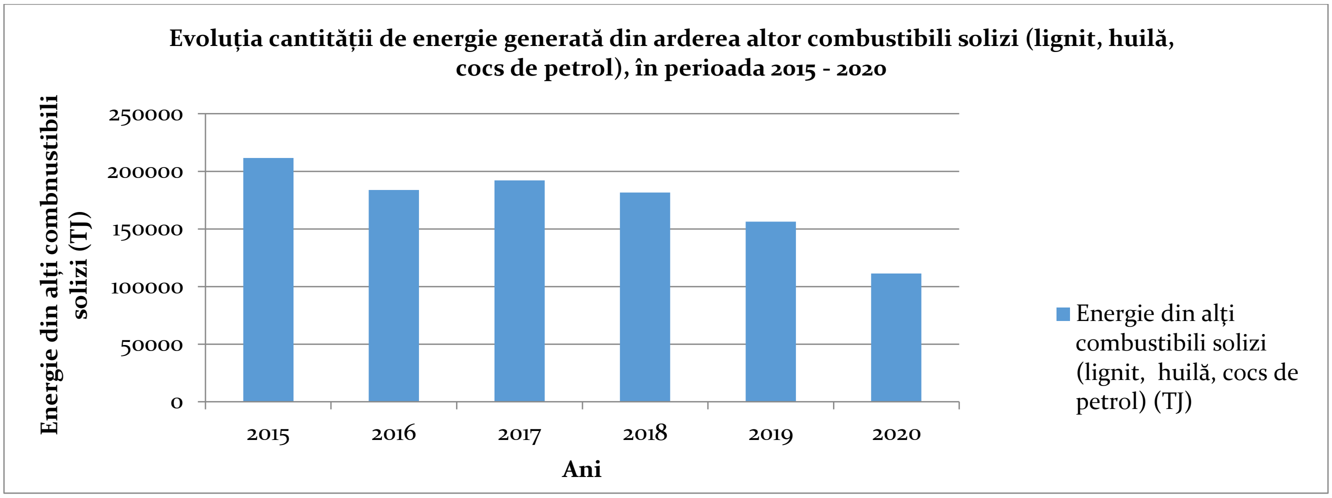
Source: NEPA

Table I.3 Evolution of the amount of energy generated from burning other solid fuels (lignite and coal), in the period 2015 – 2020

Years	2015	2016	2017	2018	2019	2020
Energy from other solid fuels (lignite and coal) (TJ)	211619.41	183880.38	192209.76	181596.29	156340.63	111293.98

Source: NEPA

Figure I.19 Evolution of the amount of energy generated from burning other solid fuels (lignite and coal), in the period 2015 – 2020



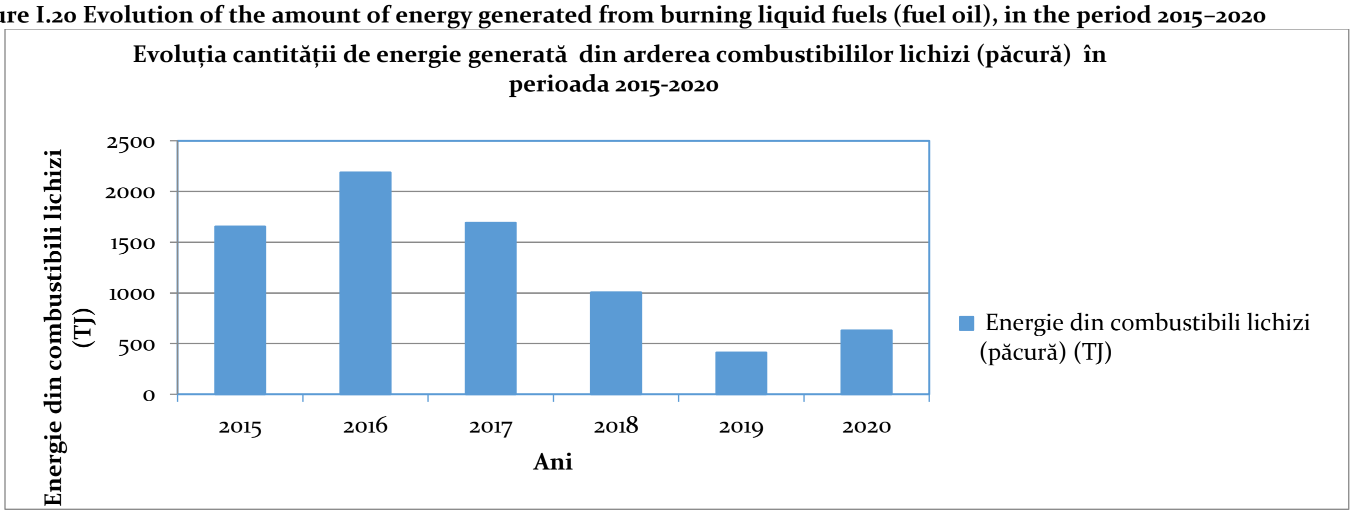
Source: NEPA

Table I.4 Evolution of the amount of energy generated from burning liquid fuels (fuel oil), in the period 2015–2020

Years	2015	2016	2017	2018	2019	2020
Energy from liquid fuels (fuel oil) (TJ)	1655,253	2187,866	1690.78	1005,134	413,204	629.81

Source: NEPA

Figure I.20 Evolution of the amount of energy generated from burning liquid fuels (fuel oil), in the period 2015–2020



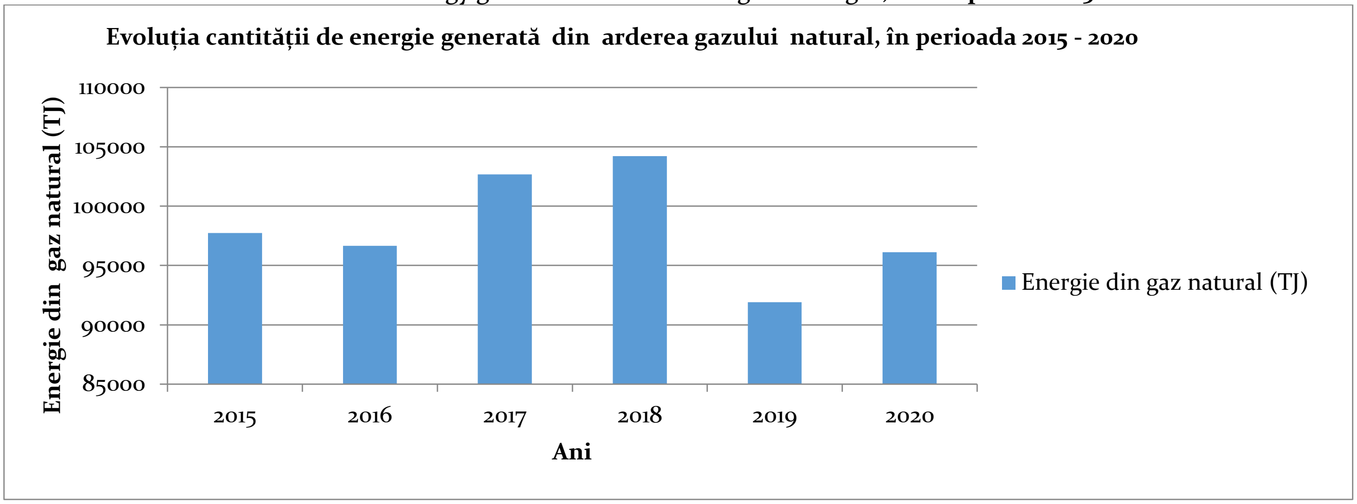
Source: NEPA

Table I.5 Evolution of the amount of energy generated from burning natural gas, in the period 2015 – 2020

Years	2015	2016	2017	2018	2019	2020
Natural gas energy (TJ)	97736.824	96652.262	102684	104210.492	91915.42	96113.646

Source: NEPA

Figure I.21 Evolution of the amount of energy generated from burning natural gas, in the period 2015 – 2020



Source: NEPA

Table I.6 Evolution of the amount of energy generated from the combustion of other combustible gases (furnace gas and refinery gas), in the period 2015 – 2020

Years	2015	2016	2017	2018	2019	2020
Energy other gases (TJ)	1389,004	1999,226	1290.66	1300,279	909,423	822,213

Source: NEPA

Chapter IV of the Industrial Emissions Directive (IED) 2010/75/EU presents Special Provisions on waste incineration plants and waste co-incineration plants

The incineration of hazardous and non-hazardous waste can produce emissions of substances that pollute the air, water and soil and have negative effects on human health. In order to limit these risks, Directive 2000/76/EC on waste incineration imposed strict operating conditions and technical requirements on waste incineration and co-incineration facilities, which were taken over in Chapter IV of Law no. 278/2013 on industrial emissions, as amended and supplemented – *Special provisions on waste incineration facilities and waste co-incineration facilities*.

This chapter refers to the technical progress recorded in terms of controlling emissions from incineration / co-incineration activities in terms of reducing pollution, especially those related to the establishment of limit values in the atmosphere for emissions of dioxins, mercury and powders at which adds limits on discharges to water from waste gas purification facilities.

According to Law no. 278/2013 on industrial emissions, with subsequent amendments and additions, this chapter applies to the activities in Annex I (*activities 5.2 and 5.3*).

In 2018, 33 incineration facilities and co-incineration facilities were inventoried.

In order to guarantee the complete combustion of waste, it is required that all installations maintain the gases resulting from incineration and co-incineration at a minimum temperature of 850°C for at least two seconds. If it is hazardous waste, with a content of halogenated organic substances, expressed in chlorine, greater than 1%, the temperature must be brought to 1100°C for at least two seconds. The heat produced by incineration or co-incineration must be utilized as much as possible.

Limit values of atmospheric emissions for incineration plants are indicated in annex no. VI part 3 of the respective law. These refer to heavy metals, dioxins and furans, carbon monoxide (CO), powders, total organic carbon (TOC), hydrochloric acid (HCl), hydrofluoric acid (HF), sulfur dioxide (SO_2) and nitrogen oxides (NO and NO_2).

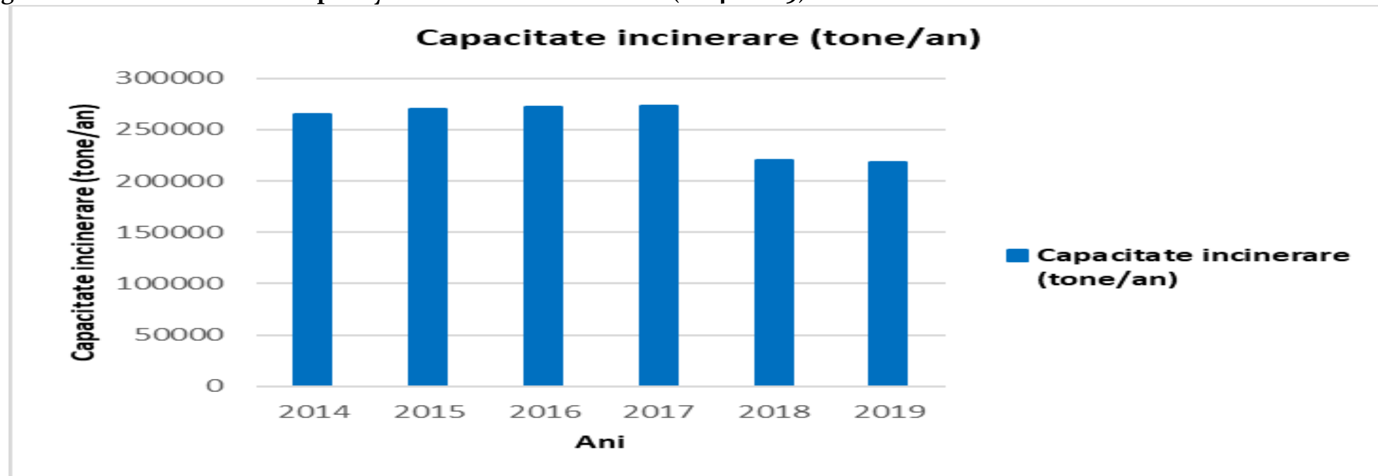
Determining the limit values of atmospheric emissions for co-incineration facilities is provided in annex no. VI part 4 of the respective law. Special provisions are also mentioned regarding cement kilns and combustion installations for waste co-incineration.

The authorizations for the incineration or co-incineration facilities must provide conditions for the discharge of waste water from waste gas treatment, in compliance with the emission limit values indicated in annex no. VI part 5 of the respective law.

Residues generated by incineration or co-incineration must be minimized and recycled as much as possible. When transporting dry residues, precautions must be taken to avoid their dispersion in the environment. Tests must be carried out to establish the physical and chemical characteristics of the residues, as well as their harmful potential.

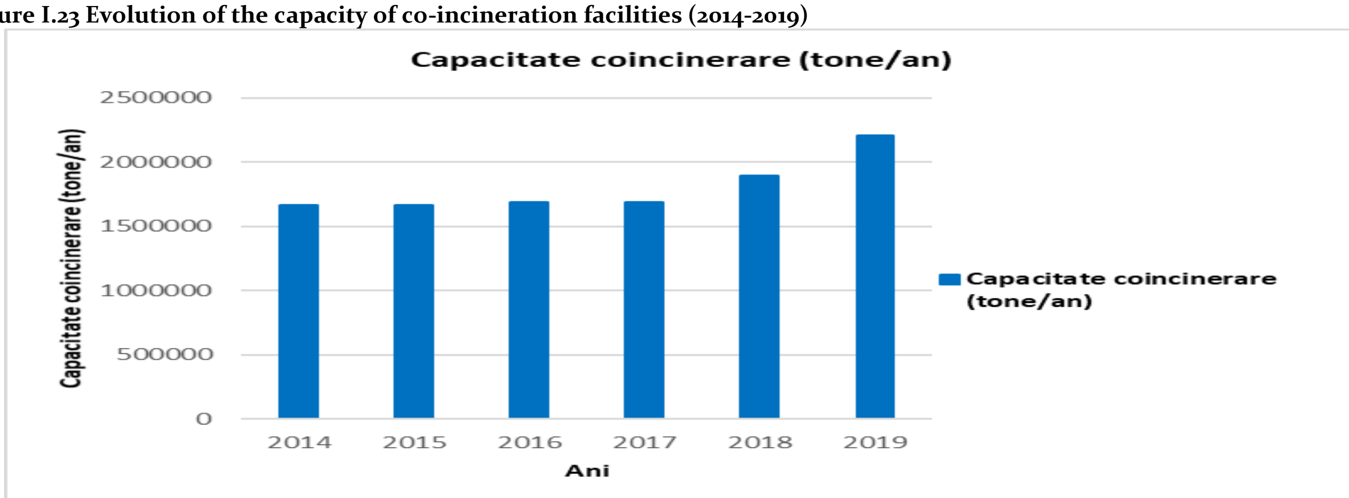
The evolution of the capacities of incineration and co-incineration facilities for the period 2014-2019 is presented in the graphs below.

Figure I.22 Evolution of the capacity of incineration facilities (2014 – 2019)



Source: NEPA

Figure I.23 Evolution of the capacity of co-incineration facilities (2014-2019)



Source: NEPA

Chapter V of the IED is intended for specific provisions applicable to installations and activities that use organic solvents

With the appearance of Directive 2010/75/EU of the European Parliament on industrial emissions, Directive 1999/13/EC on the establishment of measures to reduce emissions of volatile organic compounds (VOC) due to the use of organic solvents in certain activities and installations has become an integral part of this one. Chapter V is intended for the specific provisions applicable to installations and activities that use organic solvents, activities listed in Annex VII Part 1 and which reach, as the case may be, the consumption thresholds established in Part 2 of that annex. These provisions are aimed at preventing or reducing the effects, direct or indirect, due to emissions of volatile organic compounds (VOCs) in the environment, mainly from the air and potential risks to human health, through measures and procedures to be implemented, in certain industrial activities whose solvent consumption is at a higher level than the thresholds established for each type of activity. The economic agents that operate the installations covered by Chapter V have the obligation to apply the measures and techniques associated with the best available techniques to ensure compliance of the operating conditions with one of the following requirements:

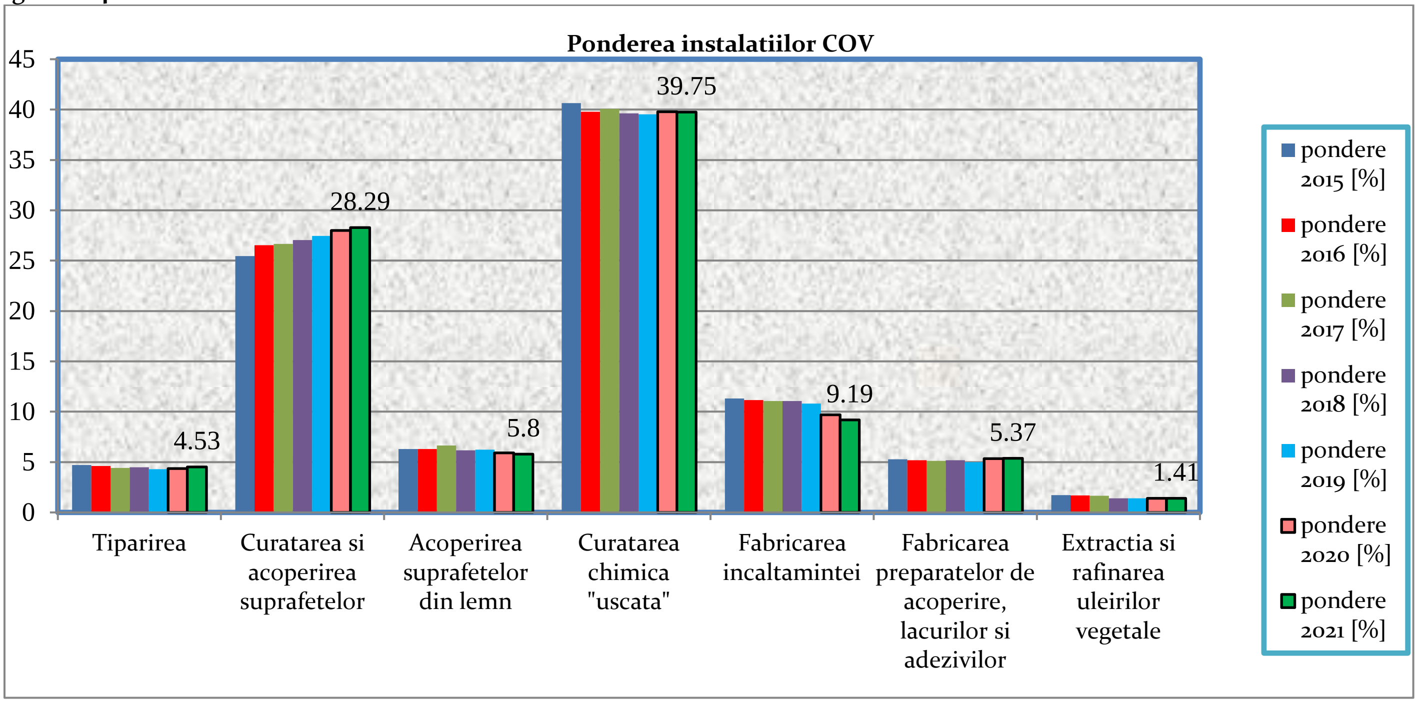
- compliance with VOC emission limit values through the use of VOC emission capture and treatment equipment;
- applying a VOC reduction Scheme by reducing the consumption of solvents through appropriate techniques, or replacing VOC-based solvents with water-based solvents, or with substances with a lower VOC content, which offer the possibility of reducing emissions at the source, reduction equivalent to the one that would be achieved by

applying the emission limit values.

The number of installations whose activities are subject to the provisions of Chapter V of the IED, inventoried in 2022 for the year 2021, was 707 (60 installations also fall under Chapter II - special provisions applicable to installations and activities listed in Annex I - IPPC), of which an important share is held by the following activities:

- printing, with a share of 4.53%;
- cleaning and covering surfaces, with a share of 28.29%;
- covering of wooden surfaces, with a share of 5.8%;
- "dry" chemical cleaning, with a share of 39.75%;
- footwear manufacturing, with a share of 9.19%;
- manufacture of paints, varnishes, inks and adhesives, with a share of 5.37%;
- the extraction and refining of vegetable oils and animal fats, with a share of 1.41% of the total activities inventoried.

Figure I.24 Share of VOC installations



Source: NEPA

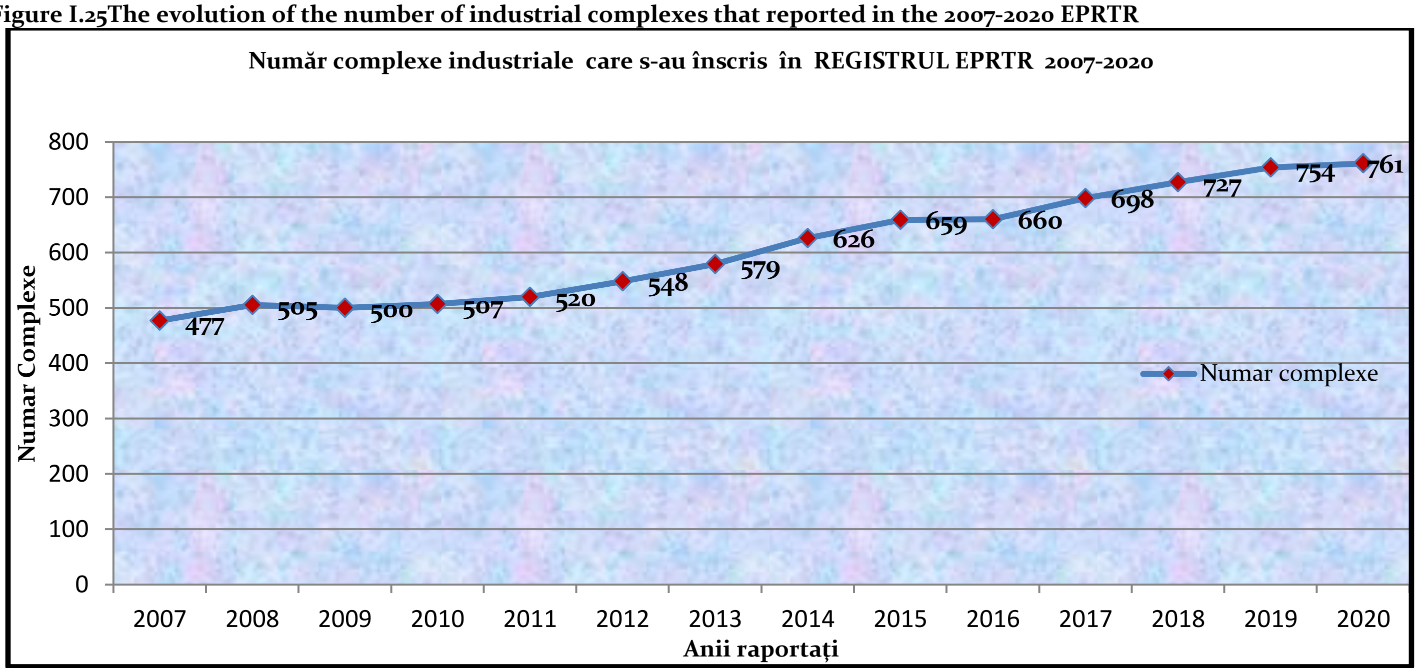
European Register of Pollutants Released and Transferred (E-PRTR Register)

The European Pollutant Release and Transfer Register (E-PRTR Register) succeeds the The European Pollutant Emission Register (EPER Register). The register is designed in the form of an electronic database that can be accessed by the public at the following address https://industry.eea.europa.eu. On January 18, 2006, at European level, Regulation (EC) No. 166/2006 of the European Parliament and of the Council was adopted, establishing the European Pollutant Release and Transfer Register (E-PRTR) and amending Council Directives 91/689/EEC and 96/61/EC (the 'E-PRTR Regulation'). In 2019, Regulation (EC) No. 166/2006 was amended by Regulation (EU) 2019/1010 to align and streamline the reporting requirements in EU environmental legislation. The amending regulation granted the European Commission the competence to adopt implementing acts specifying the type, format, and frequency of information to be reported under Regulation (EC) No. 166/2006. As a result, Commission Implementing Decision (EU) 2019/1741 introduced specific changes to the E-PRTR following Regulation (EU) No. 1010/2019.

The register contains specific data and information regarding pollutant emissions into air, water, and soil, as well as transfers of pollutants from wastewater and hazardous and non-hazardous waste, outside the premises of industrial facilities, from all European Union member states. Reporting is required when the capacity threshold and emission or transfer thresholds outside the premises for pollutants in wastewater or waste are exceeded. Romania has implemented the provisions of the EPRTR Regulation at national level through Government Decision no. 140/2008, which establishes measures for the application of Regulation (EC) No. 166/2006 of the European Parliament and of the Council on the establishment of the European Pollutant Release and Transfer Register and the amendment of Council Directives

91/689/EEC and 96/61/EC, establishing the institutional framework necessary for the direct application of the E-PRTR Regulation.
In accordance with the requirements of the EPRTR Regulation, the National Environmental Protection Agency has created the national website of the Pollutant Release and Transfer Register (PRTR), providing public access both within the country and abroad to environmental information on industrial complexes in Romania. The website can be accessed at http://prtr.anpm.ro . As requested by the European Commission, the link has been forwarded at European level to be integrated into the European register under the "Links - National Registries" section.
Both the European E-PRTR and the national PRTR Register contain information for the period (2007-2020), the data collections related to the latter year being reported by the member states to the European Commission until November 30, 2021. The E-PRTR Regulation established new requirements, additional to those established by the EPER Decision, extending the reporting for the industrial sectors subject to the IPPC Directive to a series of non-IPPC activities, thus totaling 66 activities grouped in 9 industrial sectors, including the mining sub-activity and the exploration/exploitation activity of oil and gas deposits.
The collection related to the year 2020, at national level, includes a number of 761 industrial complexes, respectively locations, which have exceeded the threshold values established by Annex II of the EPRTR Regulation, with 284 industrial complexes more than in 2007 (477), with 256 industrial complexes more than in 2008 (505), with 261 industrial complexes more than in 2009 (500), with 254 industrial complexes more than in 2010 (507), with 241 industrial complexes more than in 2011 (520), with 213 industrial complexes more than in 2012 (548), with 182 industrial complexes more than in 2013 (579), with 135 industrial complexes more than in 2014 (626), with 102 industrial complexes more than in 2016 (659), with 101 industrial complexes more than in 2016 (660), with 63 industrial complexes more than in 2017 (698), with 34 industrial complexes more than in 2018 (727) and with 7 industrial complexes more than in 2019 (754).

Figure I.25The evolution of the number of industrial complexes that reported in the 2007-2020 EPRTR

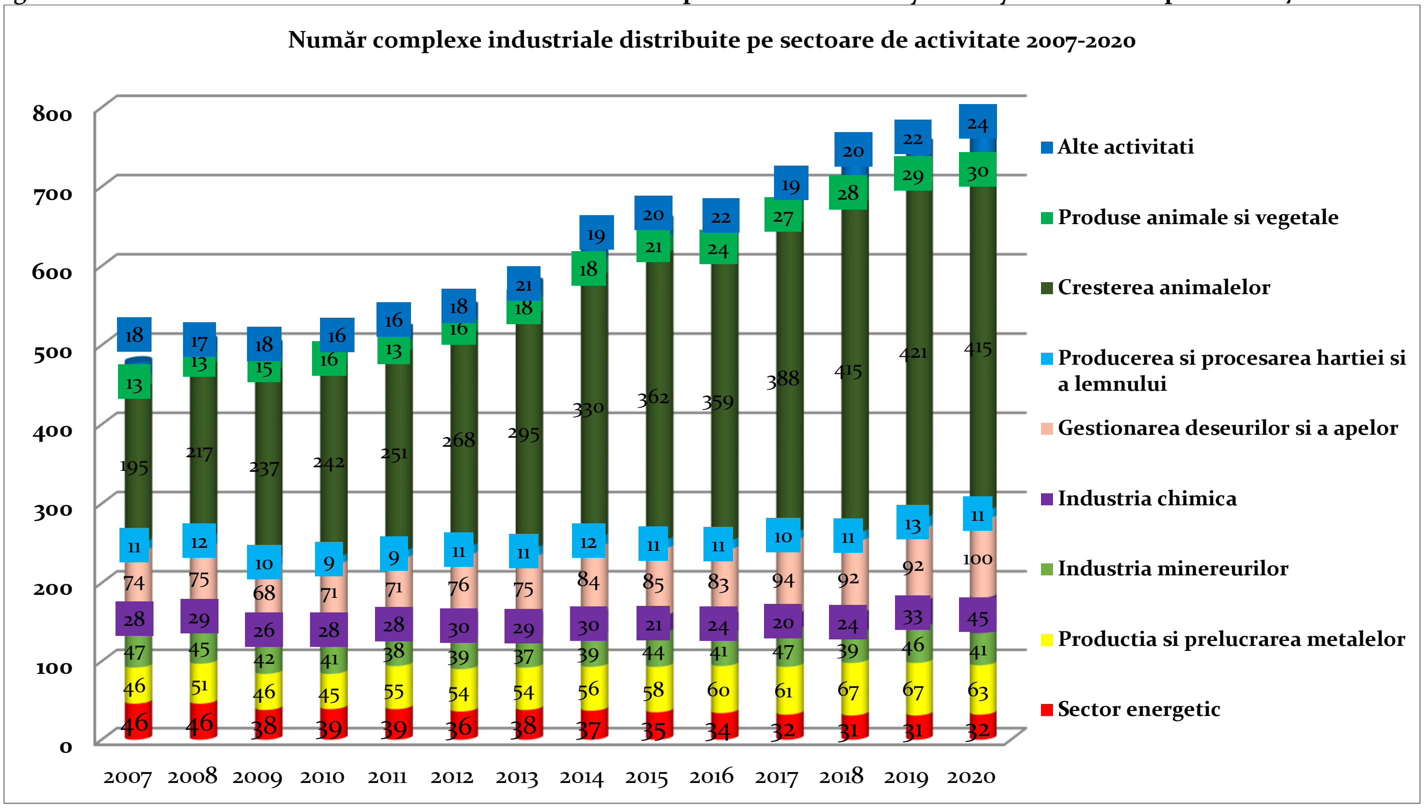


Source: NEPA

Compared to 2019, in 2020 there is an increase of 0.92% in the number of complexes registered in the PRTR National Register, and compared to 2007 an increase of 59.53%. In the 2020 collection, a number of 40 industrial complexes were registered for the first time in the PRTR National Register.

The evolution of the number of industrial complexes distributed by activity sector is presented below:

Figure I.26 Evolution of the number of EPRTR industrial complexes distributed by activity sector in the period 2007-2020



Source: NEPA

As can be seen, the share of the total number of installations reported in the energy sector, metal production and processing, mining industry, chemical industry, paper and wood production and processing, animal plant products sector, as well as other activities, remains more or less the same over the time series, and the number of reported industrial complexes carrying out animal breeding activity was continuously increasing until 2015, after which a small decrease is recorded for 2016 followed by a new increase in 2017, 2018 and 2019, and for 2020 there is a small decrease, with approximately 1.43% compared to 2019.
Their distribution by development regions is as follows:

- Region 1 North - East 107 industrial complexes,
- Region 2 South - East 94 industrial complexes,
- Region 3 South – Muntenia 164 industrial complexes,
- Region 4 South West – Oltenia 47 industrial complexes,
- Region 5 West 116 industrial complexes,
- Region 6 North - West 87 industrial complexes,
- Region 7 Center 119 industrial complexes,
- Region 8 Bucharest – Ilfov 28 industrial complexes.

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Although the energy sector continues to improve its environmental performance, it contributes to air pollution with significant amounts of sulfur dioxide, carbon monoxide, carbon dioxide, nitrogen oxides and powders. Analyzing at national level the evolution of these main pollutants emitted into the air, a general trend of their decrease is observed. We can say that reducing the impact of energy systems on the environment was achieved by rehabilitating and modernizing large combustion plants, by creating desulphurization, deoxidation and powders removal facilities. At the same time, the reduction of SOx emissions in the energy sector was also achieved by giving up the use of fuels with a high sulfur content (coal or fuel oil), but also by using fuels with a low sulfur content (natural gas). But we must admit that this decline in emissions also occurred due to the closure of some facilities as a result of the economic crisis. Overall, in 2020 compared to 2007, most emissions from the energy sector were reduced, as follows: SOx by approximately 94.53%, NOx by approximately 74.61%, PM10 by 91.36%, and CO2 by approximately 62.97 %.

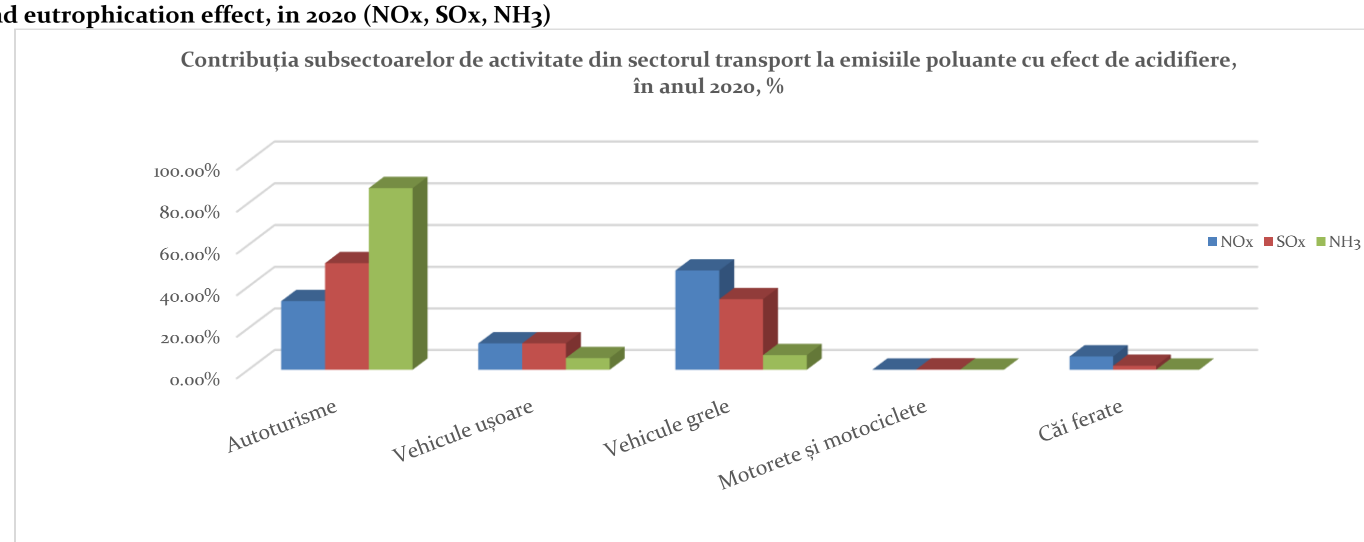
Transport

Emissions of acidifying substances

RO 01
Indicator code Romania: RO 01 EEA indicator code: CSI 01
TITLE: **EMISSIONS OF ACIDIFYING SUBSTANCES**
DEFINITION: The indicator follows the trends of anthropogenic emissions of acidifying substances: nitrogen oxides (NOx), ammonia (NH_3) and sulfur oxides (SOx, SO_2), with each of them taking into account its acidifying potential. The indicator also provides information on changes in emissions from the main source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; the commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Depending on the acidifying potential of anthropogenic emissions of nitrogen oxides (NOx), ammonia (NH_3), and sulfur oxides (SOx, SO_2), the graph below shows the shares of activity subsectors in the transport sector (excluding aviation).

Figure I.27 The contribution of the activity sub-sectors in the transport sector to the emissions of pollutants with an acidifying and eutrophication effect, in 2020 (NOx, SOx, NH_3)



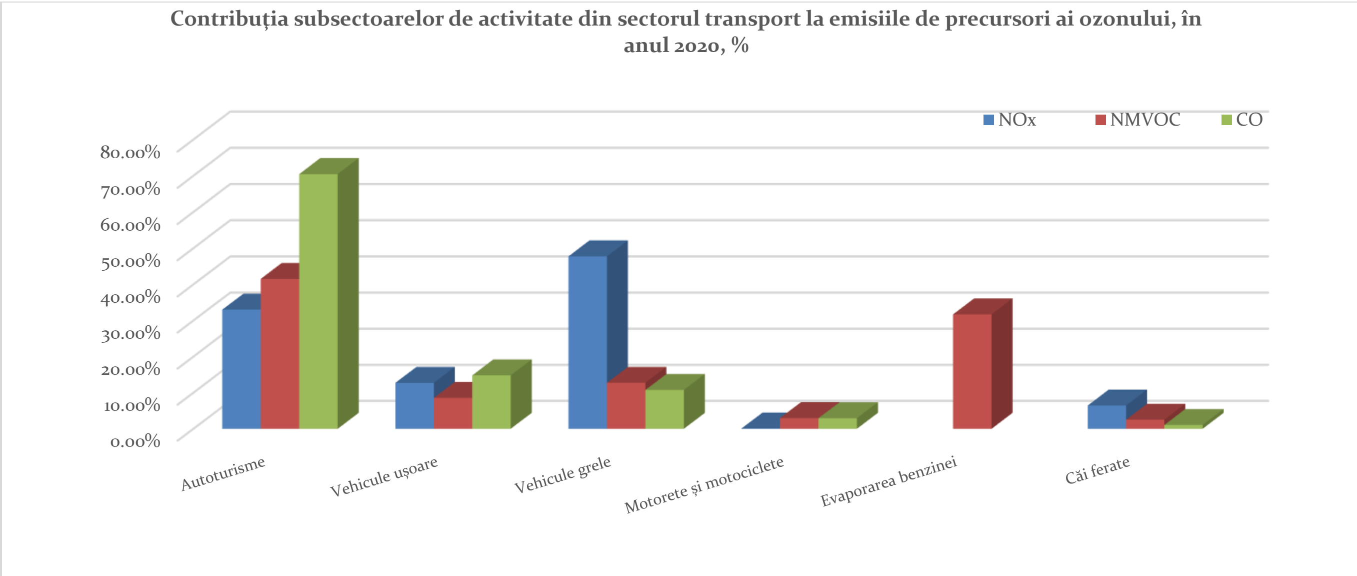
Source: Romania's Informative Inventory Report 2022

From the analysis of the presented data regarding the acidifying potential of anthropogenic emissions of nitrogen oxides (NOx), sulfur oxides (SOx, SO_2), and ammonia (NH_3), it is evident that within the total emissions from the transport sector, the largest contribution comes from road transport in the passenger car category, followed by heavy-duty vehicles, light-duty vehicles, and railway transport.

Emissions of ozone precursors

RO 02
Indicator code Romania: RO 02 EEA indicator code: CSI 02
TITLE: **EMISSIONS OF OZONE PRECURSORS**
DEFINITION: The indicator tracks trends in anthropogenic emissions of ozone precursor pollutants: nitrogen oxides (NOx), carbon monoxide (CO), methane (CH_4) and non-methane volatile organic compounds (VOCs) from the sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; the commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Figure I.28 The contribution of the activity subsectors in the transport sector to the emissions of ozone precursors (NOx, NMVOC, CO), in 2020



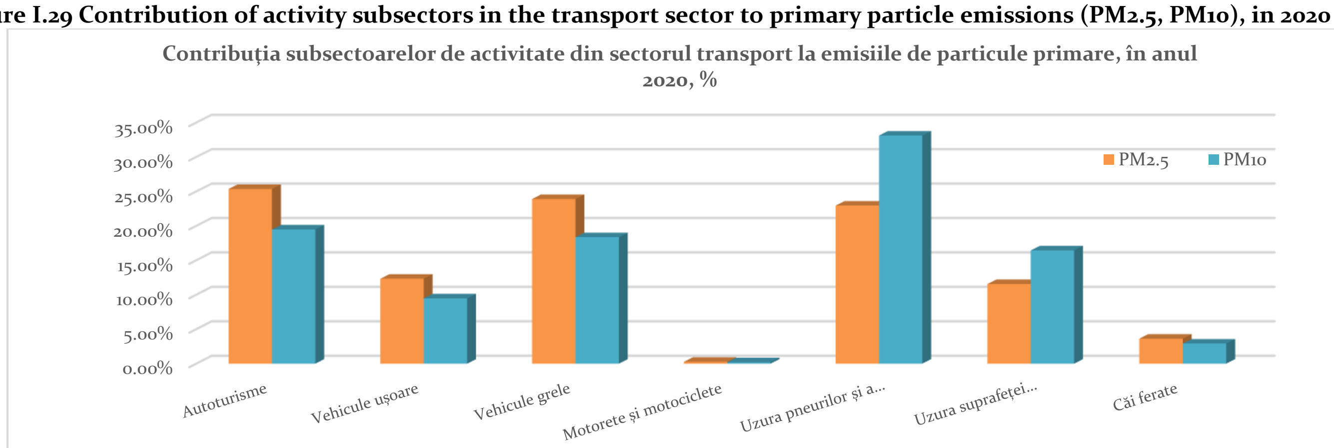
Source: Romania's Informative Inventory Report 2022

Observations show that in the transport sector, the highest share belongs to road transport, particularly passenger cars, for carbon monoxide (CO) and non-methane volatile organic compounds (NMVOCs), while heavy-duty vehicles dominate for nitrogen oxides (NOx). Evaporation processes in gasoline-powered vehicles significantly contribute to the emissions of non-methane volatile organic compounds (NMVOCs).

Emissions of primary particles and secondary particle precursors

RO 03
Indicator code Romania: RO 03 EEA indicator code: RO 03
TITLE: **EMISSIONS OF PRIMARY PARTICLES AND SECONDARY PARTICLE PRECURSORS**
DEFINITION: This indicator shows the trends in emissions of primary particles with a diameter smaller than 2.5 µm (PM2.5) and respectively 10 µm (PM10) and secondary particle precursors (nitrogen oxides (NOx), ammonia (NH_3) and carbon dioxide sulfur (SO_2), from anthropogenic sources, by source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste other sources.

Figure I.29 Contribution of activity subsectors in the transport sector to primary particle emissions (PM2.5, PM10), in 2020



Source: Romania's Informative Inventory Report 2022

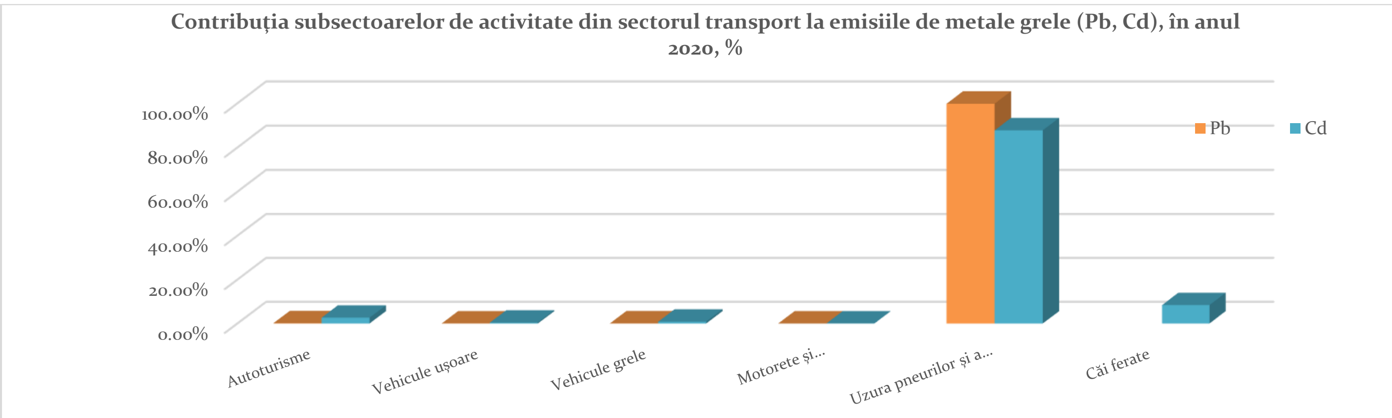
From the analysis of data from the transport sector, it is found that emissions of primary particles and secondary particles precursors mainly come from road transport.

Heavy metal emissions

Ro 38
Indicator code Romania: RO 38 EEA indicator code: APE 05
TITLE: **HEAVY METAL EMISSIONS**
DEFINITION: Trends in anthropogenic emissions of heavy metals by activity sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

The graph below illustrates the share of anthropogenic emissions of heavy metals (Pb, Cd) from activity subsectors in the transport sector for the year 2019 (Figure I.30).

Figure I.30 The contribution of the activity sub-sectors in the transport sector to the emissions of heavy metals (Pb, Cd), in 2020



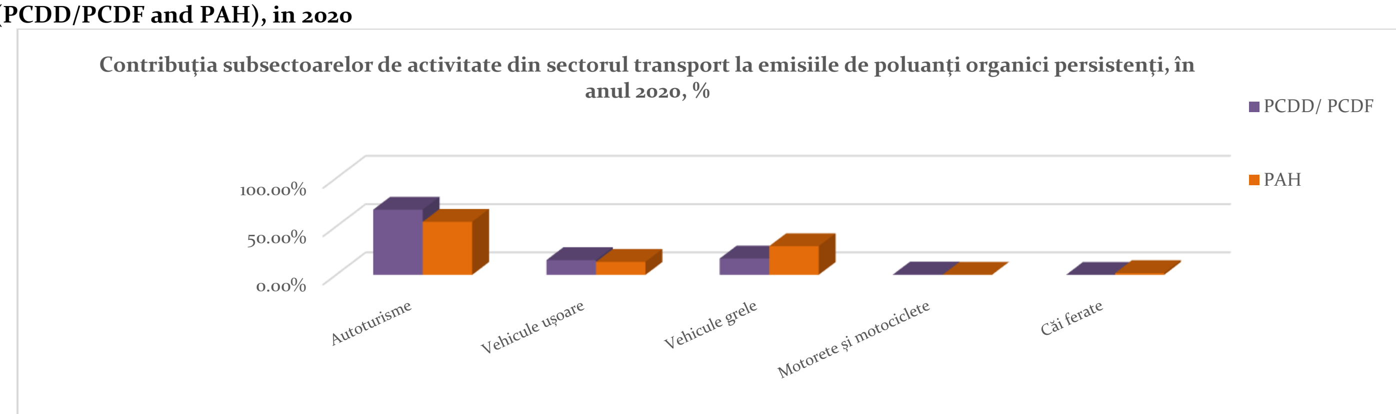
Source: Romania's Informative Inventory Report 2022

From the graph above, it can be seen that in the transport sector, the largest contribution to heavy metal emissions comes from tire and brake wear of road vehicles.

Emissions of persistent organic pollutants

RO 39
Indicator code Romania: RO 39 EEA indicator code: APE 06
TITLE: **EMISSIONS OF PERSISTENT ORGANIC POLLUTANTS**
DEFINITION: Trends in anthropogenic emissions of persistent organic pollutants, of polycyclic aromatic hydrocarbons (PAH), by activity sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

Figure I.31 Contribution of activity subsectors in the transport sector to emissions of persistent organic pollutants (PCDD/PCDF and PAH), in 2020



Source: Romania's Informative Inventory Report 2022

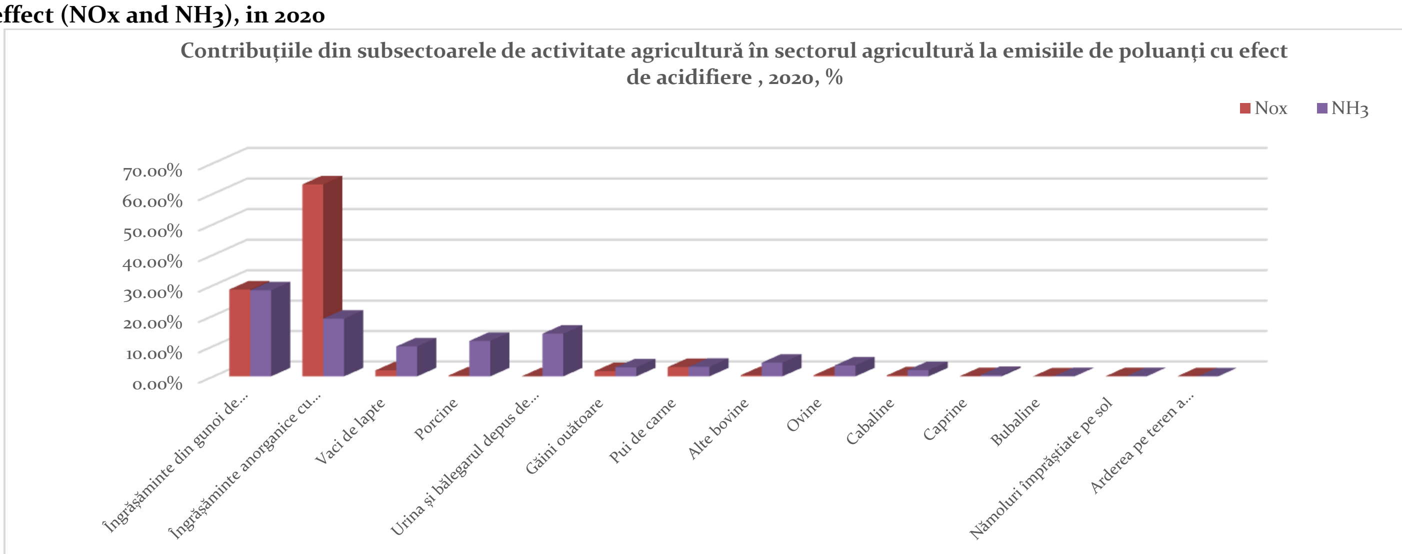
From the analysis of data from the transport sector, it is found that road transport has the largest share of persistent organic pollutant emissions in the category of passenger cars, followed by the categories of heavy-duty vehicles and light-duty vehicles.

Agriculture

Emissions of acidifying substances

RO 01
Indicator code Romania: RO 01 EEA indicator code: CSI 01
TITLE: **EMISSIONS OF ACIDIFYING SUBSTANCES**
DEFINITION: The indicator follows the trends of anthropogenic emissions of acidifying substances: nitrogen oxides (NOx), ammonia (NH_3) and sulfur oxides (SOx, SO_2), for each of them taking into account its acidifying potential. The indicator also provides information on changes in emissions from the main source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Figure I.32 The contributions of activity subsectors in the agricultural sector to the emissions of pollutants with an acidifying effect (NOx and NH3), in 2020



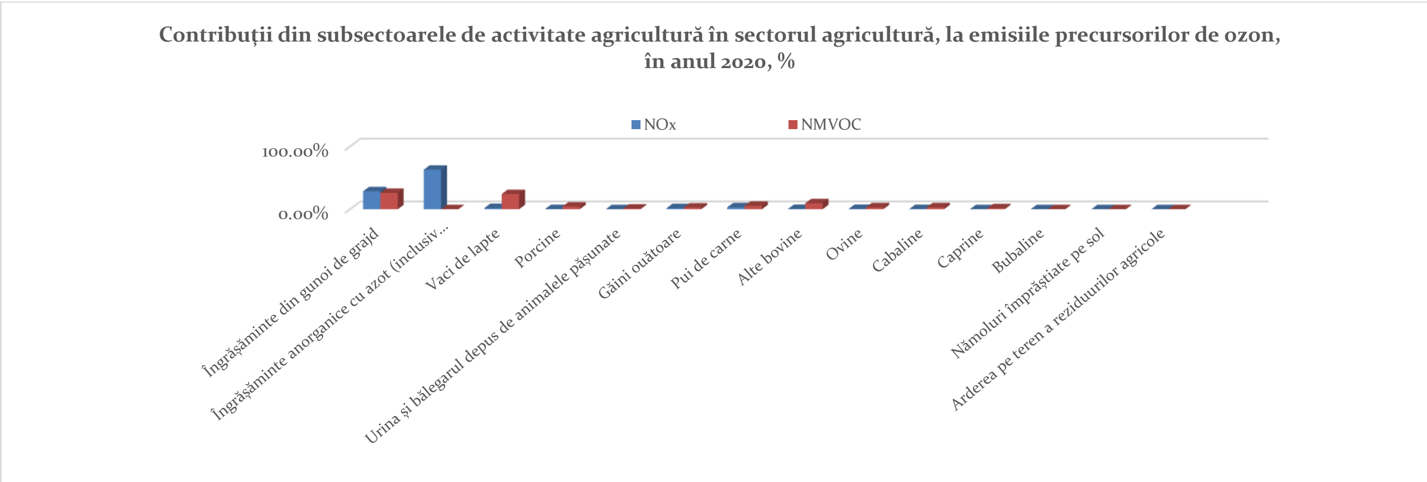
Source: Romania's Informative Inventory Report 2022

From the analysis of the data presented regarding the contribution of activity subsectors in agriculture to acidifying pollutant emissions, it is evident that the activities with the most significant impact are the application of synthetic and natural fertilizers in agricultural crops, followed by animal husbandry (milk cows, pigs, laying hens). The activity subsector related to the application of organic and inorganic nitrogen fertilizers (including urea) to the soil is the main contributor to NOx emissions in agriculture.

Emissions of ozone precursors

RO 02
Indicator code Romania: RO 02 EEA indicator code: CSI 02
TITLE: **EMISSIONS OF OZONE PRECURSORS**
DEFINITION: The indicator tracks trends in anthropogenic emissions of ozone precursor pollutants: nitrogen oxides (NOx), carbon monoxide (CO), methane (CH_4) and non-methane volatile organic compounds (VOCs) from the sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Figure I.33 The contributions of activity subsectors in the agricultural sector to the emissions of ozone precursors (NMVOC and NOx), in 2020



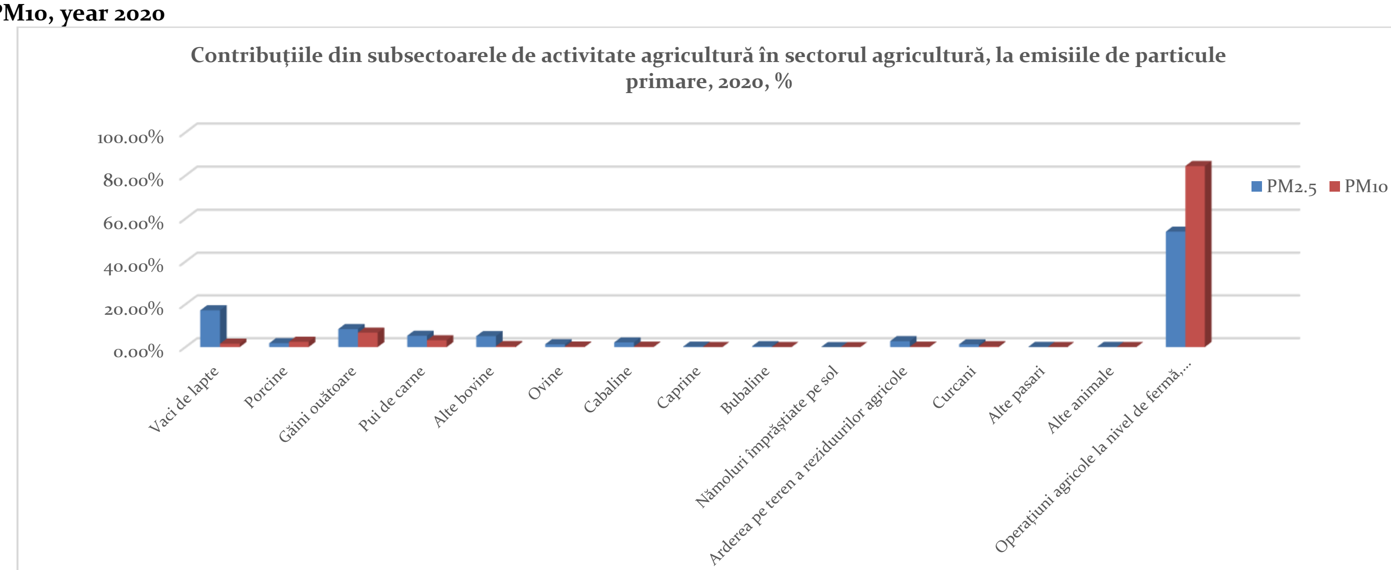
Source: Romania's Informative Inventory Report 2022

From the analysis of the data presented regarding the contribution of activity sectors in agriculture to national-level ozone precursor emissions, it is evident that livestock farming activities (milk cows, broiler chickens, other cattle) along with the application of fertilizers from manure have the highest share for the pollutant NMVOC. As for NOx emissions, the primary emitter is the activity subsector related to the application of inorganic nitrogen fertilizers (including urea) and the subsector related to the application of manure fertilizers.

Emissions of primary particles and secondary particle precursors

RO 03
Indicator code Romania: RO 03 EEA indicator code: CSI 03
TITLE: **EMISSIONS OF PRIMARY PARTICLES AND SECONDARY PARTICLE PRECURSORS**
DEFINITION: The indicator tracks trends in anthropogenic emissions of ozone precursor pollutants: nitrogen oxides (NOx), carbon monoxide (CO), methane (CH4) and non-methane volatile organic compounds (VOCs) from the sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Figure I.34 The contributions of activity sub-sectors in the agricultural sector to the emissions of primary particles PM2.5 and PM10, year 2020



Source: Romania's Informative Inventory Report 2022

From the analysis of the data on the contribution of activity sectors in agriculture to primary particles emissions PM2.5 and PM10 in the agricultural sector, it is evident that a significant share is held by the activity related to agricultural operations on farms, transportation, and storage of agricultural products, followed by the activity of dairy cow farming.

Emissions of persistent organic pollutants

RO 39
Indicator code Romania: RO 39 EEA indicator code: APE 06
TITLE: **EMISSIONS OF PERSISTENT ORGANIC POLLUTANTS**
DEFINITION: Trends in anthropogenic emissions of persistent organic pollutants, of polycyclic aromatic hydrocarbons (PAH), by activity sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

In the year 2020, the agriculture sector had a national-level contribution of 0.0661 tons, representing 0.1% of the national total for emissions of polycyclic aromatic hydrocarbons resulting from the open burning of agricultural residues.

AMBIENT AIR POLLUTION TRENDS AND FORECASTS

The values of emissions of polluting substances released into the atmosphere are directly proportional to:

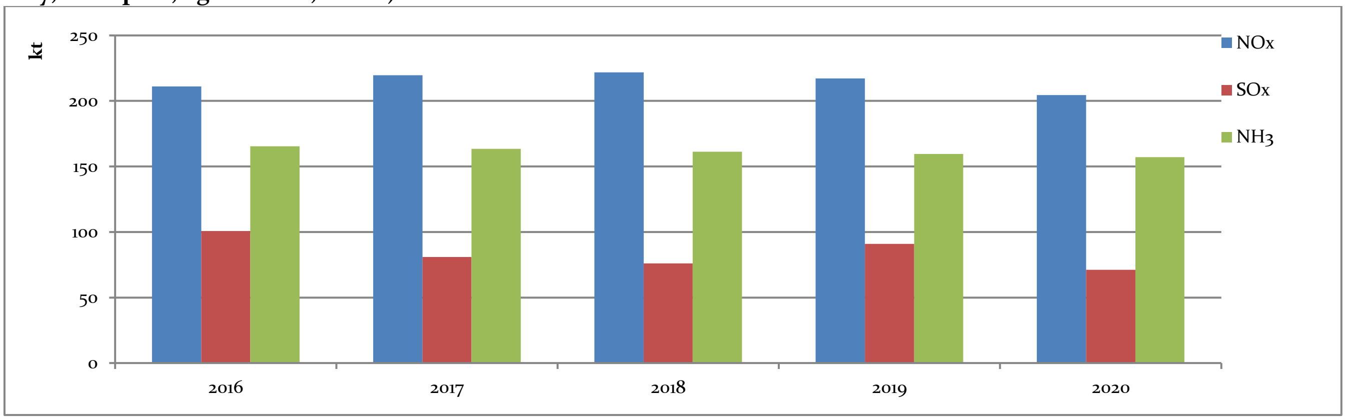
- the level of production achieved from various sectors of activity at national level;
- the level of modernization of facilities (cleaner technologies, with minimal emissions of polluting substances);
- replacing old installations, which are not economically and financially justified to be refurbished, with new, non-polluting installations;
- the transposition of European legislation into Romanian legislation so as to achieve the targets regarding the limitation of pollutant emissions into the atmosphere, the maintenance and improvement of air quality indicators.

Air pollution is a complex problem because it is a widespread phenomenon, generated by many activities, such as increased industrial and energy production, burning of fossil fuels, increased traffic, warming, etc.

Emissions of acidifying substances

RO 01
Indicator code Romania: RO 01 EEA indicator code: CSI 01
TITLE: **EMISSIONS OF ACIDIFYING SUBSTANCES**
DEFINITION: The indicator follows the trends of anthropogenic emissions of acidifying substances: nitrogen oxides (NO_x), ammonia (NH_3) and sulfur oxides (SO_x, SO_2), for each of them taking into account its acidifying potential. The indicator also provides information on changes in emissions from the main source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Figure I.35 **Trend of air pollutant emissions with acidification and eutrophication effect at national level 2016-2020 (energy, industry, transport, agriculture, waste)**



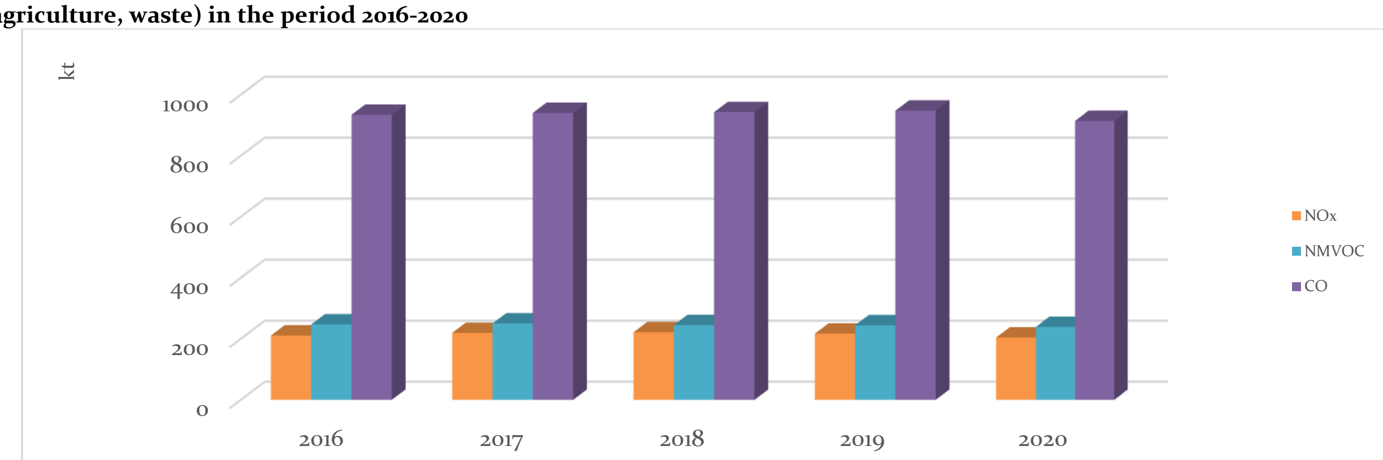
Source: LRTAP-RO 2022

The emissions of sulfur dioxide have shown a decreasing trend due to the progressive implementation of compliance measures by activity holders with emission limit values.
From the analysis of the national-level data over the analyzed period, variations in increase or decrease can be observed from year to year across sectors. The decrease is predominantly evident in the energy and industry sectors, as well as the agriculture and transport sectors.

Emissions of ozone precursors

RO 02
Indicator code Romania: RO 02 EEA indicator code: CSI 02
TITLE: **EMISSIONS OF OZONE PRECURSORS**
DEFINITION: The indicator tracks trends in anthropogenic emissions of ozone precursor pollutants: nitrogen oxides (NOx), carbon monoxide (CO), methane (CH_4) and non-methane volatile organic compounds (VOCs) from the sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

Figure I.36 The trend of ozone precursor atmospheric pollutant emissions at national level (energy, industry, transport, agriculture, waste) in the period 2016-2020



Source: LRTAP-RO-2022

From the analysis of the data sets presented regarding the trend of ozone precursor pollutant emissions at national level, small variations are observed over the analyzed period as a result of the implementation of the principles of sustainable development and the adoption of environmental policies, such as:

- the production of electricity by partially replacing fossil fuels with alternative sources: nuclear energy (commissioning of reactors 3 and 4 at CNE Cernavodă), wind energy, energy produced in the fields of photovoltaic panels, biomass, etc.;
- the reduction of sulfur content in fuels and motor fuels, and the partial replacement of gasoline and diesel fuels with

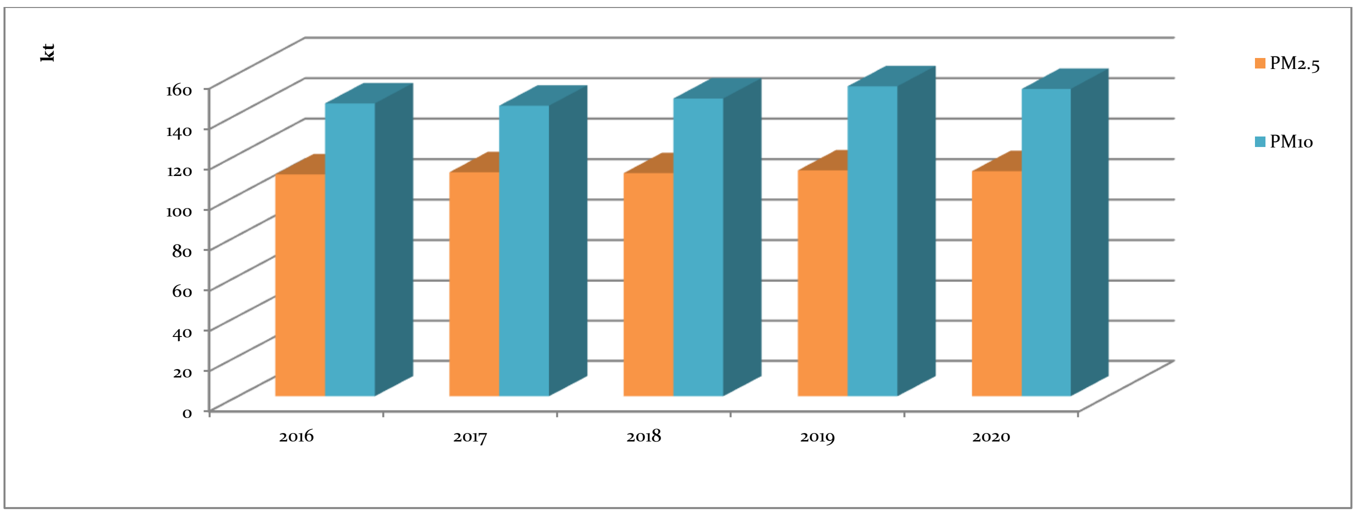
biofuels and electric vehicles;

- replacing the heating of rural households (traditional wood stoves) with modernized stoves that use pellets or gas as fuel and that have high combustion efficiencies and low pollutant emissions;
- the introduction into operation of motor vehicles equipped with electrically powered engines;
- the provision of economic-financial mechanisms to allow the replacement of installations with a significant polluting effect on the environment with less polluting ones;
- the provision of facilities for the retention, capture, storage of polluting substances (e.g. carbon capture and storage at large combustion plants - IMA, electrostatic filters, low NOx burners, scrubbers, etc.).

Emissions of primary particles and secondary particle precursors

RO 03
Indicator code Romania: RO 03 EEA indicator code: CSI 03
TITLE: **EMISSIONS OF PRIMARY PARTICLES AND SECONDARY PARTICLE PRECURSORS**
DEFINITION: This indicator shows the trends in emissions of primary particles with a diameter smaller than 2.5 µm (PM2.5) and respectively 10 µm (PM10) and secondary particle precursors (nitrogen oxides (NOx), ammonia (NH3) and carbon dioxide sulfur (SO2), from anthropogenic sources, by source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste other sources.

Figure I.37 The trend of emissions of primary particles in suspension at national level (energy, industry, transport, agriculture, waste) 2016-2020

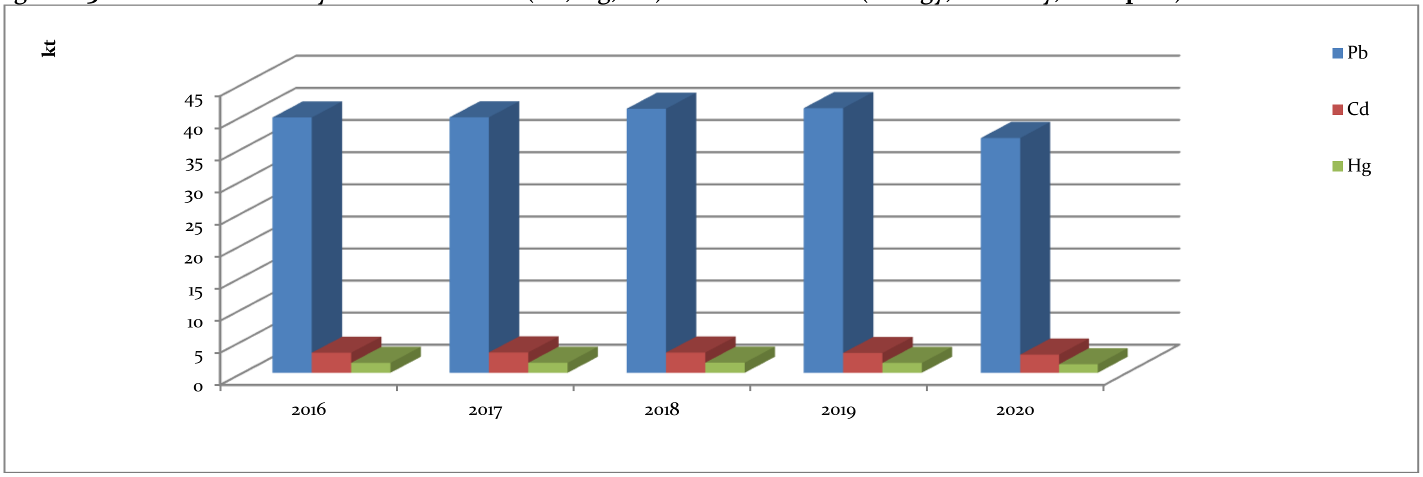


Source: LRTAP-RO-2022

Heavy metal emissions

RO 38
Indicator code Romania: RO 38 EEA indicator code: APE 05
TITLE: **HEAVY METAL EMISSIONS**
DEFINITION: Trends in anthropogenic emissions of heavy metals by activity sector: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

Figure I.38 The trend of heavy metal emissions (Cd, Hg, PB) at national level (energy, industry, transport) 2016-2020



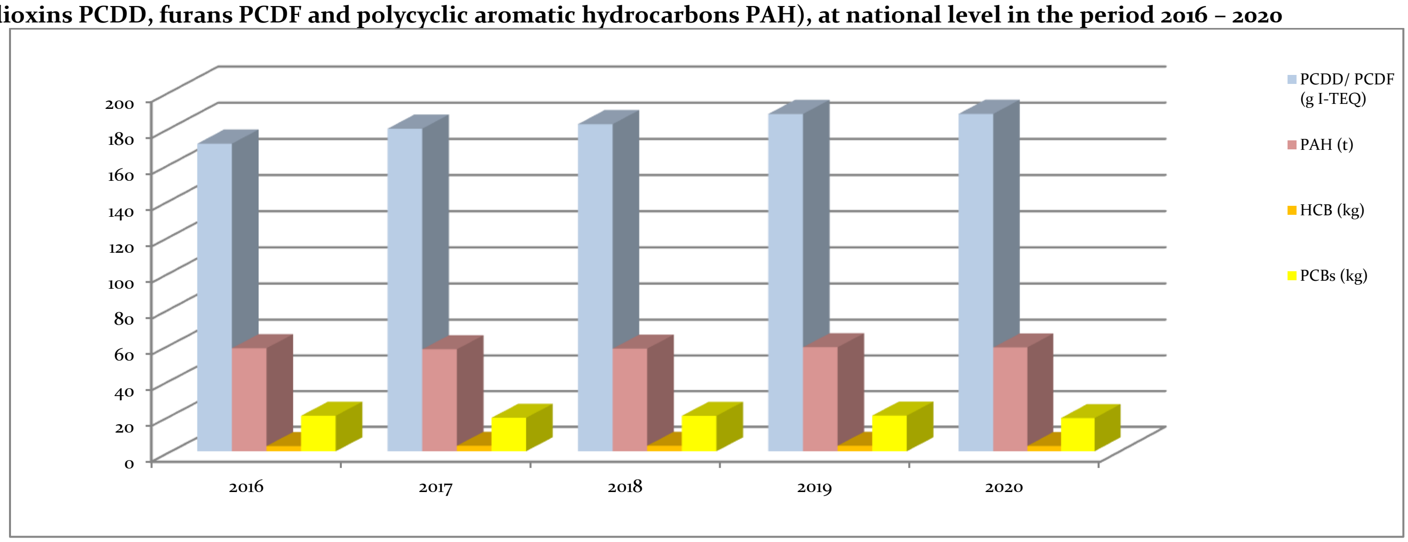
Source: LRTAP-RO-2022

At national level, from the analysis of the data presented regarding the trend of heavy metal emissions, an increase can be observed in the years 2016-2020, driven by economic development, with a decrease in 2020. The transport sector shows an annual growth trend mainly due to the expansion of the national vehicle fleet, both civil and industrial, except for the year 2020.

Emissions of persistent organic pollutants

RO 39
Indicator code Romania: RO 39 EEA indicator code: APE 06
TITLE: **EMISSIONS OF PERSISTENT ORGANIC POLLUTANTS**
DEFINITION: Trends in anthropogenic emissions of persistent organic pollutants, of polycyclic aromatic hydrocarbons (PAH), by activity sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; commercial, institutional and residential; use of solvents and other products; agriculture; waste; other sources.

Figure I.39 The trend of emissions of persistent organic pollutants (hexachlorobenzene HCB, polychlorinated biphenyls PCBs, dioxins PCDD, furans PCDF and polycyclic aromatic hydrocarbons PAH), at national level in the period 2016 – 2020



Source: LRTAP-RO-2022

In the industry and transport sectors, there is a moderate variation in the emissions of persistent organic pollutants mainly due to the variation in economic activities, respectively the increase in the car fleet.

POLICIES, ACTIONS AND MEASURES TO IMPROVE AMBIENT AIR QUALITY

The assessment of ambient air quality is regulated by Law no. 104/2011 on ambient air quality, which transposes Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe and Directive 2004/107/EC of the European Parliament and of the Council on arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons in ambient air. Law no. 104/2011 on ambient air quality provides for the establishment of agglomerations and air quality management zones where the ambient concentrations of pollutants do not meet air quality objectives (limit values or target values). For these zones, it is necessary to manage air quality by developing and implementing air quality plans/programs, which should include measures to reduce emissions and protect sensitive population groups.


KALE LOCKS

II. WATER

WATER RESOURCES, QUANTITIES AND FLOWS

RO 18 Natural water resources at the level of 2019

Indicator code Romania: RO 18
EEA indicator code: CSI 18

TITLE: USE OF FRESHWATER RESOURCES

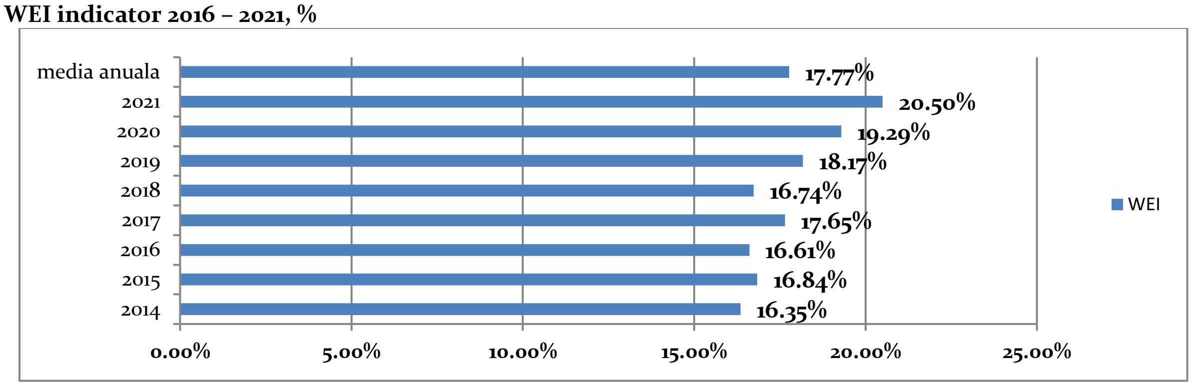
DEFINITION: The Water Exploitation Index (WEI) represents the total average annual fresh water abstraction related to the total average annual renewable water resources at national level, it is expressed as a percentage and calculated with the following formula.
WEI = CT/RTx100
where: WEI is the water exploitation index, expressed in %;
CT - the total average annual abstraction of fresh water, expressed in billions of m^3/year;
RT - the total average annual resources of renewable water at national level, expressed in millions of m^3/year.

Table II.1 Potential and technically usable water resources (theoretical and usable) 2016 - 2021

Years	Theoretical resource (billion m3)	Usable resource (billion m3)	Total water sampling (billion m3)	WEI indicator (%)
2016	134.60	38.35	6.37	16.61
2017	134.60	38.35	6.77	17.65
2018	134.60	38.35	6.42	16.74
2019	134.60	38.35	6.97	18,17
2020	134.60	38.35	7.40	19.29
2021	134.60	38.35	7.86	20.49
Average years 2016 - 2021	134.60	38.35	6,815	17,776

Source: NARW, NIHWM

Figure II.1 WEI indicator 2016 – 2021, %



Source: NARW, NIHWM

Surface water resources

Table II.2 Water resources in 2021, compared to the previous period (2016-2020)

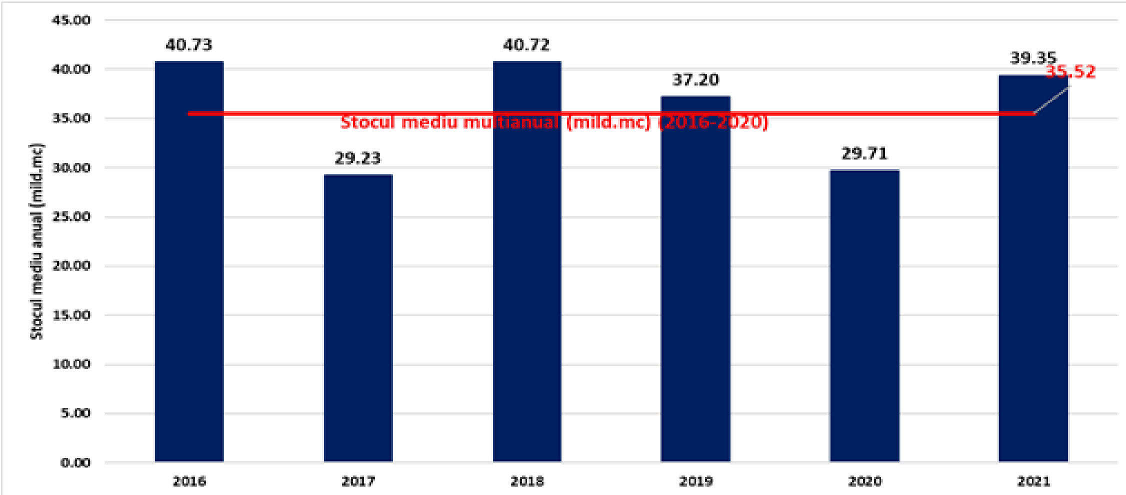
Hydrographic basin	Parameter	F (km2)	Annual avg Q (m^3/s) 2016	2017	2018	2019	2020*	Avg 2016-2020	2021	Q2021/Qavg (%)
TISA*	Q	4540	62.2	74.57	70.7	65.87	62.1	67.1	73.8	110
	V		1980	2352	2230	2077	1964	2121	2327	

SOMEȘ	Q	17840	129.8	95.21	93.21	109.38	80.3	102	136.1	134
	V		4105	3003	2939	3450	2539	3207	4290	
CRIȘURI	Q	14860	90.4	64.92	81.48	79.88	52.1	73.8	87.6	119
	V		2859	2047	2569	2519	1648	2328	2762	
MUREȘ	Q	29390	176.4	116.1	159.4	139.2	135.2	145	161.4	111
	V		5578	3661	5027	4391	4275	4586	5090	
BEGA – TIMIȘ - CARAȘ	Q	13060	78.85	46.61	66.3	80.86	65.9	67.7	98.4	145
	V		2487	1470	2091	2550	2084	2136	3103	
NERA - CERNA	Q	2740	35.8	19.38	33.01	32.4	31.1	30.3	35.4	116
	V		1132	611	1041	1022	983	958	1115	
JIU	Q	10080	154	70.8	111	92.7	79.0	102	123.7	122
	V		4870	2233	3500	2923	2498	3205	3901	
OLT	Q	24050	162	134	205	156	135	158	189	119
	V		5123	4226	6465	4920	4269	5001	5960	
VEDEA	Q	5430	15.9	7.15	25.1	10.28	4.81	12.6	9.72	77.0
	V		503	225	791	324	152	399	307	
ARGEȘ	Q	12550	75	57.68	74.85	89.27	48.8	69.1	70.4	102
	V		2372	1819	2361	2815	1543	2182	2221	
IALOMIȚA	Q	10350	45.1	40.2	45	33	28.8	38.4	45.4	118
	V		1426	1268	1419	1041	911	1213	1432	
DUNĂREA	Q	34141	33.1	23.55	35.17	32.09	21.1	29.0	29.9	103
	V		1047	743	1109	1012	667	916	943	
SIRET	Q	42890	217	160.3	272.57	241.45	187.2	216	176.2	81.7
	V		6862	5055	8596	7614	5920	6809	5560	
PRUT**	Q	10990	7.39	13.72	15.16	15,363	6.86	11.7	9.55	81.6
	V		234	433	478	484	217	369	301	
DOBROGEA	Q	5480	4.88	2.63	3.34	1.67	1.12	2,728	1.33	48.8
	V		154	82.8	105	53	35	86.0	42.0	
Total Romania without the Danube River	Q	238391	1288	926.83	1291.29	1179.45	939.39	1125	1247.9	111
	V		40732	29228	40722	37195	29705	35516	39354	

Source: NIHWM

Note: Q - Flow rate Q (m^3/s), V - total volume ($10^6 m^3$)
** - does not include the flow and volume of the Tisa River*
*** does not include the flow and volume of the Prut River, which is a border watercourse*

Figure II.2 Water resources (volume 106 m3) of 2021, compared to the previous period (2016-2020)



Source: NIHWM

Extending the comparative analysis of the 2021 resource evolution at the level of the main basins, it is observed that at the national level, the volume flow in 2021 was approximately 4% higher than the multi-year average of the last 5 years. The lowest value of the average annual stock (below 50% of the multi-year average of the last 5 years) was recorded in the Dobrogea hydrographic area (48.8%) (Table II.2). With the exception of the Vedea (77%), Siret (81.7%), and Prut (81.6%) hydrographic basins, the other analyzed basins recorded multi-year average stock values higher than the multi-year average values determined for the 2015-2019 period, with increases ranging from 10% to 45%.
In conclusion, 2021 was a normal to rainy year in terms of the total water resource volume from inland rivers. The Danube River presents a similar situation to that recorded on inland river courses, with the flow at the entry into the country (Baziaș hydrometric station) and at the exit from the country (Isaccea hydrometric station) being below the calculated average for the last 5 years (Table II.3). The resource corresponding to the Danube River at the entry into the country was 80,007 million cubic meters in 2021 (or 75,624 billion cubic meters in the 2016-2020 period), approximately 6% higher than the multi-year average of the river, which, for the last 60 years, is about 85,000 billion cubic meters (values represent 50% of the volumes flowing on the Danube at the entry into the country, for Romania, the other half belonging to the Republic of Serbia).

Table II.3 Water resources of the Danube River in 2021, compared to the previous period (2016-2020)

Hydrometric control stations on the Danube river	Parameter	Annual avgQ (m3/s)							Q2021/Q avg (%)
		2016	2017	2018	2019	2020*	MED 2016-2020	2021	
Baziaș	Q	5410	4530	5072	4813	4419	4849	5074	106
	V	170610	142858	159950	151783	139738	152988	160015	
	V 1/2	85305	71429	79975.3	75891.5	69869	75624	80007	
Isaccea	Q	6470	5210	6499	5593	4893.5*	5943	6022	105
	V	204038	164303	204952	176381	154742	180883	189910	

Source: NIHWM

Note: Q - Flow Q (m3/s), V - total volume (106m3), V 1/2 - the values represent 50% of the volumes flowing on the Danube at the entrance to the country, related to Romania, the other half belonging to the Republic of Serbia
** as a result of the inconclusiveness of the data from the Isaccea hydrometric station, the water resource of the Danube, at the exit from the country, was determined for the year 2020 by summing the water stock determined at the Grindu hydrometric station on the Danube river with the summation of the water stock of the river Prut determined at the Oancea hydrometric station*

The average resource in Romania is about 0.165 million m3/km2. In 2021, the richest water resources were represented by the Tisa, Someș, Crișuri, Mureș basins, those in the Banat, Jiu, Olt, Argeș, Ialomița hydrographic area, while the rivers

corresponding to the Dobrogrean area were the most deficient from this point of view. Also, in 2021, Romania had a specific resource from inland rivers of 2071m³/inhabitant/year compared to 19003002 million inhabitants (the population of Romania in 2021 according to https://www.worldometers.info/world-population/romania-population/).
Extending the analysis, the specific resource was calculated on each waterbasin analyzed. Thus, through GIS techniques, the corresponding population of each hydrographic basin was determined based on the "Localities" shp, the "Population" field based on the data obtained from the Population and Housing Census of 2011 (http://www.recensamantromania.ro/). The obtained data were presented in table no. II.4.

Table II.4 The specific resource calculated by hydrographic basins based on data from the 2011 Population and Housing Census

Hydrographic basin	F (km2)	Average annual volume (mil.m³)	No. inhabitants (2011)	Theoretical specific resource (m³/loc./year)
TISA	4540	2327	300747	7737
SOMEȘ	17840	4290	1505499	2850
CRIȘURI	14860	2762	853134	3237
MUREȘ	29390	5090	1902949	2675
BEGA – TIMIȘ - CARAȘ	13060	3103	874429	3549
NERA - CERNA	2740	1115	52651	21177
JIU	10080	3901	929184	4198
OLT	24050	5960	1892452	3149
VEDEA	5430	307	360155	852
ARGEȘ	12550	2221	3379628	657
IALOMIȚA	10350	1432	1279917	1119
DUNĂREA	34141	943	1537039	614
SIRET	42890	5560	3563802	1560
PRUT	10990	301	1072436	281
DOBROGEA	5480	42	617565	68.0
Total Romania without the Danube River	238391	39354	20121587	1956

Source: NIHWM

Note: The volume values for the year 2021 were reported based on data from the 2011 Population and Housing Census

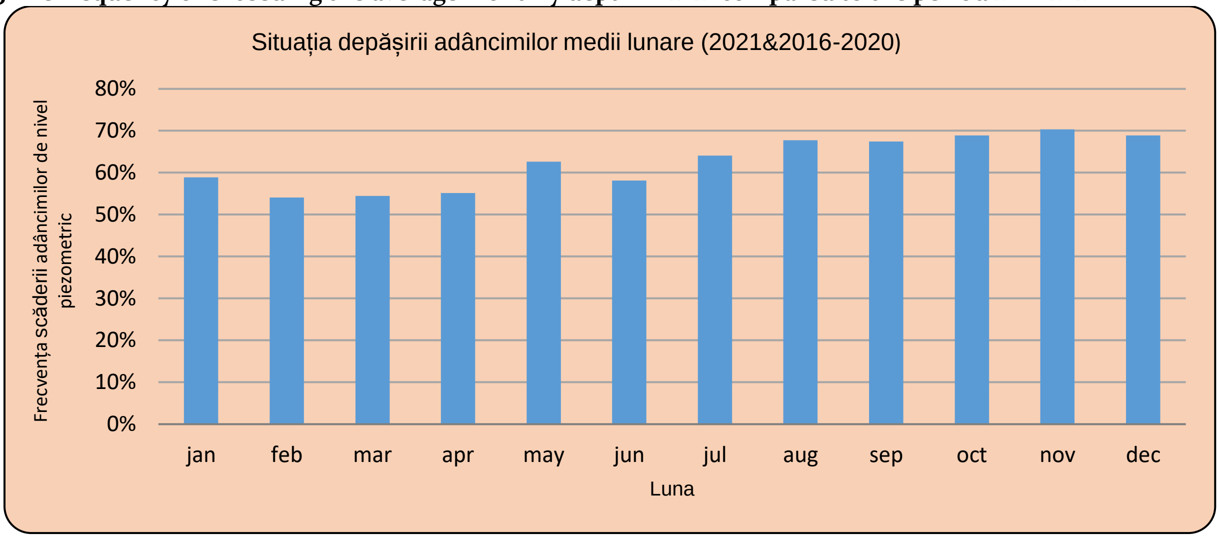
Groundwater resources

Groundwater resources represent the volume of water that can be extracted from an aquifer, in other words, the exploitable water volume. This notion is complex because the amount of water that can be supplied by an aquifer depends on the volume of reserves and is limited by technical and economic possibilities, conservation and protection of resources.
Groundwater reserves represent the volume of gravitational water stored in a specific period or at a specific moment in an aquifer or rock formation. Thus, reserves are conditioned by the geological structure, i.e., the geometry of the aquifer and the effective porosity or storage coefficient, a factor that expresses the volume of free water in the rock formation. Reserves depend solely on volumetric data and are expressed in volume units (usually in cubic meters, m³).
The total groundwater resources in Romania were estimated at 9.68 billion cubic meters per year, of which 4.74 billion cubic meters per year are shallow groundwater and 4.94 billion cubic meters per year are deep groundwater, representing approximately 25% of surface water.
In Romania, the identification and delineation of groundwater bodies were carried out in accordance with the specific methodology for characterizing groundwater developed within the National Institute of Hydrology and Water Management (NIHWM), taking into account the provisions of the Water Framework Directive 2000/60/EC and the guidelines developed under the Common Implementation Strategy of the WFD. Delineation of groundwater bodies was done for areas where there are significant aquifers important for water supply, namely exploitable flows greater than 10 m³/day. In the rest of the territory, even if there are local conditions for groundwater accumulation, they do not constitute water bodies according to the provisions of the Water Framework Directive. In Romania, a total of 143 groundwater bodies have been identified, delineated, and characterized. Out of these, 115 represent phreatic groundwater bodies, and 28 are deep groundwater bodies.

Analysis of the evolution of shallow groundwater levels during the period 2016-2021
In 2021, compared to the period 2016-2020, the frequency of decreases in monthly average levels exceeds 50% across the entire country and reaches a maximum of 70% in November (Figure II.3). In the hydrographic basins located in the

northwest and central part of the country, the February-May interval of 2021 was characterized by groundwater levels exceeding those of the previous five years, in accordance with the monthly cumulative precipitation maps (source: National Meteorological Administration). For the rest of the territory, this characteristic was only locally observed.

Figure II.3 The frequency of exceeding the average monthly depth in 2021 compared to the period 2016-2020



Source: NIHWM

The difference, in centimeters, between the average values for the year 2021 and the multi-year average values of the analyzed period is presented in Figures II.4 and II.5. Thus, negative values, indicating a decrease in piezometric levels in wells, are represented in red and highlight about 61% of the situations.

The range of values ranges from -224 (Black Sea water table) cm to 146 cm (Tisa river water table). The comparative situation is presented by basins/hydrographic areas in Table II.5, highlighting the maximum and minimum recorded values and the proportions of level increases/decreases.

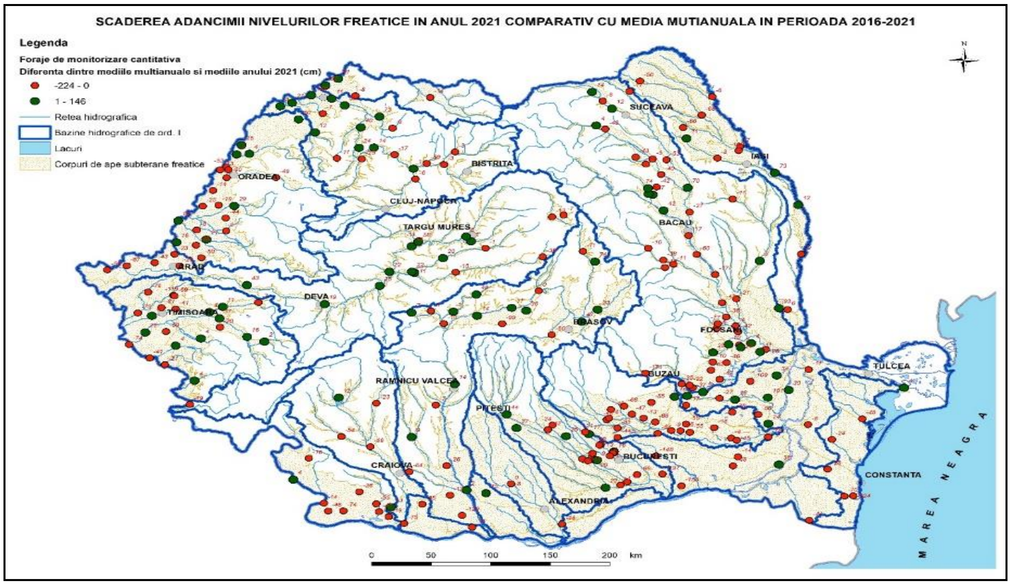
Table II.5 The comparative situation of the differences in annual average values for 2021 and the multi-year period (2016-2020)

Hydrographic basin	Increases (cm)/ Location	Decreases (cm)/ Location	Increases (%)	Decreases (%)
Someş-Tisa hydrographic area	146 (Oar, C. Joasă a Someşului, ROSO01)	50 (Reteag, Culoarele Someșelor Mic și Mare, ROSO09)	55	45
Crişuri	80 (Vărșand, C. Joasă a Crişurilor, ROCR01)	90 (Oradea, C. Joasă a Crișurilor, ROCR01)	45	55
Mureş	72 (Mihalț, Culoarul Aiudului, ROMU03)	67 (Nădlac, C. Nădlac, ROMU20)	50	50
Banat hydrographic area	37 (Silha, C. Timișanei, ROBA04)	119 (Pişchia, C. Vingăi, ROMU02)	19	81
Jiu	12 (Telești, Depresiunea Tg. Jiu, ROJI05)	67 (Filiaşi, Culoarul Jiului, ROJI05)	20	80
Olt	76 (Sânsimion, Depresiunea Tuşnad, ROOT01)	129 (Hoghiz, Olt superior, ROOT07)	57	43
Argeş-Vedea hydrographic area	44 (Ştefănești-Argeş, ROAG05)	197 (Nana, C. Nana, ROAG03)	41	59
Ialomita	18 (Cioranca, C. Urziceni, ROIL08)	88 (Radila, Glacisul Valea Călugărească, ROIL15)	5	95
Siret	74 (Girov, Culoarul Siretului, ROSI03)	171 (Viperești, Depresiunea Cislău, ROIL10)	31	69
Prut	93 (Băleni, Colinele Bălăbănești, ROPR06)	100 (Moimești, Colinele Gloduri, ROPR07)	38	62
Danube	101 (Viziru, C. Viziru, ROIL17)	153 (Spanțov, C. Nana, ROIL17)	32	68

Dobrogea Litoral		224 (Techirghiol, Podișul Mangaliei, RODL10)		100

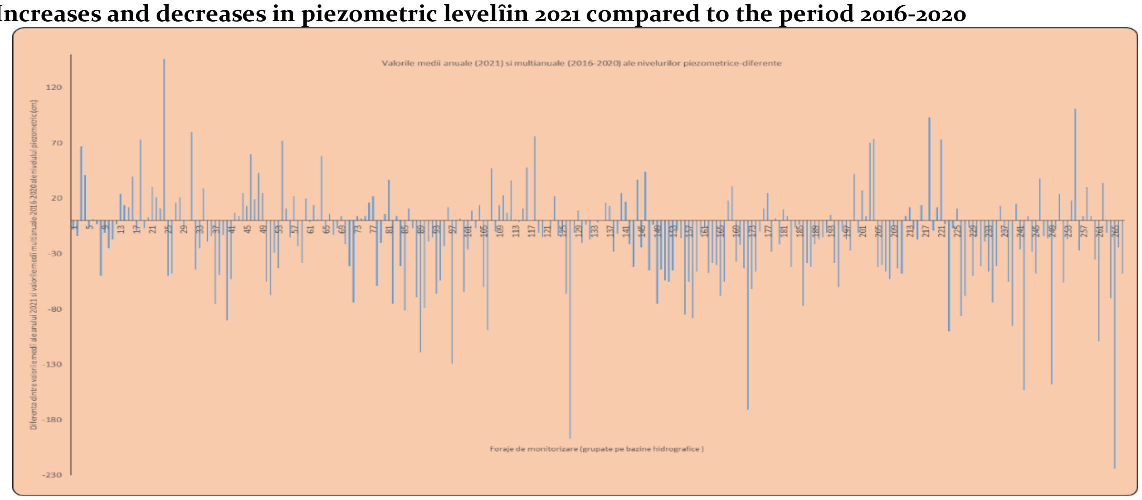
Source: NIHWM

Figure II.4 The situation of the monthly average depth of piezometric levels in the year 2021 compared to the multi-year average of the period 2016-2020.



Source: NIHWM

Figure II.5 – Increases and decreases in piezometric levelîin 2021 compared to the period 2016-2020



Source: NIHWM

Conclusions

The analysis of the evolution of piezometric levels during the period 2016-2021 was conducted based on data from representative monitoring wells in the Monthly Transmission Program, which represents approximately 10% of the total number of wells managed by the Water Basin Administrations, so its character is informative.

According to the summarized results presented in this report, the analyzed period is characterized, in terms of the trend in piezometric level evolution, by pronounced decreases in aquifers in the Dobrogea-Litoral, Ialomița, Banat, and Jiu hydrographic basins and areas. Local but significant increases were recorded in the Olt, Someș-Tisa, Crișuri, and Mureș hydrographic basins.

The basins located in the northern and eastern parts of Romania have, over the entire year, a satisfactory situation due to the cumulative amounts from the months of July, August, and December, mostly exceeding 50 mm. These values were estimated in monitoring wells according to the maps of the National Meteorological Administration.

II.1.1.3. Extreme events caused by watercourses flow rates

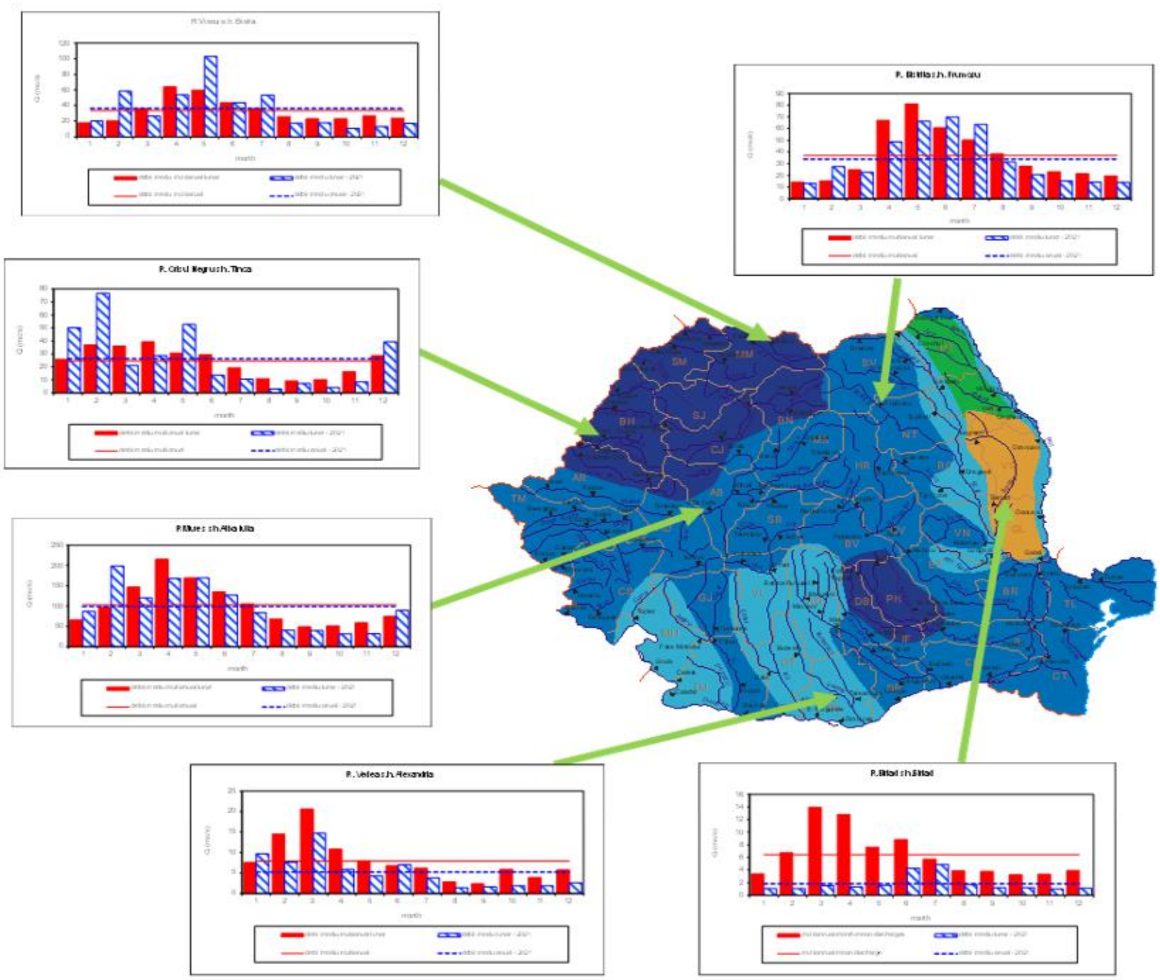
RO 52
Indicator code Romania: RO 52 EEA indicator code: CLIM 16
TITLE: WATERCOURSES FLOW RATES
DEFINITION: The indicator defines the estimated changes in the average daily, monthly, seasonal and annual flows of water courses.

Hydrological characterization of the year 2021

I) RIVERS

n 2021, based on the hydrological situation and meteorological forecasts, prior to the occurrence of hazardous phenomena, a total of **63 HYDROLOGICAL WARNINGS were issued nationwide (61 ORANGE CODE and 2 RED CODE), along with 47 YELLOW CODE ALERTS, 159 immediate warnings (of which 39 were RED CODE), and 296 immediate alerts**.

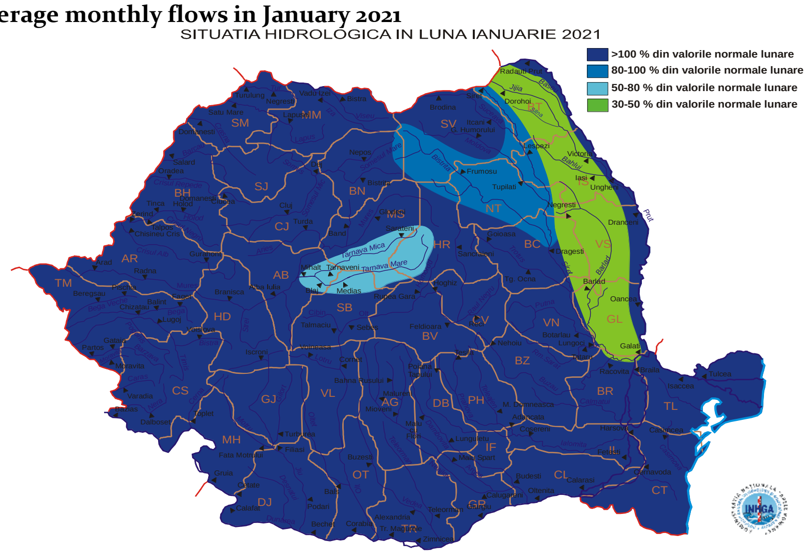
Figure II.6 The map illustrating the distribution of annual coefficient modules (the ratio of average annual flow to multi-year average flow) for the year 2021, the hydrograph of average monthly flows ( ) compared to normal monthly values ( ), the average annual flow in 2021 ( ), the multi-year average flow ( ) at several representative hydrometric stations for the main regions of the country.



Source: NIHWM

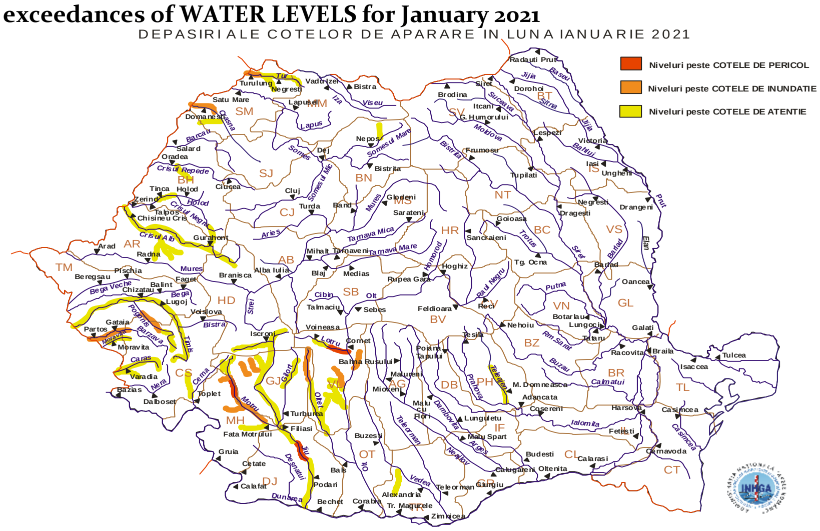
Characterization of the winter months 2021

Figure II.7 The regime of average monthly flows in January 2021



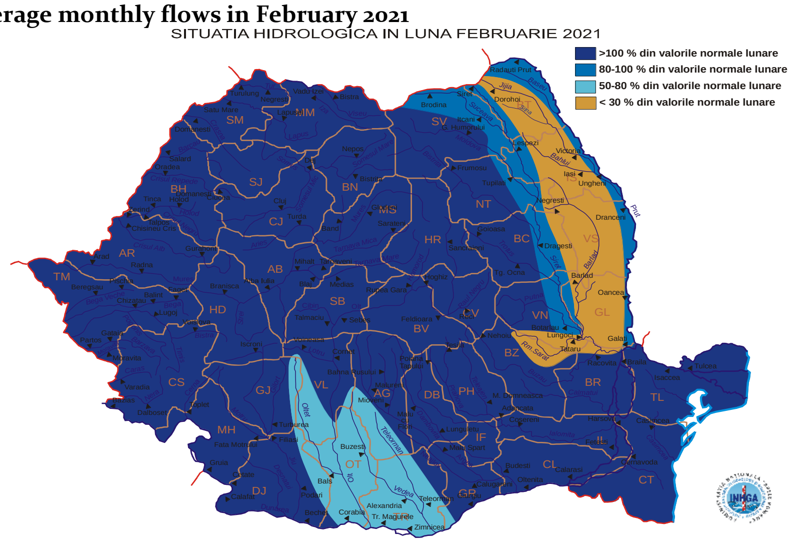
Source: NARW

Figure II.8 The situation of exceedances of WATER LEVELS for January 2021



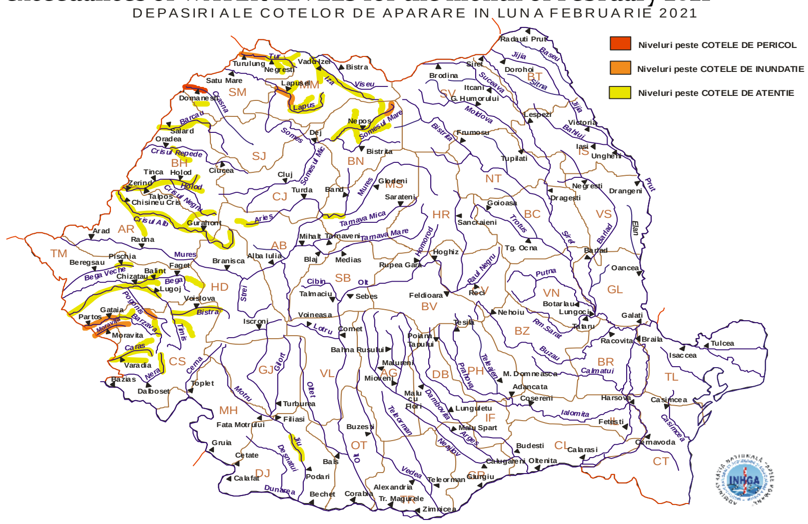
Source: NARW

Figure II.9 The regime of average monthly flows in February 2021



Source: NARW

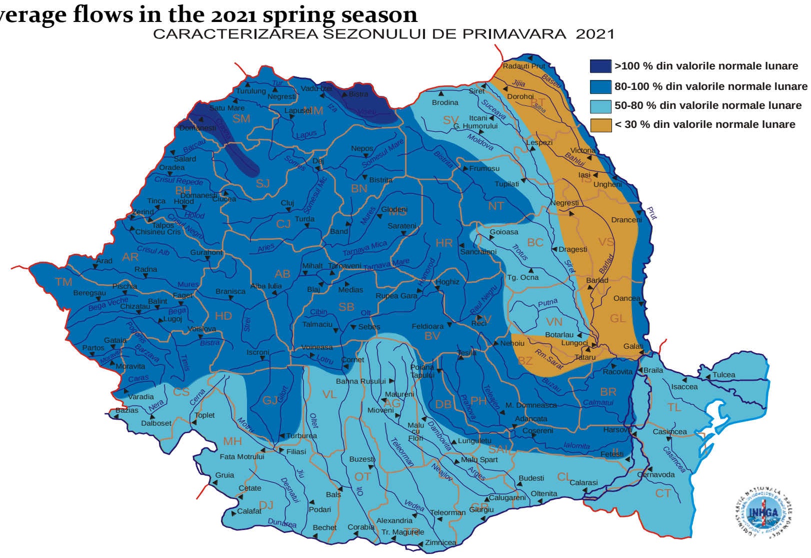
Figure II.10 The situation of exceedances of WATER LEVELS for the month of February 2021



Source: NARW

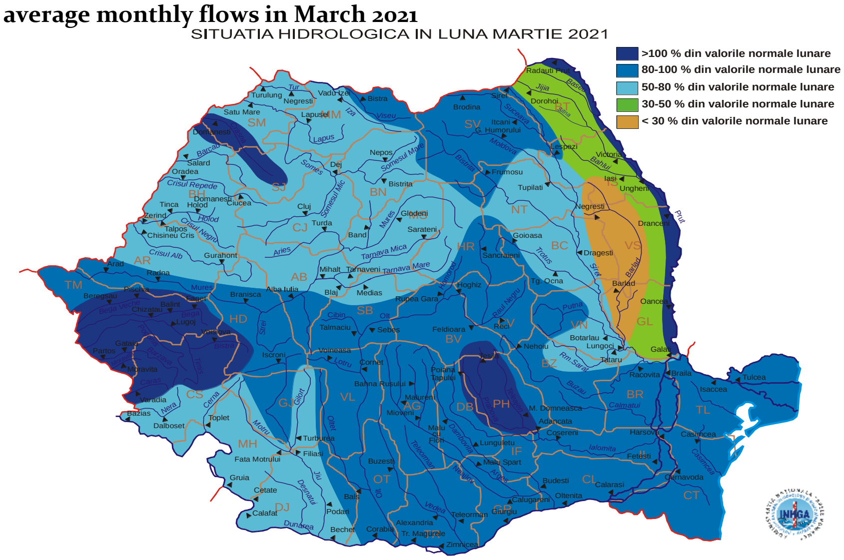
Characterization of the spring season 2021

Figure II.11 The regime of average flows in the 2021 spring season



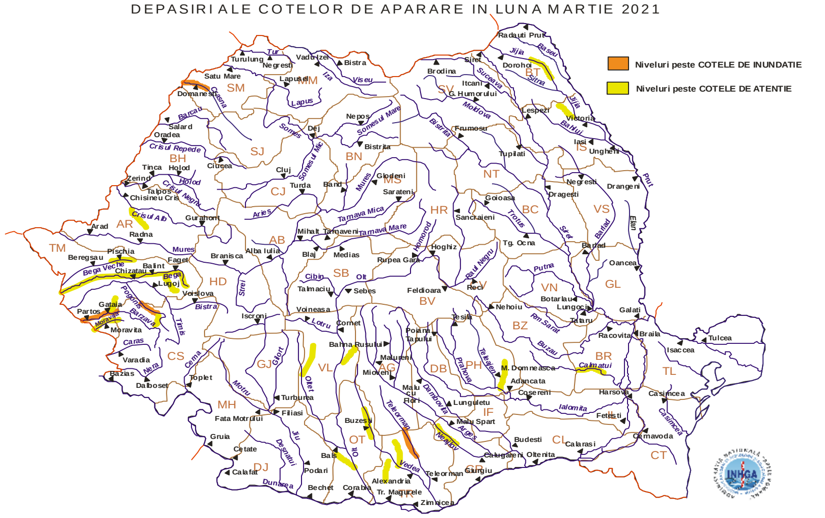
Source: NARW

Figure II.12 The regime of average monthly flows in March 2021



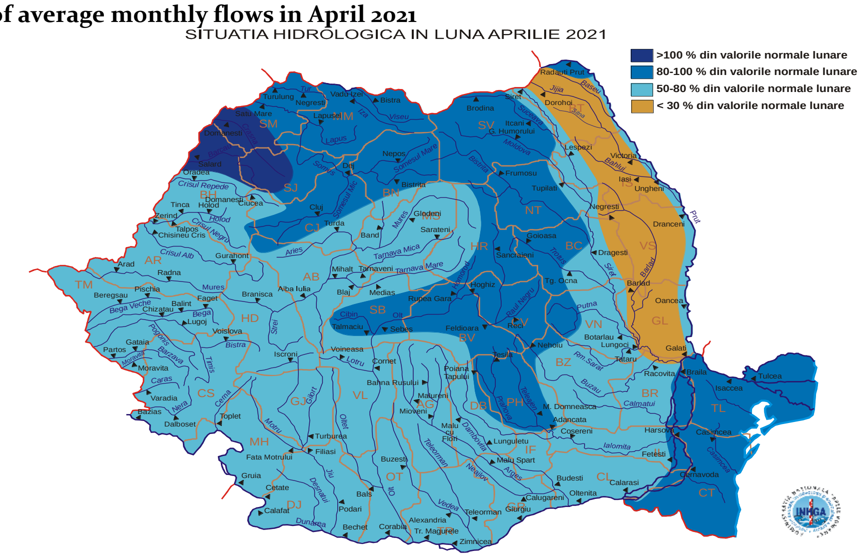
Source: NARW

Figure II.13 The situation of EXCEEDANCES Of WATER LEVELS for the month of March 2021



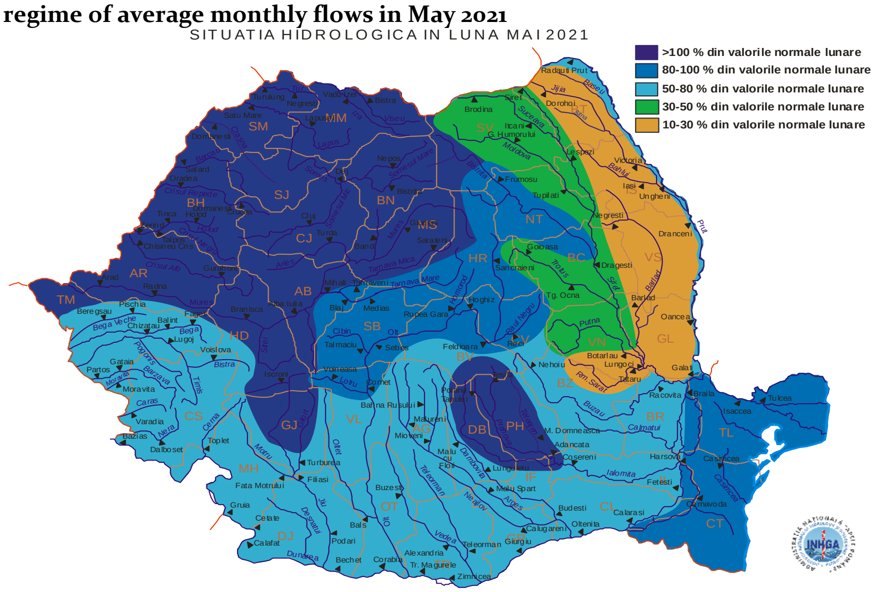
Source: NARW

Figure II.14 The regime of average monthly flows in April 2021



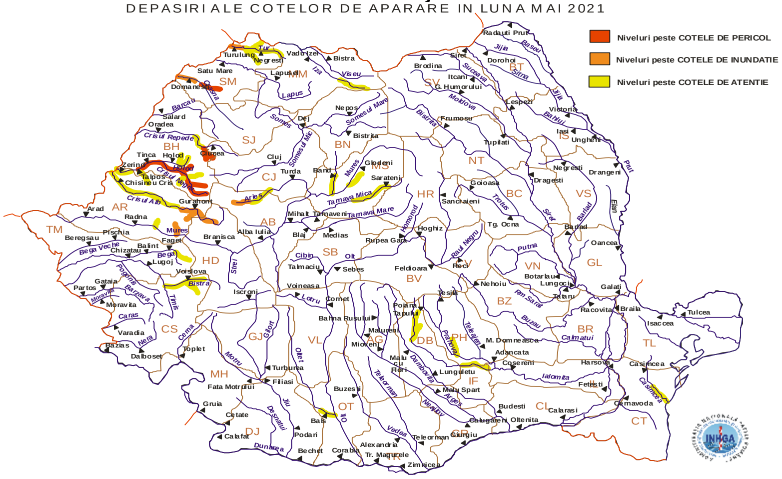
Source: NARW

Figure II.15 Hydrological regime of average monthly flows in May 2021



Source: NARW

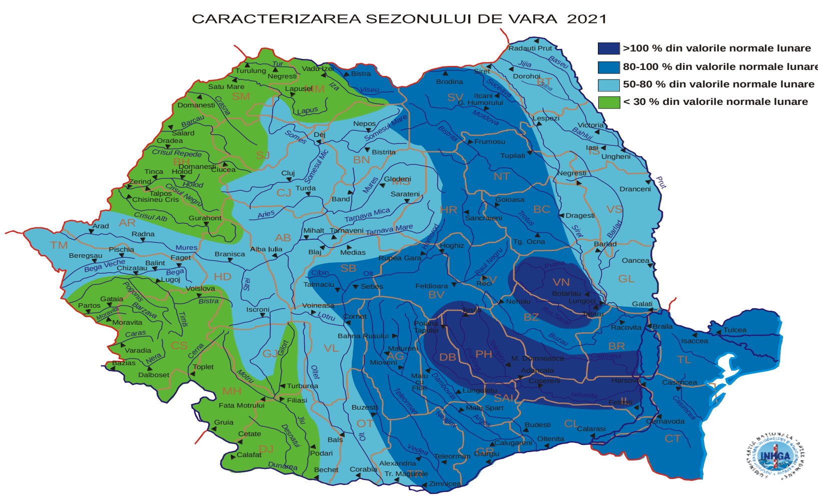
Figure II.16 The situation of exceedances of WATER LEVELS for May 2021



Source: NARW

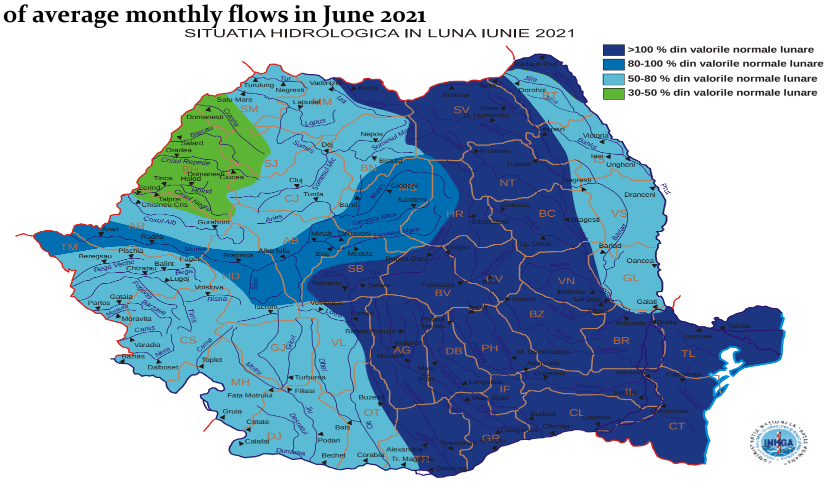
Characterization of summer season 2021

Figure II.17 The regime of average flows in the 2021 summer season



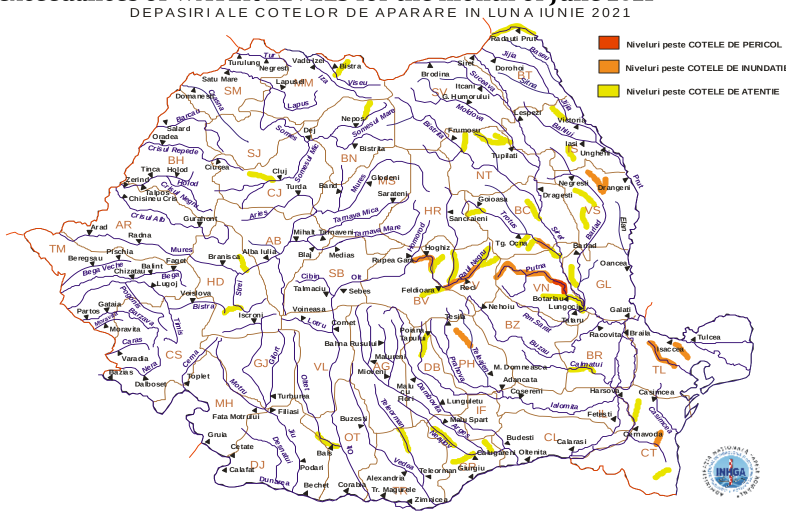
Source: NARW

Figure II.18 The regime of average monthly flows in June 2021



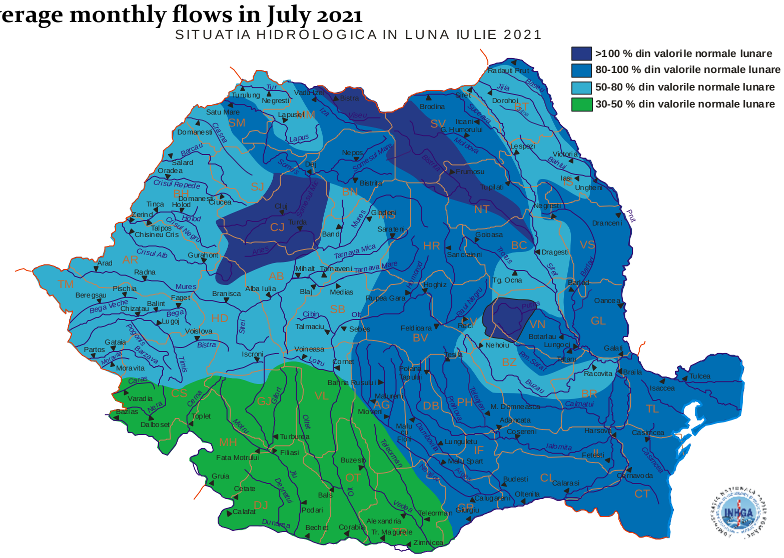
Source: NARW

Figure II.19 The situation of exceedances of WATER LEVELS for the month of June 2021



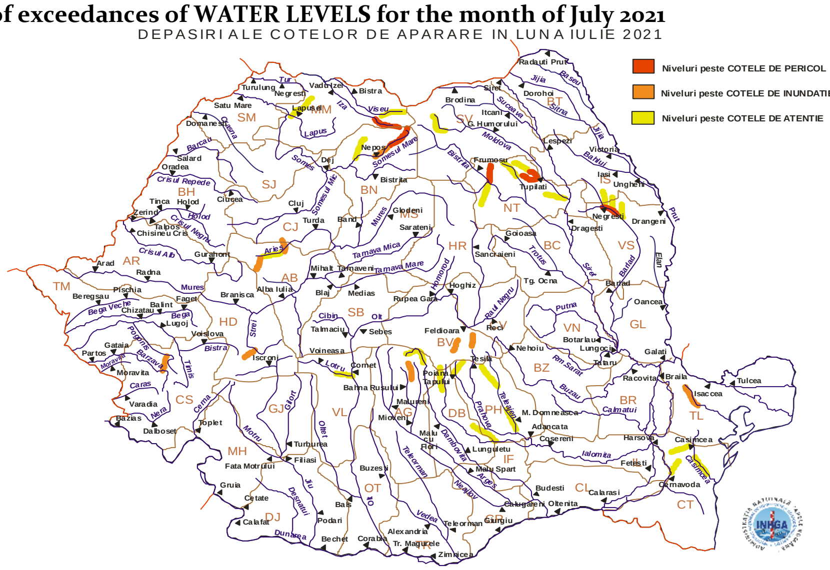
Source: NARW

Figure II.20 The regime of average monthly flows in July 2021



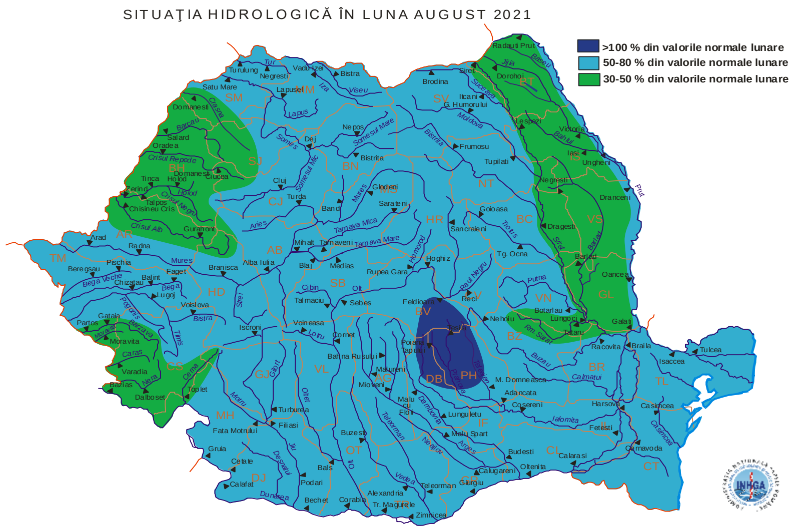
Source: NARW

Figure II.21 The situation of exceedances of WATER LEVELS for the month of July 2021



Source: NARW

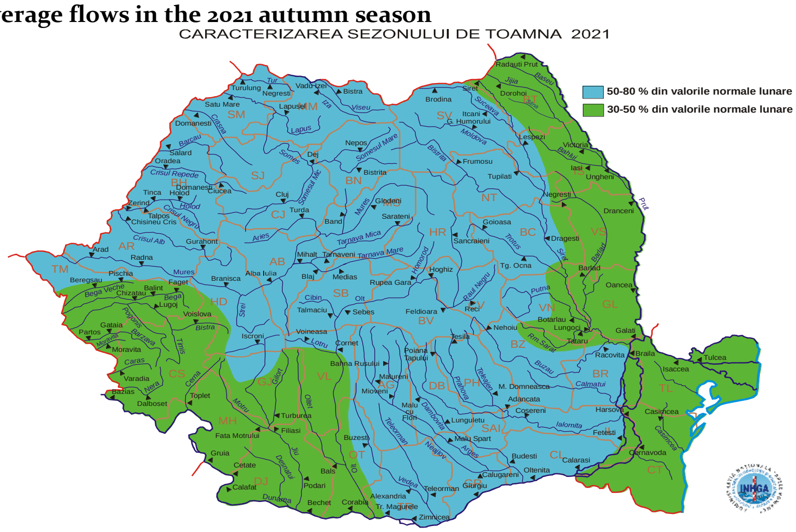
Figure II.22 The regime of average monthly flows in August 2021



Source: NARW

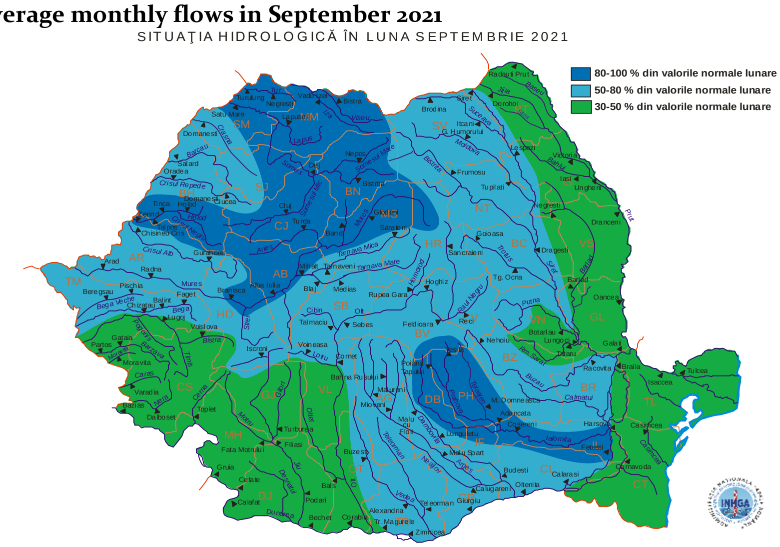
Characterization of the autumn season 2021

Figure II.23 The regime of average flows in the 2021 autumn season



Source: NARW

Figure II.24 The regime of average monthly flows in September 2021

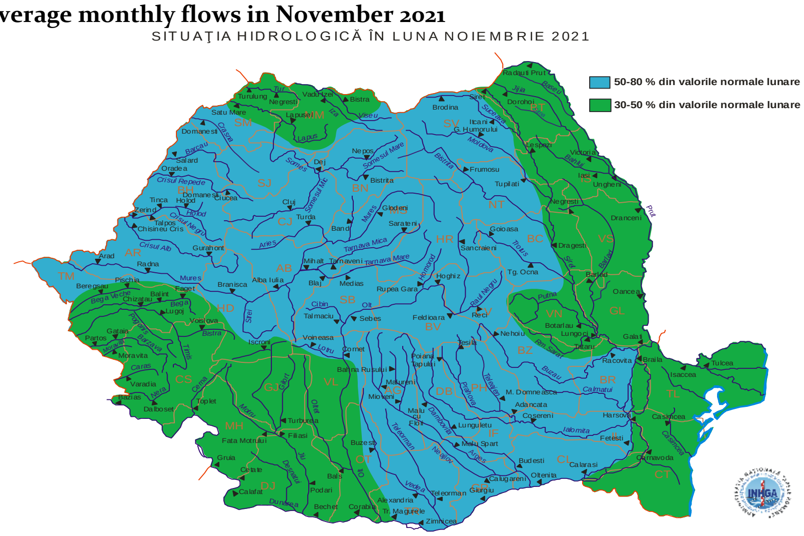


Source: NARW

Figure II.25 The regime of average monthly flows in October 2021

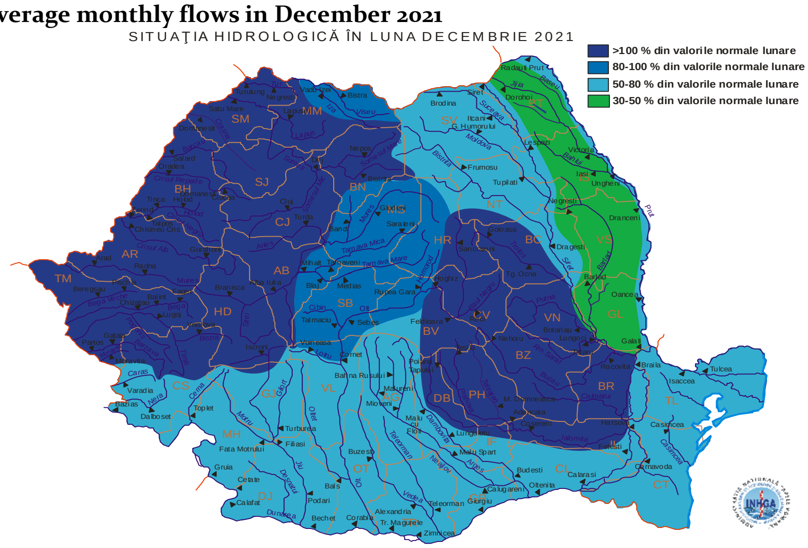
Source: NARW

Figure II.26 The regime of average monthly flows in November 2021



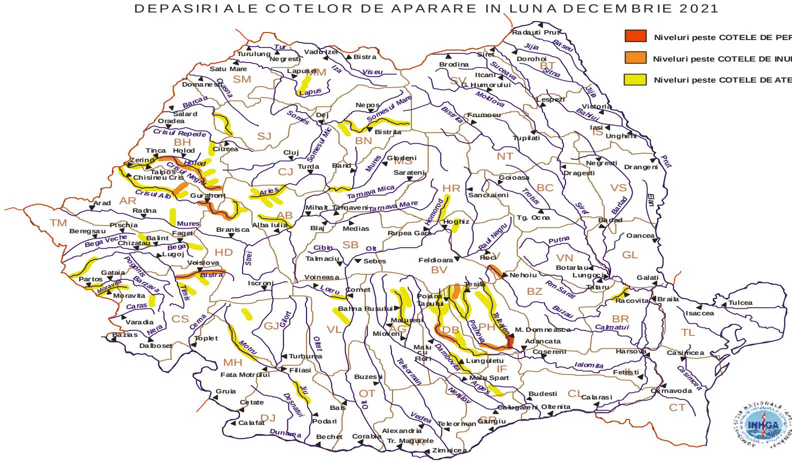
Source: NARW

Figure II.27 The regime of average monthly flows in December 2021



Source: NARW

Figure II.28 The situation of exceedances of WATER LEVELS for the month of December 2021



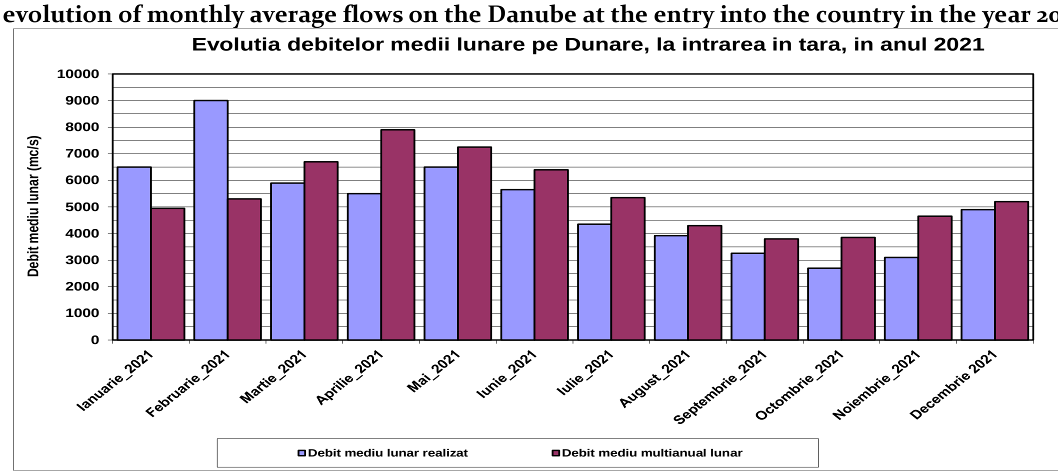
Source: NARW

II) THE DANUBE RIVER

Throughout the year 2021, the monthly average flows recorded on the Danube at the entry into the country (Baziaș section) were above the multi-year monthly averages in January and February and below the monthly norms, ranging from 67-93% of the multi-year monthly averages in the period from March to December 2021.

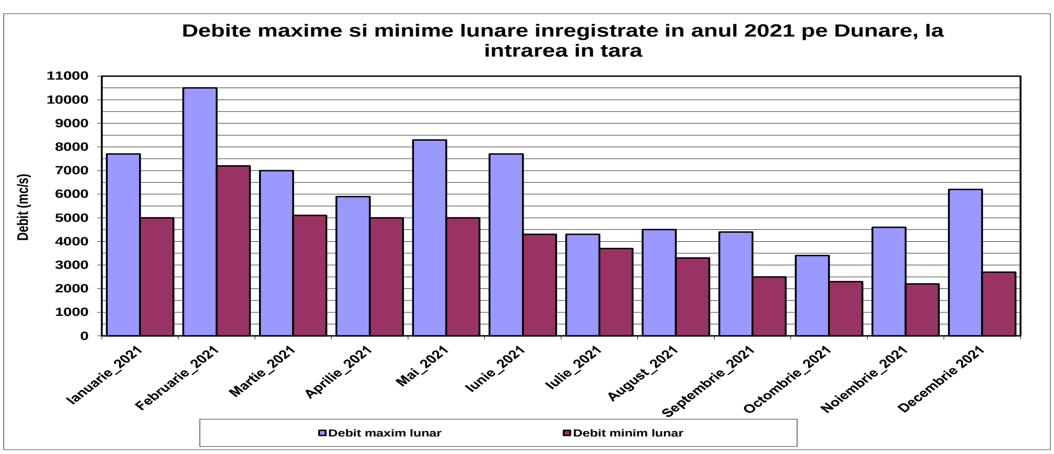
Figures II.29 - II.30 present the evolution of monthly average, maximum, and minimum flows on the Danube at the entry into the country.

Figure II.29 The evolution of monthly average flows on the Danube at the entry into the country in the year 2021



Source: NARW

Figure II.30 The evolution of maximum and minimum monthly flows recorded on the Danube at the entry into the country in the year 2021



Source: NARW

Characterization of the hydrological regime of the Danube during the winter season of 2021

In the winter season of 2021, the average flows at the entry into the country (Baziaș section) were above the multi-year monthly averages, ranging from 131-170% of the monthly norms.

In **January 2021**, the flows at the entry into the country (Baziaș section) increased from 5400 m^3/s on the first day of the month to the maximum monthly value of 7700 m^3/s on January 14, then decreased to the minimum monthly value of 5000 m^3/s recorded on January 24 and 25, and again increased to 7500 m^3/s on the last day of the month.

In **February 2021**, the flows at the entry into the country (Baziaș section) increased from 7700 m^3/s on the first day of the month to the maximum monthly value of 10500 m^3/s on February 15, then decreased to the minimum monthly value of 7200 m3/s recorded on the last day of the month.

Characterization of the hydrological regime of the Danube in the spring of 2021

In the spring season of 2021, the average flows recorded on the Danube at the entry into the country (Bazias section) had values below the multi-year monthly averages, with values between 70-90% of the monthly normals (table II.6).

Table II.6The characteristic values of the months of March, April and May

Characteristic values	Month		
	March	April	May
Multiannual monthly averages	6700 m^3/s	7900 m^3/s	7250 m^3/s
Monthly minima in 2021	5500 m^3/s	5000 m^3/s	5000 m^3/s
Monthly averages 2021	5900 m^3/s	5500 m^3/s	6500 m^3/s
Monthly maxima in 2021	7000 m^3/s	5900 m^3/s	8300 m^3/s

Source: NARW

In the 2021 summer season, the average monthly flows of the Danube at the entry into the country (Baziaș section) were below the monthly norms, with values between 81-91% (table II.7).

Characterization of the hydrological regime of the Danube in the summer of 2021

Table II.7 The characteristic values of the months of June, July and August

Characteristic values	Month		
	June	July	August
Multiannual monthly averages	6400 m^3/s	5350 m^3/s	4300 m^3/s
Monthly minima in 2021	4200 m^3/s	3700 m^3/s	3300 m^3/s
Monthly averages 2021	5650 m^3/s	4350 m^3/s	3920 m^3/s
Monthly maxima in 2021	7700 m^3/s	5500 m^3/s	4500 m^3/s

Source: NARW

Characterization of the hydrological regime of the Danube in the autumn of 2021

Table II.8 The characteristic values of the months of September, October and November

Characteristic values	Month		
	September	October	November
Multiannual monthly averages	3800 m^3/s	3850 m^3/s	4650 m^3/s
Monthly minima in 2021	2500 m^3/s	2300 m^3/s	2200 m^3/s
Monthly averages 2021	3260 m^3/s	2700 m^3/s	3100 m^3/s
Monthly maxima in 2021	4400 m^3/s	3400 m^3/s	4600 m^3/s

Source: NARW

Characterization of the hydrological regime of the Danube in December 2021

In the year 2021, the average flow recorded on the Danube at the entry into the country (Baziaș section) was at 93% of the multi-year average. This value is a result of the fact that the monthly average flows in ten out of the twelve analyzed months were below the multi-year monthly averages. Furthermore, in the other two months where the average flow values exceeded the monthly norms, only in February, the average value of 9000 m3/s was significantly above the monthly norm (170%).

Flood risks and pressures

RO 53
Indicator code Romania: RO 53 EEA indicator code: CLIM 17
TITLE: FLOODS
DEFINITION: The indicator highlights the tendency for major flooding at national level, as well as the anticipated changes in the variation of floods with a 100-year return period.

Table II.9 Synthetic table regarding floods in Romania

No. Crt.	Year	No. event	No. significant events	Affected urban areas
1	2010	94	9	117
2	2011	45	1	19
3	2012	39	6	39
4	2013	74	4	47
5	2014	151	14	72
6	2015	49	2	20
7	2016	171	18	93
8	2017	137	***	68
9	2018	164	***	138
10	2019	154	***	131
11	2020	158	***	111
12	2021	207	***	122

Source: NARW

*Note: ***significant historical events are established within the 3rd implementation cycle of the Floods Directive 2007/60/EC*

During 2021, a number of 207 extreme weather phenomena were recorded, of which:
- 205 extreme events caused by flooding through overflowing rivers or runoff from the slopes;
- 2 2 extreme wind events, the first recorded during the period 17-20.05.2021, when wind gusts affected the radar dome of the Igniș meteorological radar owned by ANAR-ABAST-SGA Maramureș, and the second event occurred in Zorlențu Mare, Caraș-Severin county, during the period 1-2.08.2021.

The following events accompanied the flooding phenomena from overflowing rivers and runoff on the slopes.
- 35 events to be caused when the snow melts or due to the freeze-thaw phenomenon;
- 23 extreme events caused by heavy rainfall and puddles;
- 10 extreme events produced by heavy precipitation and hail;
- 11 extreme events produced by heavy rainfall and wind;
- 29 events due to the inability to collect rainwater of the sewage network;
- 15 events were accompanied by landslides.

During the floods of 2021, a victim was registered who was surprised by the flood on pr. Provița, in Adâncata locality, Prahova county. A number of 1043 UATs, respectively a number of 2912 localities, were affected by floods at least once.

WATER QUALITY
Water quality of watercourses

RO 65
Indicator code Romania: RO 65 EEA indicator code: VHS 02
TITLE: HAZARDOUS SUBSTANCES FROM WATER COURSES
DEFINITION: The indicator quantifies the concentrations (annual averages) of dangerous substances present in watercourses. The hazardous substances requested for reporting are those listed in GD no. 570/2016 on the approval of the Program for the gradual elimination of discharges, emissions and losses of priority hazardous substances and other measures for the main pollutants

For this indicator, the reporting of priority substances from Government Decision no. 570/2016 was considered, which forms the basis for assessing the chemical status of surface waters (investigation environment WATER and investigation environment BIOTA).

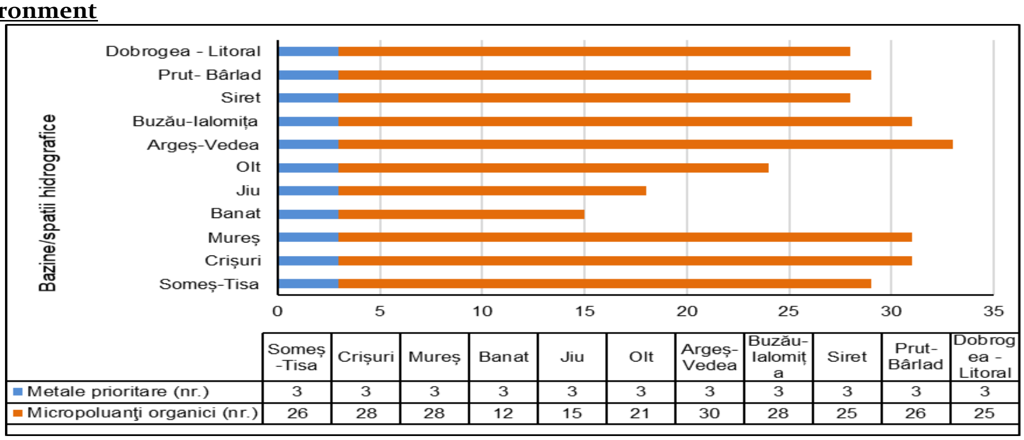
The distribution of the number of monitored priority substances in rivers by areas/hydrographic basins in the year 2021.

Table II.10 Priority substances monitored in watercourses by areas/hydrographic basins in 2021 (no.) – investigation environment WATER and investigation environment BIOTA

Space / Hydrographic basin	Monitored length (Km)	Monitored sections (no.)	WATER priority substances		BIOTA priority substances	
			Priority metals (no.)	Organic micropollutants (no.)	Priority metals (no.)	Organic micropollutants (no.)
Someş-Tisa	4482.67	127	3	26	1	5
Crişuri	1503.35	60	3	28	0	2
Mureş	2793.64	68	3	28	1	5
Banat	2059.57	39	3	12	1	7
Jiu	2048.60	49	3	15	1	7
Olt	1456.00	65	3	21	0	0
Argeş-Vedea	531.32	18	3	30	1	7
Buzău-Ialomiţa	1134.00	52	3	28	1	7
Siret	1941,64	29	3	25	1	7
Prut- Bârlad	2453.98	55	3	26	1	7
Dobrogea-Litoral	1485.94	61	3	25	0	0
Total	**21890.72**	**623**	**3**	**30**	**1**	**7**

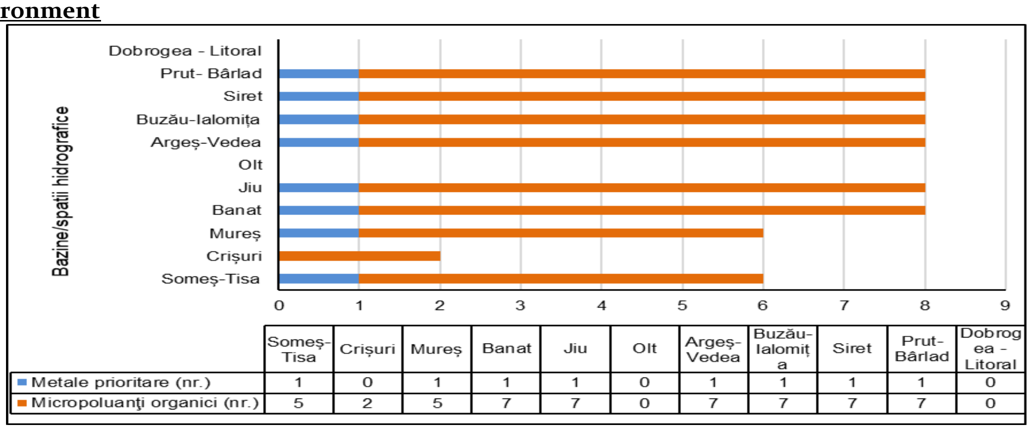
Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Figure II.31 Priority substances monitored in watercourses by areas/watersheds in the year 2021 (no.) – the WATER investigation environment



Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Figure II.32 Priority substances monitored in watercourses by areas / hydrographic basins in the year 2021 (no.) – <u>BIOTA investigation environment</u>



Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Table II.11 The proportion of monitoring sections with concentrations higher than the Environmental Quality Standards (EQS) (%) in the period 2015-2021.

The year	2015	2016	2017	2018	2019	2020	2021
Priority monitored substances (no.)	36	42	33	35	42	42	41
Monitoring Sections (No.)	435	392	385	615	611	628	623
Share of sections with higher concentration than EQS (%)	3.44	3.82	5.71	6.67	4.75	7.64	7.70

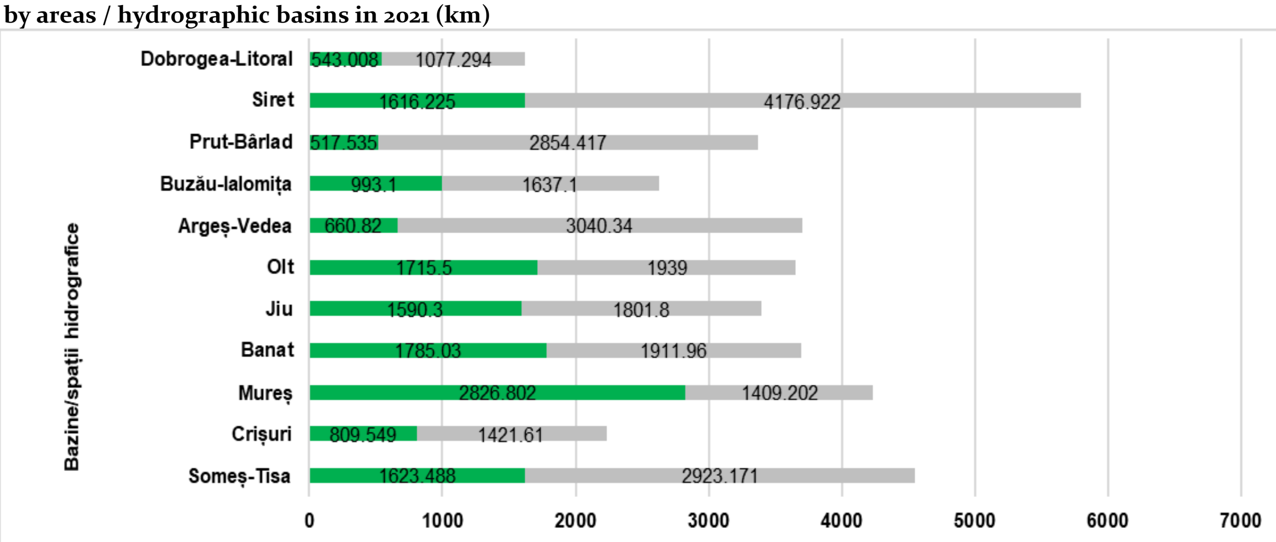
Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

RO 67
Indicator code Romania: RO 67 EEA indicator code: WEC 04
TITLE: WATERCOURSES CLASSIFICATION SCHEMES
DEFINITION: Watercourse classification schemes are designed to give an indication of the degree of pollution.

ECOLOGICAL STATUS/ECOLOGICAL POTENTIAL OF MONITORED WATERCOURSES (natural, heavily modified, artificial water bodies - rivers) BY AREAS/HYDROGRAPHIC BASINS AND AT NATIONAL LEVEL

Assessment of the ecological status/ecological potential of monitored watercourses (natural, heavily modified, artificial water bodies - rivers) by areas/hydrographic basins in the year 2021 (km)

Figure II.33 Ecological status/ecological potential of monitored watercourses (natural, highly modified, artificial water bodies - rivers) by areas / hydrographic basins in 2021 (km)



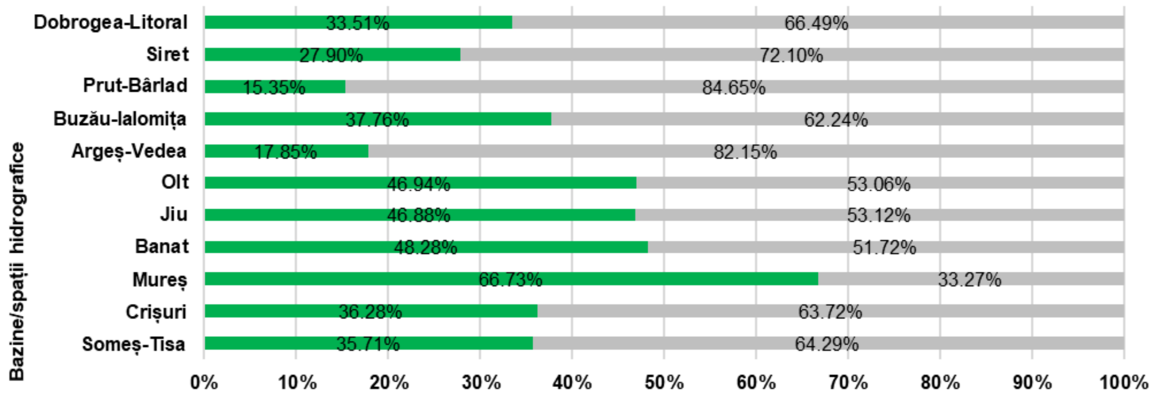
	Someș-Tisa	Crișuri	Mureș	Banat	Jiu	Olt	Argeș-Vedea	Buzău-Ialomița	Prut-Bârlad	Siret	Dobrogea-Litoral
SE bună/bun (km)	1623.488	809.549	2826.802	1785.03	1590.3	1715.5	660.82	993.1	517.535	1616.225	543.008
SE inferioară stării bune (km)	2923.171	1421.61	1409.202	1911.96	1801.8	1939	3040.34	1637.1	2854.417	4176.922	1077.294

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

***SE - ecological state / ecological potential**

Evaluation of the ecological state / ecological potential of the monitored watercourses (natural, highly modified, artificial water bodies - rivers) by areas / hydrographic basins in 2021 (%)

Figure II.34 Ecological status / ecological potential of monitored watercourses (natural, highly modified, artificial water bodies - rivers) by areas / hydrographic basins in 2021 (%)



	Someș-Tisa	Crișuri	Mureș	Banat	Jiu	Olt	Argeș-Vedea	Buzău-Ialomița	Prut-Bârlad	Siret	Dobrogea-Litoral
SE bună/bun (%)	35.71%	36.28%	66.73%	48.28%	46.88%	46.94%	17.85%	37.76%	15.35%	27.90%	33.51%
SE inferioară stării bune (%)	64.29%	63.72%	33.27%	51.72%	53.12%	53.06%	82.15%	62.24%	84.65%	72.10%	66.49%

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Assessment of the ecological status and the ecological potential of the monitored watercourses (natural, heavily modified, artificial water bodies - rivers) at national level in 2021

Table II.12 Evaluation of the ecological state / ecological potential of the monitored watercourses (natural, highly modified, artificial water bodies - rivers) at national level in 2021

Ecological status / Ecological potential	2021
Very Good and Good (%) / Maximum and Good (%)	**37.77**
Moderate (%) / Moderate (%)	**53.69**
Weak (%)	**7.76**
Poor (%)	**0.78**
SE below good condition (%)	**62,23**
Monitored river network length (km)	**38874.173**
Number of monitoring sections	**1166**

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

RO 19

Indicator code Romania: RO 19
EEA indicator code: CSI 19

TITLE: OXYGEN CONSUMING SUBSTANCES IN RIVERS

DEFINITION: The main indicator for the water bodies' oxygenation status is the Biochemical Oxygen Demand after 5 days of incubation (BOD5), representing the oxygen needed by aquatic organisms consuming easily oxidizable organic matter present in the aquatic environment. The indicator provides the current situation and trends in BOD5 and ammonia (NH_4^+) concentrations in rivers.

Discharges of organic substances and nutrients into water resources from human agglomerations at national level

Table II.13 Amounts of pollutants discharged into wastewater (tons/year)

Human agglomerations category	Amounts of pollutants discharged into wastewater (tons/year)							
	CBO5		COD,		Not at all		P total	
	2020	2021	2020	2021	2020	2021	2020	2021

> 100,000 l.e	12927.16	13498.15	39026.01	40403.16	8894.86	8884.01	735.57	770.79
10,000 - 100,000 l.e	3548.79	3716.41	11113.71	11384.82	2079.63	2175.97	269.25	249.44
2,000 - 10,000 l.e	1854.89	1941.86	4476.19	5025.55	232.21	204.36	24.72	24.44
< 2,000 l.e	336.98	556.23	927.64	1492.25	16.67	12.25	1.50	1.87

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in the period 2018 - 2020, Synthesis of water quality in Romania in 2021

Lakes' water quality

RO 66

Indicator code Romania: RO 66
EEA indicator code: VHS 03

TITLE: HAZARDOUS SUBSTANCES IN LAKES

DEFINITION: The indicator quantifies the concentrations (annual averages) of dangerous substances present in the lakes. The hazardous substances requested for reporting are those listed in GD no. 570/2016 regarding the approval of the Program for the gradual elimination of discharges, emissions and losses of priority hazardous substances and other measures for the main pollutants.

For this indicator, consideration was given to reporting the priority substances outlined in Government Decision 570/2016, which underlie the assessment of the chemical status of surface waters (the investigated environment WATER). Additionally, by exceeding the SCM (Specific Concentration of a Substance in Water), it is understood to mean surpassing both the SCM-MA (Mean Arithmetic Value) and the SCM-CMA (Maximum Permissible Concentration) values, as defined by Government Decision No. 570/2016).

Distribution of the number of priority substances monitored in lakes (natural, heavily modified and artificial lakes) by watershed area/basin in 2021

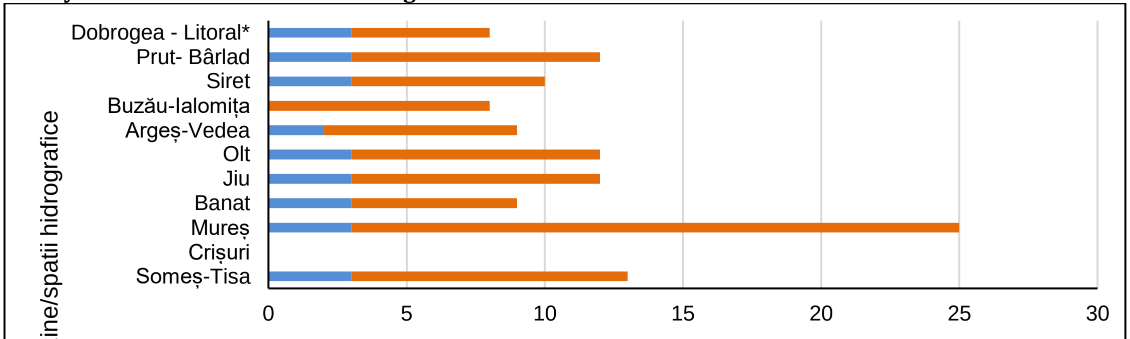
Table II.14 Distribution of priority substances monitored in lakes (natural, highly modified and artificial lakes) by hydrographic areas/basins in the year 2021 – WATER investigation environment

Area / Hydrographic basin	Monitored sections (no.)	WATER priority substances	
		Priority metals (no.)	Organic micropollutants (no.)
Someş - Tisa	22	3	10
Crişuri	0	0	0
Mureş	17	3	22
Banat	5	3	6
Jiu	6	3	9
Olt	14	3	9
Argeş - Vedea	1	2	7
Buzău - Ialomiţa	4	0	8
Siret	6	3	7
Prut - Bârlad	21	3	9
Dobrogea – Litoral*	14	3	5
Total	**110**	**3**	**22**

includes the transitional lacustrine lake Sinoe

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Figure II.35 Distribution of priority substances monitored in lakes (natural, highly modified and artificial lakes) by hydrographic areas/basins in the year 2021 – the WATER investigation environment



	Someș-Tisa	Crișuri	Mureș	Banat	Jiu	Olt	Argeș-Vedea	Buzău-Ialomița	Siret	Prut-Bârlad	Dobrogea - Litoral*
Metale prioritare (nr.)	3	0	3	3	3	3	2	0	3	3	3
Micropoluanţi organici (nr.)	10	0	22	6	9	9	7	8	7	9	5

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Table II.15 Share of monitoring sections for priority substances with concentrations higher than the SCM (%) in 2021 by hydrographic areas/basins – WATER investigation environment

Area / Hydrographic basin	Monitoring sections (no.)	Monitoring sections with concentrations higher than SCM (no.)	Share of monitoring sections with concentrations higher than SCM (%)
Someş - Tisa	22	0	0
Crişuri	0	0	0
Mureş	17	0	0
Banat	5	0	0
Jiu	6	0	0
Olt	14	0	0
Argeş - Vedea	1	0	0
Buzău - Ialomiţa	4	0	0
Siret	6	0	0
Prut - Bârlad	21	0	0
Dobrogea - Litoral*	14	0	0
Total	**110**	**0**	**0.00**

*includes the transitional lacustrine lake Sinoe

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Evolution of monitoring sections with higher concentration than SCM

Table II.16 Share of monitoring sections with higher concentration than SCM (%) in the period 2015 – 2021

Year	2015	2016	2017	2018	2019	2020	2021
Monitored priority substances (no.)	31	37	26	18	32	32	25
Monitoring Sections (No.)	71	95	55	111	107	104	110
Share of sections with higher concentration than SCM (%)	2.81	3.15	1.82	0.90	1.87	2.88	0.00

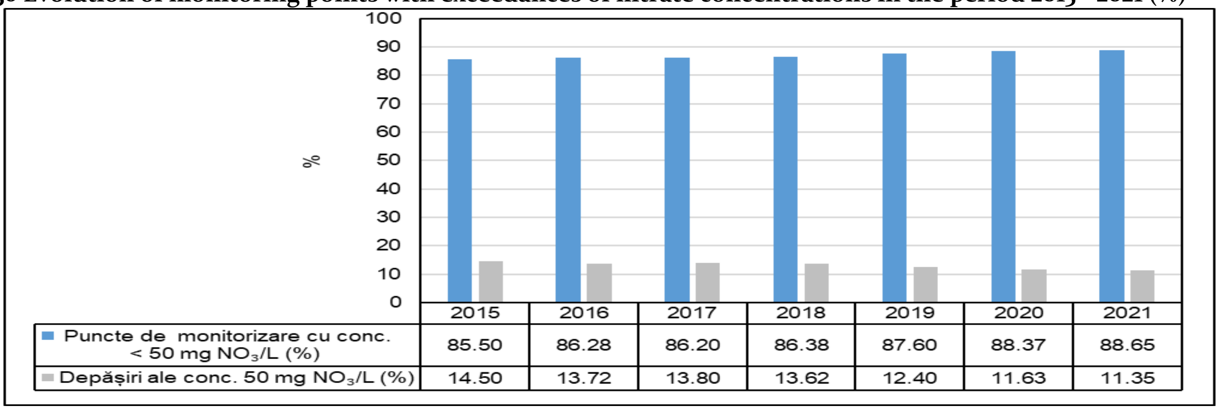
Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Groundwater quality

RO 20
Indicator code Romania: RO 20 EEA indicator code: CSI 20
TITLE: NUTRIENTS IN WATER
DEFINITION: The indicator quantifies the nitrates present in the groundwater and is used to highlight the geographical variations of their concentrations and their evolution over time.

EVOLUTION OF THE NUMBER OF MONITORING POINTS WITH EXCESSES OF THE NITRATE CONTENT IN THE PERIOD 2015 – 2021 (%)

Figure II.36 Evolution of monitoring points with exceedances of nitrate concentrations in the period 2015 - 2021 (%)



Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

RO 64
Indicator code Romania: RO 64 EEA indicator code: VHS 01
TITLE: PESTICIDES IN GROUNDWATER
DEFINITION: The indicator presents the concentration of an active substance or the sum of concentrations of active substances from the pesticide class determined in groundwater. The pesticides requested for reporting are those mentioned in Government Decision No. 53/2009 for the approval of the National Plan for the protection of groundwater against pollution and deterioration.

The distribution of the number of pesticide monitoring points across areas/hydrographic basins in the year 2021.

Table II.17 Pesticides monitored in 2021 (no.)

2021				
Area / Hydrographic basin	**Number of monitored water bodies**	**Total number of monitoring points**	**Number of points where pesticides are monitored**	**Pesticides monitored (no.)**
Someș - Tisa	15	133	1	2
Crișuri	9	133	1	3
Mureș	22	122	6	12
Banat	20	214	15	5
Jiu	8	95	69	2
Olt	14	137	12	13
Argeș - Vedea	11	163	120	27
Buzău - Ialomița	18	192	53	8
Siret	6	109	2	18
Prut- Bârlad	7	120	57	20

Dobrogea - Litoral	9	106	10	18
TOTAL	**139**	**1524**	**346**	**28**

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

The proportion of monitoring points with concentrations exceeding 0.1 µg/L out of the total number of wells monitored for pesticides in the year 2021

Table II.18 The percentage of monitoring points with concentrations greater than 0.1 µg/L out of the total number of wells where pesticides were monitored in the year 2021. (%)

Area / Hydrographic basin	Points where pesticides are monitored (no.)	Monitoring points with conc. > 0.1 µg/L (no.)	Monitoring points with conc. > 0.1 µg/L (%)
Someș - Tisa	1	0	0
Crișuri	1	0	0
Mureș	6	0	0
Banat	15	0	0
Jiu	69	0	0
Olt	12	0	0
Argeș - Vedea	120	1	0.83
Buzău - Ialomița	53	0	0
Siret	2	0	0
Prut- Bârlad	57	0	0
Dobrogea - Litoral	10	0	0
Total	**346**	**1**	**0.29**

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Evolution of monitoring points with concentration greater than 0.1µg/L for the period 2015 - 2021 (%)

Table II.19 Evolution of monitoring points with a concentration higher than 0.1 µg/L for the period 2015 - 2021 (%)

Year	2015	2016	2017	2018	2019	2020	2021
Number of pesticides monitored	19	20	21	2. 3	30	28	28
Total number of monitored points	1310	1523	1536	1535	1533	1487	1524
Number of points where pesticides are monitored	365	574	550	272	275	356	346
Share of monitoring points with concentration higher than 0.1µg/L from no. points where pesticides are monitored (%)	6.3	3.31	2.0	2.94	2.55	2.25	0.29

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Table II.20 The number of monitored points where pesticides are monitored and the number of points with a concentration higher than 0.1 µg/L in 2021

No. crt.	PESTICIDES	No. of points where pesticides are monitored	No. monitoring points with conc. > 0.1 µg/L
1	*alpha - Hexachlorocyclohexane*	188	0
2	*beta - Hexachlorocyclohexane*	188	0
3	*range HCH - Lindane*	264	0
4	*alpha-Endosulfan*	273	0
5	*beta-Endosulfan*	273	0
6	*Trifluralin*	190	0
7	*Alacati*	193	0
8	*Aldrin*	220	0

9	*Atrazine*	241	1
10	*chlorfenvinphos*	189	0
11	*chlorpyrifos*	189	0
12	*Dichlorvos (2.2-dichlorovinyl dimethyl phosphate)*	179	0
13	*Dieldrin*	251	0
14	*Diuron*	128	0
15	*Endrin*	220	0
16	*Isodrin*	221	0
17	*Isoproturon*	128	0
18	*Linuron (3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea)*	120	0
19	*Mevinfos (2-methoxycarbonyl-1-methylvinyl dimethyl phosphate)*	60	0
20	*Monolinuron (3-(4-chlorophenyl)-1-methoxy-1-methylurea)*	120	0
21	*ortho-para DDT*	124	0
22	*para-para DDD*	120	0
2. 3	*para-para DDE*	120	0
24	*para-para DDT*	263	0
25	*simazine*	249	0
26	*Methoxychlor*	120	0
27	*Chlorotoluron*	120	0
28	*Monuron*	120	0

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Bathing water quality

RO 22

Indicator code Romania: RO 22
EEA indicator code: CSI 22

TITLE: BATHING WATER QUALITY

DEFINITION: The indicator expresses in percentage terms the coastal and inland bathing areas that comply with the mandatory standards and recommended levels for microbiological and physico-chemical parameters.

In the 2021 bathing season (June 1 – September 15), 50 bathing natural areas across Romania were inventoried, for which territorial Public Health Departments (DSPs) established a monitoring schedule. The list containing these areas and the monitoring schedule were posted on the Ministry of Health's website. Out of these 50 areas, 49 have seawater for bathing, and one area has freshwater from a lake.

The assessment of water quality for the total of 50 designated bathing natural areas identified and reported by Romania to the European Commission (through the EIONET platform - a EU platform created by EEA) in 2020 was carried out for the areas continuously monitored over the past 4 years. The evaluation was conducted through classification, using the current season's (2020) database and the databases from the previous 3 seasons. This assessment was performed in accordance with Directive 2006/7/EC, as well as the provisions of Government Decision No. 546/2008, articles 18-24, and the provisions of Annex 2.

- excellent 84.00% (42),
- good 16.00% (8),
- satisfactory 0.00% (0) and
- unsatisfactory 0.00% (0).

Table II.21 shows the fact that in Romania, within the classifications of the last 7 years, there were no more areas where the water quality was unsatisfactory, the percentage of those classified as good and satisfactory is still high. The quality of bathing water is predominantly compliant only with the values from the mandatory norms and not with the reference ones to which it should be aimed.

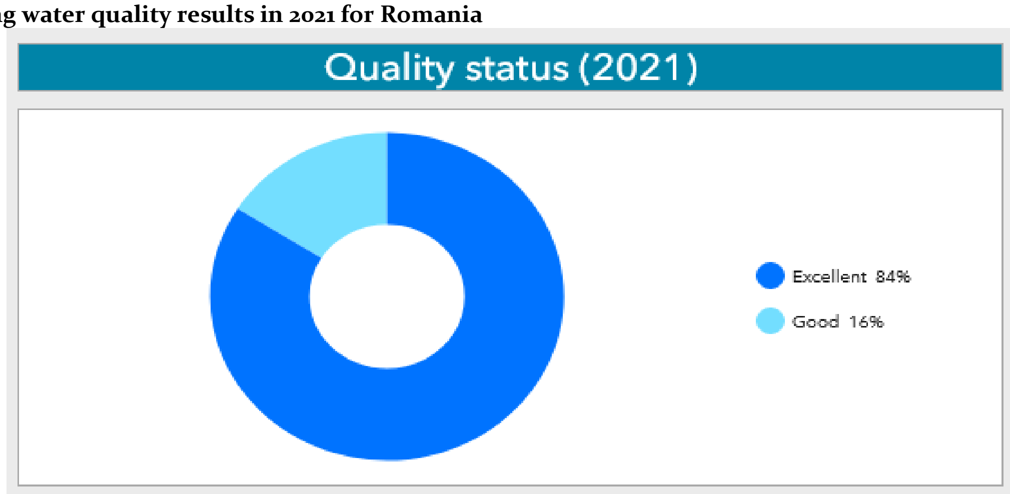
Table II.21 Trend of bathing water quality in Romania for the period 2015-2021

B	C	D	E	F	G	H	I
DENUMIREA ZONEI DE ÎMBĂIERE	2015	2016	2017	2018	2019	2020	2021
județul CONSTANȚA							
DELFIN NAVODARI I TD	BUNA	EXCELENTA	BUNA	EXCELENTA	BUNĂ	EXCELENTĂ	EXCELENTĂ
P.NAVODARI II H.P	BUNA	BUNA	BUNA	EXCELENTA	BUNĂ	BUNĂ	EXCELENTĂ
P.NAVODARI IIIZ.ICMS	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.NAVODARI IIIZ.IIPM	BUNA	EXCELENTA	BUNA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.NAVODARI IVZ1PIIIM	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.NAVODARI IV Z.2 CP	EXCELENTA	BUNA	BUNA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.MAMAIA.I Z.1 T.T	EXCELENTA	EXCELENTA	EXCELENTA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.MAMAIA.I Z.2 E	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.MAMAIA.II ESTIVAL	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.MAMAIA.III VEGA	BUNA	EXCELENTA	BUNA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.MAMAIA.IV REX	EXCELENTA	EXCELENTA	EXCELENTA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.MAMAIA.V CASTEL	BUNA	EXCELENTA	EXCELENTA	BUNA	EXCELENTĂ	BUNĂ	EXCELENTĂ
P.MAMAIA.VI CAZINO	EXCELENTA	EXCELENTA	EXCELENTA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
P.MAMAIA.VII PERLA	SATISFACATOARE	BUNA	BUNA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
MAMAIA.VIII AURORA	BUNA	BUNA	BUNA	EXCELENTA	BUNĂ	BUNĂ	EXCELENTĂ
C.I DELFINARIU	BUNA	EXCELENTA	BUNA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
C.II MODERN	BUNA	EXCELENTA	BUNA	EXCELENTA	BUNĂ	EXCELENTĂ	EXCELENTĂ
E.NORD I DEBARCADER	SATISFACATOARE	BUNA	BUNA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
E.NORD II BELONA	SATISFACATOARE	BUNA	BUNA	EXCELENTA	BUNĂ	BUNĂ	EXCELENTĂ
CORDON E.N-E.S I.A	SATISFACATOARE	EXCELENTA	EXCELENTA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
CORDON E.N-E.S II.TL	NESATISFACATOARE	BUNA	BUNA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
E.SUD I S.BEACH	BUNA	BUNA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
EFORIE SUD II CAZINO	SATISFACATOARE	BUNA	BUNA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
COSTINESTI IPESCARIE	SATISFACATOARE	BUNA	BUNA	EXCELENTA	BUNĂ	BUNĂ	EXCELENTĂ
COSTINESTI II FORUM	SATISFACATOARE	EXCELENTA	BUNA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
OLIMP I PESCARIE	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
OLIMP II Z.1 P.O	EXCELENTA	BUNA	BUNA	EXCELENTA	EXCELENTĂ	BUNĂ	BUNĂ
OLIMP II Z.2 Z.P	BUNA	BUNA	BUNA	BUNA	EXCELENTĂ	BUNĂ	EXCELENTĂ
NEPTUN I TERASABRIZA	BUNA	BUNA	BUNA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
NEPTUN II NEPTUN	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
JUPITER 1 B.DELFINUL	BUNA	BUNA	BUNA	SATISFACATOARE	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
JUPITER 2 C.COMETA	BUNA	BUNA	BUNA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
JUPITER 3 H.CAPITOL	SATISFACATOARE	BUNA	BUNA	EXCELENTA	EXCELENTĂ	BUNĂ	BUNĂ
JUPITER 4 H.C	SATISFACATOARE	BUNA	BUNA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
CAP AURORA I H.OPAL	BUNA	EXCELENTA	EXCELENTA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
CAP AURURA II H.ONIX	EXCELENTA	EXCELENTA	EXCELENTA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
CAP AURORA III RP	BUNA	BUNA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
VENUS I Z.1 R.C	BUNA	BUNA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
VENUS I Z.2 H.A	BUNA	EXCELENTA	BUNA	EXCELENTA	EXCELENTĂ	BUNĂ	BUNĂ
VENUS II H.SILVIA	EXCELENTA	BUNA	BUNA	BUNA	BUNĂ	BUNĂ	BUNĂ
VENUS PERLA VENUSULUI	EXCELENTA	BUNA	BUNA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
CORDON V-S I B.A	SATISFACATOARE	BUNA	SATISFACATOARE	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
CORDON V-S IIACTETIS	SATISFACATOARE	BUNA	SATISFACATOARE	BUNA	BUNĂ	BUNĂ	BUNĂ
SATURN I ADRAS	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
SATURN II PLAJADIANA	BUNA	BUNA	BUNA	BUNA	BUNĂ	BUNĂ	EXCELENTĂ
MANGALIA	BUNA	BUNA	BUNA	BUNA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ
DOI MAI	BUNA	BUNA	BUNA	EXCELENTA	BUNĂ	BUNĂ	BUNĂ
VAMA VECHE	BUNA	BUNA	EXCELENTA	EXCELENTA	EXCELENTĂ	EXCELENTĂ	EXCELENTĂ

Source: INSP

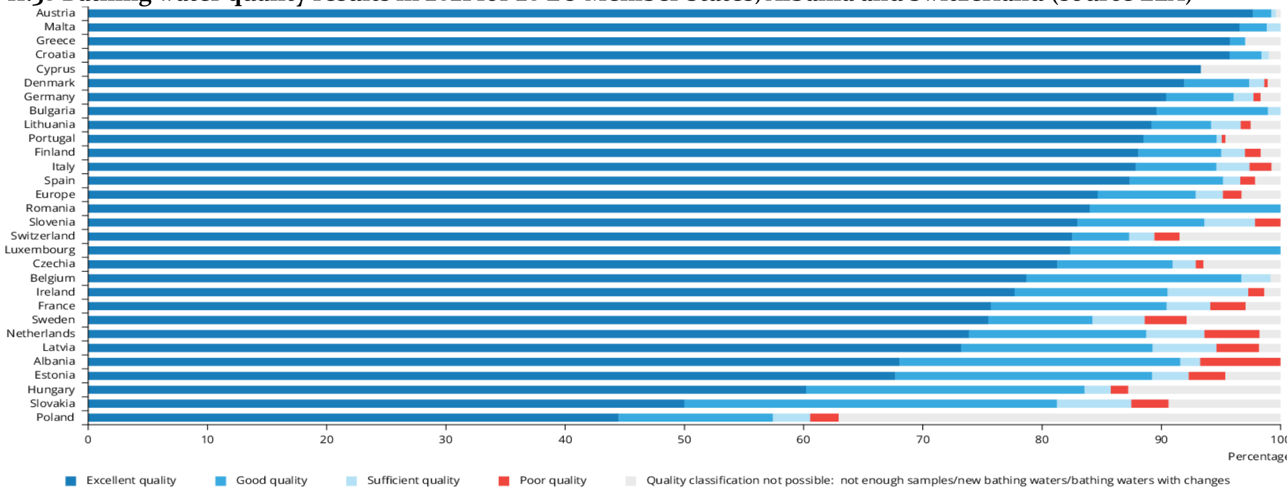
From the annual reports of the EU Member States, it was found that Romania has no non-compliant bathing areas in the classification for 2021 (figure II.37 and figure II.38).

Figure II.37 Bathing water quality results in 2021 for Romania



Source:WISE bathing water quality database (data from annual reports by EU Member States).

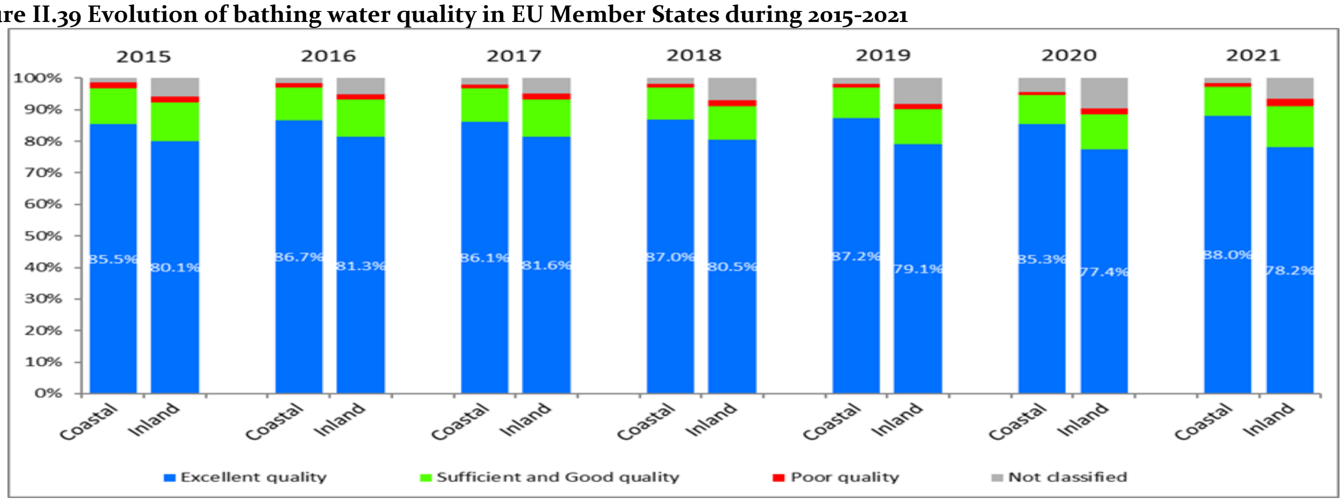
Figure II.38 Bathing water quality results in 2021 for 28 EU Member States, Albania and Switzerland (source EEA)



Source:WISE bathing water quality database (data from annual reports by EU Member States).

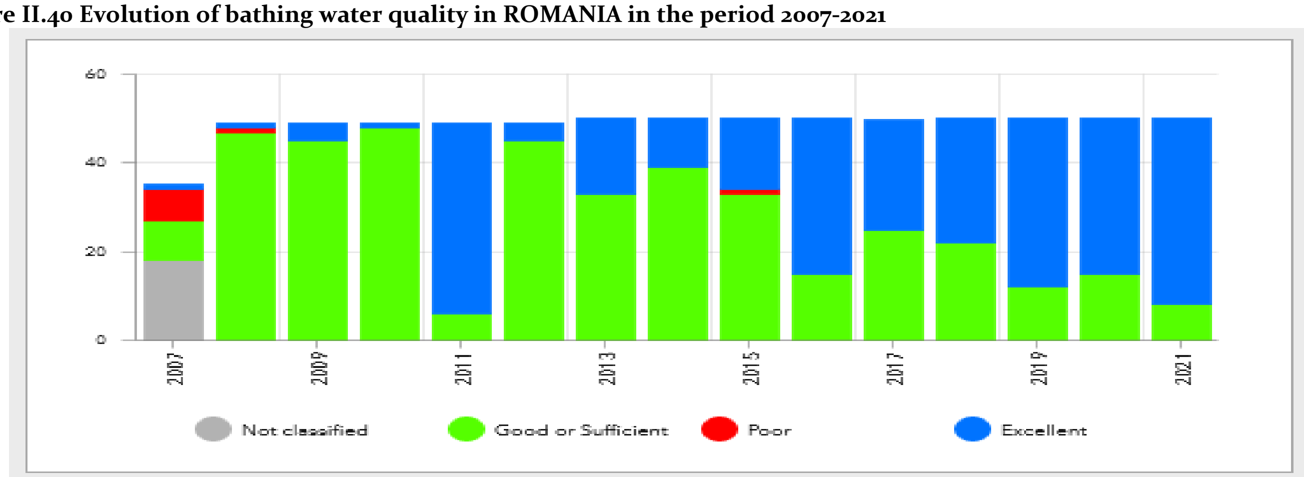
In the latest assessment of bathing water quality in the EU Member States presented in the 2021 report prepared by the European Environment Agency (EEA) in cooperation with the European Commission (EC), the evolution of quality is presented for the period 2015-2021 for the EU Member States (Figure II.39), and specifically for Romania from the year 2007 when it joined the EU until 2021 (Figure II.40).

Figure II.39 Evolution of bathing water quality in EU Member States during 2015-2021



Source: INSP

Figure II.40 Evolution of bathing water quality in ROMANIA in the period 2007-2021



Source: INSP

Determining factors and pressures affecting water quality

Significant pressures on water resources in Romania

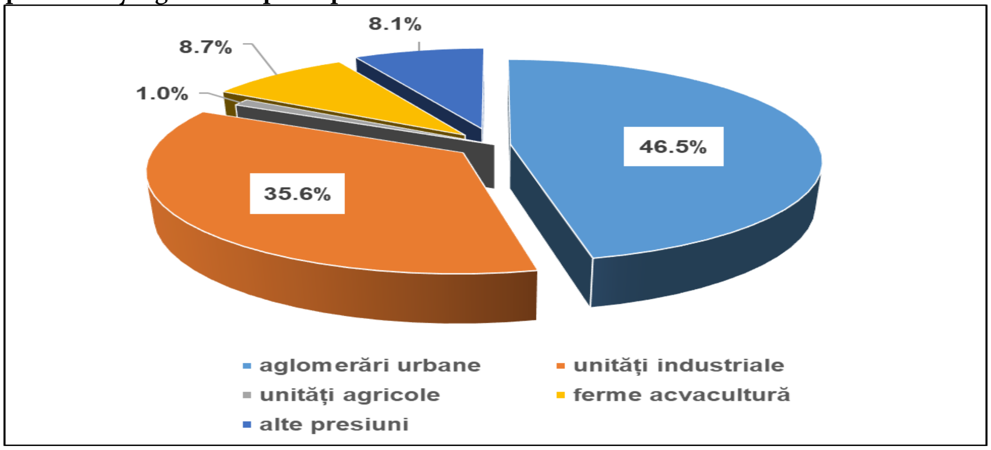
RO 25
Indicator code Romania: RO 25 EEA indicator code: CSI 25
TITLE: GROSS BALANCE OF NUTRIENTS
DEFINITION: The indicator estimates the nitrogen surplus on agricultural land. This is achieved by calculating the balance between the total amount of nitrogen entering the agricultural system and the total amount of nitrogen leaving the agricultural system, reported per unit area of agricultural land. The indicator presents all nitrogen inputs and outputs from an agricultural land. Inputs consist of the amount of nitrogen applied through mineral and natural fertilizers, nitrogen fixed by plants, and emissions to the air. The nitrogen leaving is contained in crops, grass, and crops consumed by animals. Emissions of nitrogen to the air in the form of NO_2 are difficult to estimate and are not considered. The gross nutrient balance provides an indication of the risk of pollution to surface and groundwater bodies due to the runoff of nutrient surplus from agricultural surfaces..

The application of the criteria set led to the identification of significant point source pressures, considering the discharge of treated or untreated waters into surface water resources:

- ***human agglomerations***(Identified in accordance with the requirements of the Urban Wastewater Treatment Directive (Directive 91/271/EEC), which have more than 2000 population equivalents (p.e.) and have wastewater collection systems with or without treatment plants, discharging into water resources; additionally, agglomerations <2000 p.e. are considered significant point sources if they have a centralized sewerage system; also considered significant sources of pollution are human agglomerations with combined sewerage systems that lack the capacity to collect and treat the mixture of wastewater and rainwater during periods of heavy rainfall;
- ***industry:***
  - the installations falling under the scope of the Industrial Emissions Directive (IED) 2010/75/EU, transposed into national legislation through Law No. 278/2013 with subsequent amendments and additions, include units that are listed in the Pollutant Release and Transfer Register (E-PRTR). These units are relevant to the environmental factor of water;
  - the units that discharge priority/priority hazardous substances above the limits set by current legislation (in accordance with the requirements of Directive 2008/105/EC as amended by Directive 2013/39/EU, transposed into national legislation through Government Decision 570/2016 approving the Program for the gradual elimination of discharges, emissions, and losses of priority hazardous substances and other measures for major pollutants) into the aquatic environment of the Community.
  - other units that discharge into water resources and that do not comply with the legislation in force regarding the water environmental factor;
- ***agriculture:***
  - zootechnical farms falling under the scope of the Industrial Emissions Directive (IED) 2010/75/EU, transposed into national legislation through Law No. 278/2013, with subsequent amendments and additions, include units that are listed in the Pollutant Release and Transfer Register (E-PRTR). These units are relevant to the environmental factor of water;
  - farms that discharge priority/priority hazardous substances above the limits set by current legislation (in accordance with the requirements of Directive 2008/105/EC as amended by Directive 2013/39/EU, transposed into national legislation through Government Decision 570/2016 approving the Program for the gradual elimination of discharges, emissions, and losses of priority hazardous substances and other measures for major pollutants) into the aquatic environment of the Community.);
  - other agricultural units with point discharge and which do not comply with the legislation in force regarding the water environmental factor.

In the updated 2021 National Management Plan, a total of **3,996** water users utilizing surface water resources as the receiving body for discharged waters have been inventoried at the national level. Considering the criteria mentioned above, a total of **2,294 potentially significant point sources were identified** (**1,065 urban, 816 industrial, 24 agricultural, 200 aquaculture, and 185 other pressures**).

Figure II.41 Share of potentially significant point pressures



Source: "Romanian Waters" National Administration, updated National Management Plan 2021

Regarding the ***diffuse sources of significant pollution***, identified with reference to the land use, the following can be mentioned:

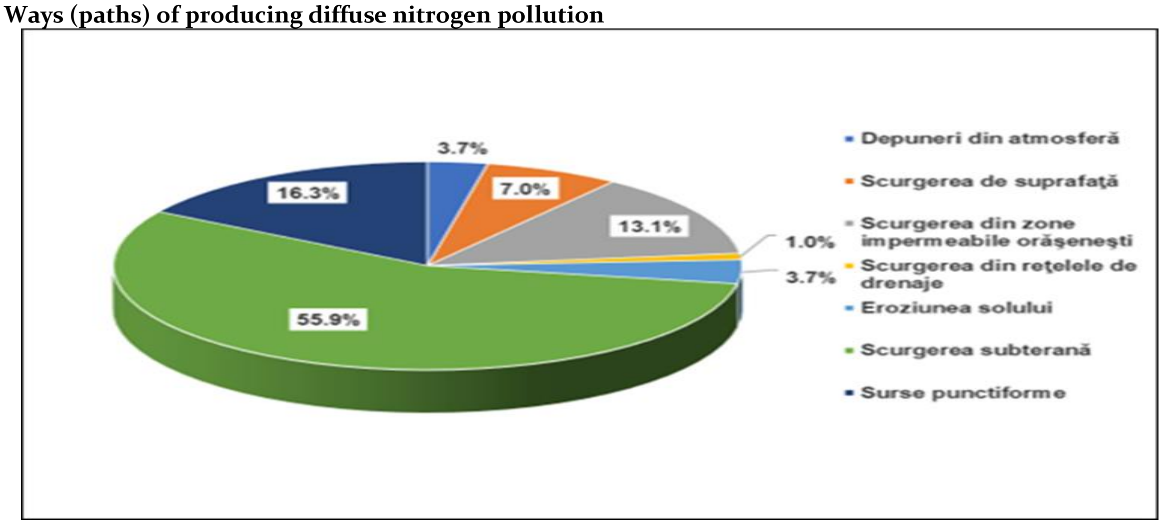
- human agglomerations/localities that do not have wastewater collection systems or appropriate systems for collecting and removing sludge from treatment plants, as well as localities that have non-compliant household waste deposits;
- agriculture: agro-zootechnical farms that do not have appropriate manure storage/use systems, localities that do not have centralized collection systems/individual manure platforms, units that use pesticides and do not comply with the legislation in force, other units/activities agricultural that can lead to significant diffuse emissions;
- warehouses of raw materials, finished products, auxiliary products, non-compliant waste storage, units that produce diffuse accidental pollution, abandoned industrial sites.

In the case of diffuse pollution sources, estimating pollutant loads in water is more challenging than for point sources, considering the different way pollution is generated. In addition to point source emissions, the MONERIS model takes into account the following pathways of diffuse pollution production.:

- deposits from the atmosphere (on surface waters);
- surface runoff;
- runoff from impermeable urban areas;
- soil erosion/sediment transport;
- leakage from drainage networks;
- underground drain.

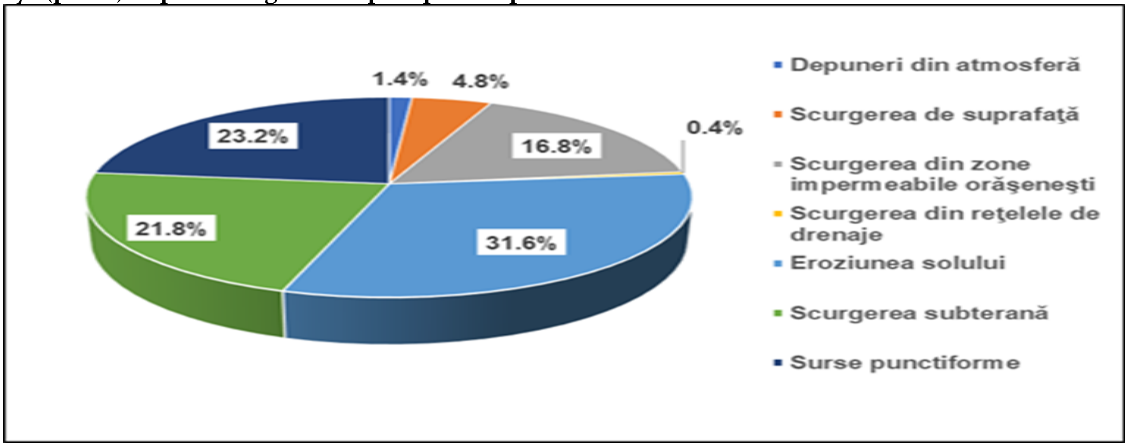
The results of applying the enhanced model at the level of the international Danube district, using updated data for the reference period 2015-2018, have been included both in the Management Plan of the International Danube River Basin District (2021) and in the updated 2021 National Management Plan. Figures II.42 and II.43 depict the contribution of diffuse pollution pathways for nitrogen and phosphorus for the year 2021, considering the pathways mentioned above.

Figure II.42 Ways (paths) of producing diffuse nitrogen pollution



Source: "Romanian Waters" National Administration, updated National Management Plan 2021

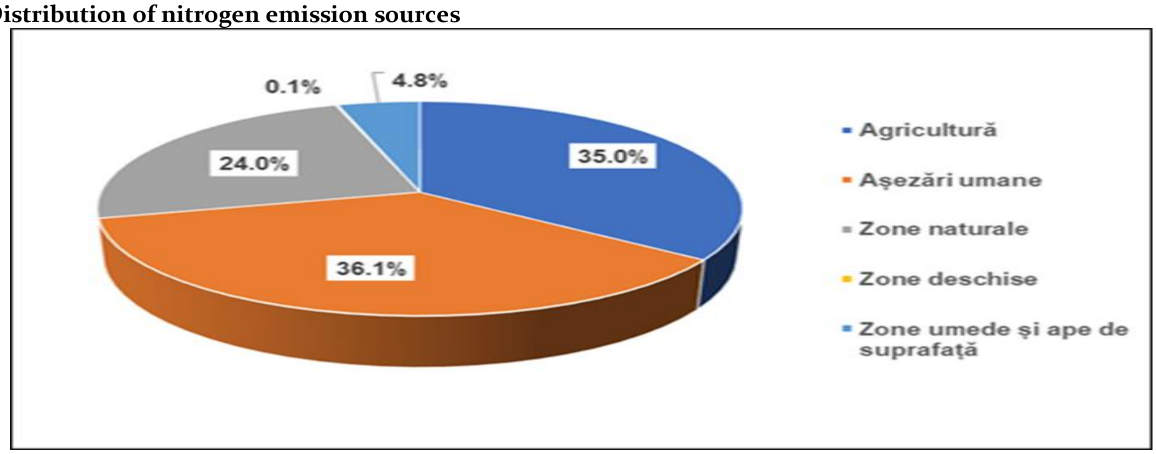
Figure II.43 Ways (paths) of producing diffuse phosphorus pollution



Source: "Romanian Waters" National Administration, updated National Management Plan 2021

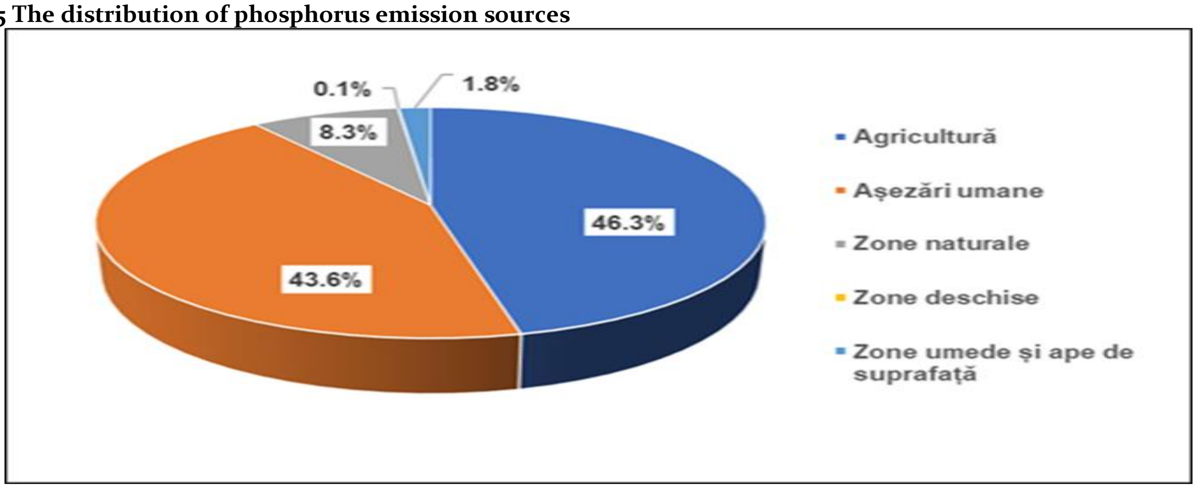
Figures II.44 - II.45 show nitrogen and phosphorus emissions from diffuse pollution sources, taking into account the contribution of each category of pollution sources.

Figure II.44 Distribution of nitrogen emission sources



Source: "Romanian Waters" National Administration, updated National Management Plan 2021

Figure II.45 The distribution of phosphorus emission sources

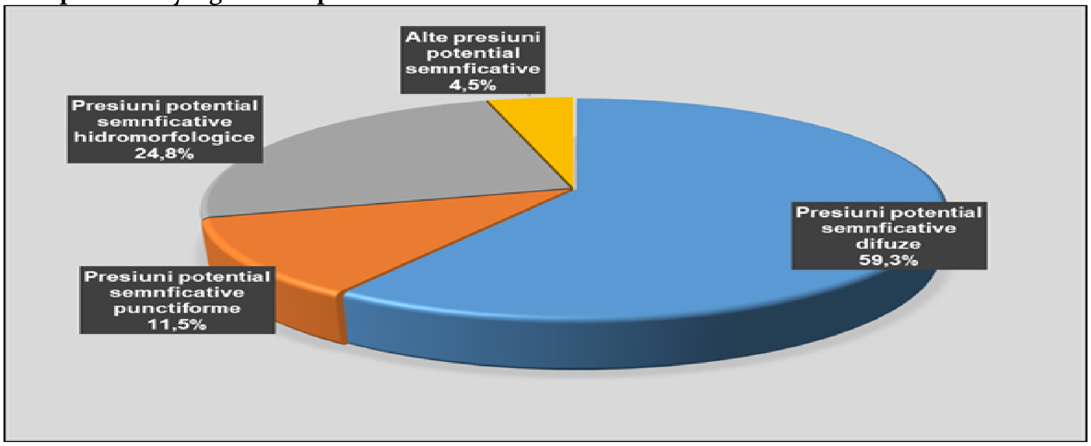


Source: "Romanian Waters" National Administration, updated National Management Plan 2021

It is observed that approximately 35% of the nitrogen quantity emitted by diffuse sources and approximately 46% of the total diffuse phosphorus emission are attributable to agricultural activities, which produce a specific emission of approximately 2.1 kg N/ha of agricultural land and 0.21 kg P/ha of agricultural land. Additionally, 36% of the nitrogen quantity and 44% of the phosphorus quantity are emitted by diffuse sources from human settlements (towns/human agglomerations).

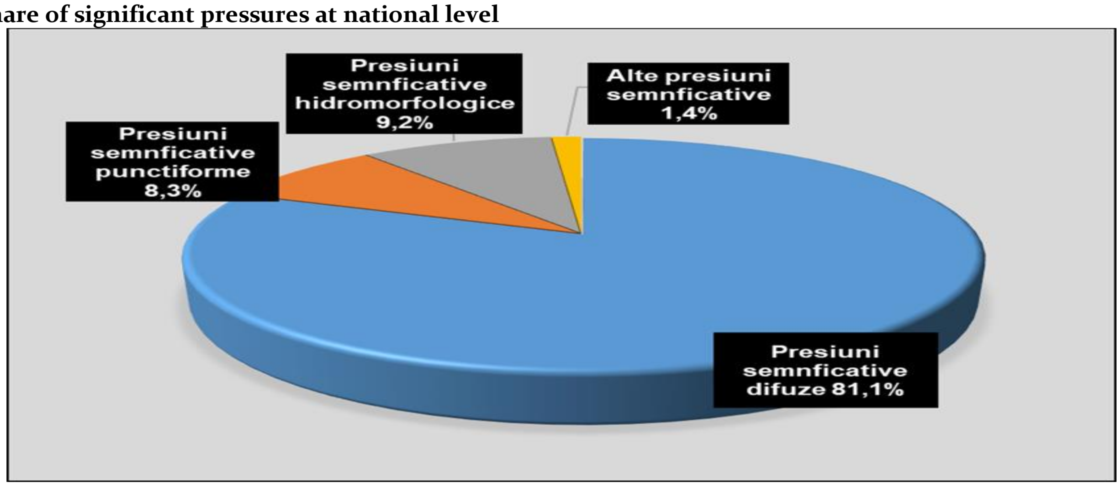
Regarding significant pressures, a total of 4,550 significant pressures have been identified, and their types are presented in Figure II.47. It is evident that the largest share of pressures is represented by diffuse pressures originating, as in the case of potentially significant pressures, from human settlements without collection systems and from agriculture.

Figure II.46 Share of potentially significant pressures at national level



Source: "Romanian Waters" National Administration, updated National Management Plan 2021

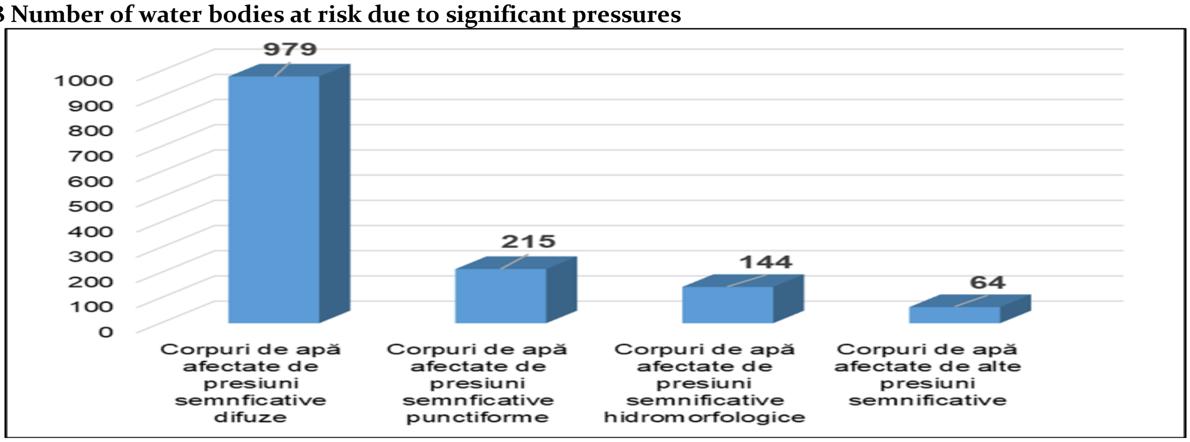
Figure II.47 Share of significant pressures at national level



Source: "Romanian Waters" National Administration, updated National Management Plan 2021 project

The number of water bodies affected by significant pressures is presented in Figure II.48. It is observed that the majority of water bodies are affected by significant diffuse pressures originating from human settlements without wastewater collection systems and from agriculture.

Figure II.48 Number of water bodies at risk due to significant pressures



Source: "Romanian Waters" National Administration, updated National Management Plan 2021
** a water body can be affected by one or more types of pressures*

According to the ***Water Quality Synthesis developed by the "Romanian Waters" National Administration***, at national level, in 2021, a number of 2994 potentially polluting sources were identified. **In 2021, there were 77 accidental pollutions of surface water courses**, mainly on inland rivers, with:

- Untreated wastewater (domestic and/or technological)
- Petroleum product and other hydrocarbons
- Semi-solid/solid waste
- Mine waters
- Unidentified substances
- Other nature

It is mentioned that accidental pollution incidents involving untreated domestic wastewater illegally discharged into water resources or onto the soil have been recorded, with an impact on the state of surface waters and, in some cases, causing fish mortality.

Regarding **the type and magnitude of anthropogenic pressures that can affect groundwater bodies** (according to the Framework Directive 2000/60/EC - Annex II - 2.1), the following are taken into account:

- *point and diffuse pollution sources:*

The following types of pollution caused by:

- point pollution caused by non-compliant waste deposits;
- diffuse pollution caused by agricultural activities (agro-zootechnical farms that do not have appropriate manure storage systems, non-compliant fertilizer deposits, improper use of fertilizers and pesticides);
- human agglomerations without collection systems and wastewater treatment stations;
- other potentially polluting human activities.

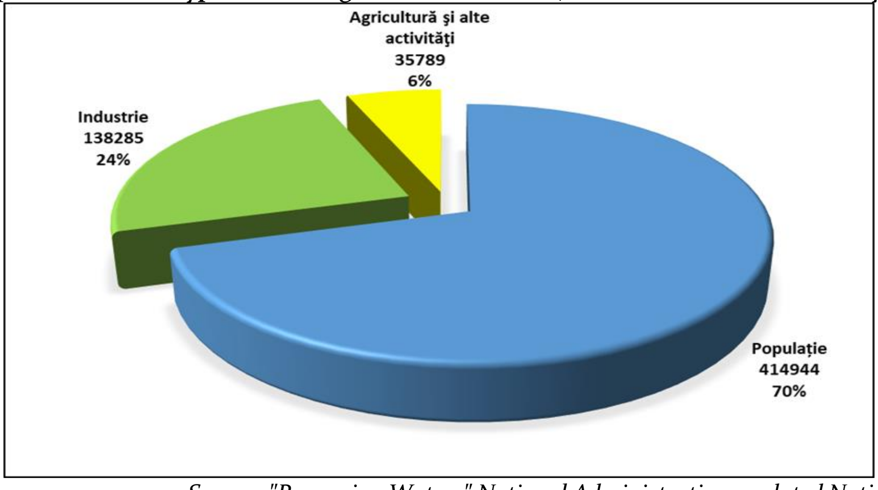
The most common **sources of pollution that can lead to the deterioration of groundwater quality**, are the sources of diffuse pollution due to human agglomerations without wastewater collection and purification systems, as well as diffuse pressures caused by agricultural activities. It should also be taken into account that the dynamics of underground water is much slower than that of surface water, so that the effect of any measures is felt after a longer period of time.

From the point of view of **impact on the quantitative status of underground water bodies**, quantitative pressures are considered significant water withdrawals, which can exceed the natural recharge rate of the aquifer.

- *water sampling and recharge of underground water bodies:*

  According to the provisions of the DCA, Annex II – 2.3, the selection criteria of water intakes are considered to be those that consider water intakes >10 m3/day. In Romania, underground water is generally used for the purpose of supplying water to the population, as well as for industrial, agricultural purposes, etc. From the total number of abstractions (figure II.49), **26 significant exploitations of underground water** were identified at the national level, respectively abstractions with flows greater than or equal to 1500 thousand m^3/year.

Figure II.49 Graphical representation of types of underground water uses (thousands of cubic meters/year)



Source: "Romanian Waters" National Administration, updated National Management Plan 2021

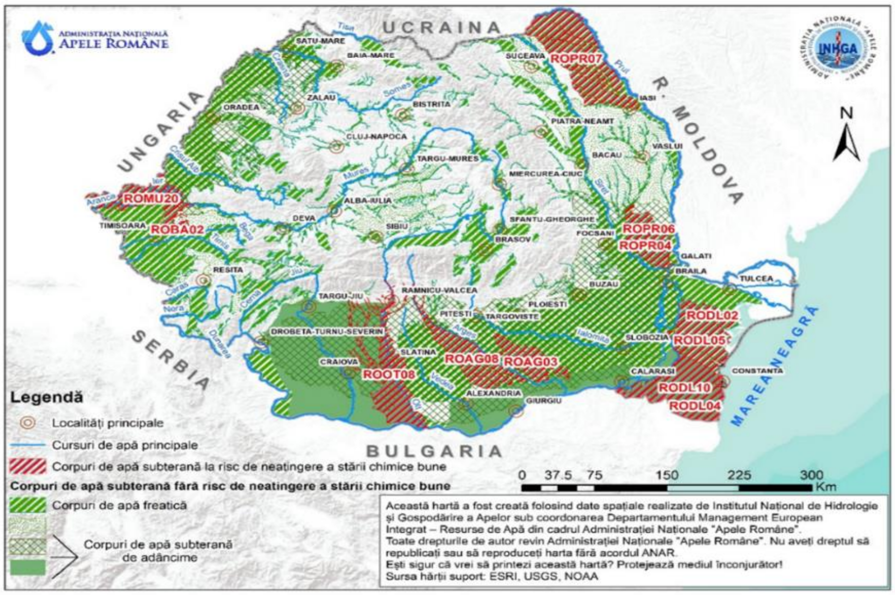
The general trend of increasing the volumes of groundwater captured in recent years can be attributed to the following causes:

- utilization of the abstraction well capacity (by some economic agents, but especially for supplying water to the urban distribution network);
- increasing the number of users and changing their profile, respectively giving up some industrial activities and focusing on different types of agricultural activities;

➢ increase in the number of localities equipped with drinking water distribution networks and groundwater intakes.

As a result of the qualitative analysis, it was found that 8.39% of groundwater bodies were identified as being at risk of not achieving good chemical status (by the year 2027), compared to 13.38% determined in the first National Management Plan in 2009 and 10.49% in the updated National Management Plan. ***All groundwater bodies do not present a risk of not achieving good quantitative status in the year 2027.***

Figure II.50 Groundwater bodies which risks not reaching the good state from a chemical point of view, for the nitrogen indicator



Source: "Romanian Waters" National Administration, updated National Management Plan 2021

Wastewater and sewage networks

RO 24
Indicator code Romania: RO 24 EEA indicator code: CSI 24
TITLE: URBAN WASTEWATER TREATMENT
DEFINITION: The indicator quantifies the level of connection of the population to the wastewater collection and treatment systems. The indicator also illustrates the effectiveness of national programs regarding wastewater treatment, the effectiveness of policies to reduce nutrient and organic substance discharges, as well as the state of implementation of the directive requirements regarding wastewater treatment (91/271/CEE and 98/15/EC) at national level .

Untreated wastewater from human agglomerations (cities and villages - the most concentrated inhabited areas) contributes to surface and underground water pollution. Pollution is mainly due to the following aspects:

➢ The reduced rate of connecting the equivalent population to the wastewater collection and treatment systems;
➢ Inadequate operation of existing sewage treatment plants;
➢ Inadequate management of sludge from treatment plants (by-products of the wastewater treatment process, considered biodegradable waste);
➢ The development of urban areas without the provision and provision of water supply and sewage systems and installations, which is then reflected by the discharge of untreated water into natural emissions, which leads to insufficient protection of water resources.

The structure of discharged wastewater. Polluting substances and indicators of wastewater pollution

According to the results of the assessment of the situation at national level, **the total volume evacuated in 2021 was 4155.77 million cubic meters**, of which 2362.14 million cubic meters. (56.84%) represents cooling water, ***water classified as waste water that does not require purification***.

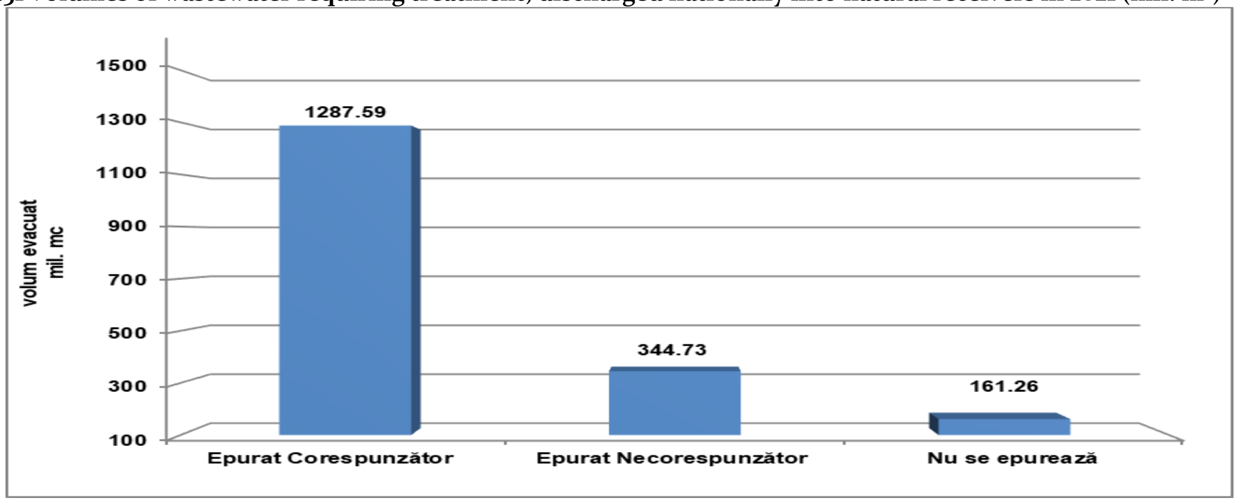
The situation regarding the volumes of wastewater discharged in 2021 is presented in table II.22 and figure II.51.

Table II.22 Volumes of wastewater discharged at national level in natural receivers in 2021 (thousand m3)

Year	Totally evacuated	No treatement required	Is treated		It is not treated
			Compliant	Non-compliant	
2021	4155767.64	2362142.95	1287592.20	344737.96	161260.17

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Figure II.51 Volumes of wastewater requiring treatment, discharged nationally into natural receivers in 2021 (mil. m3)



Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

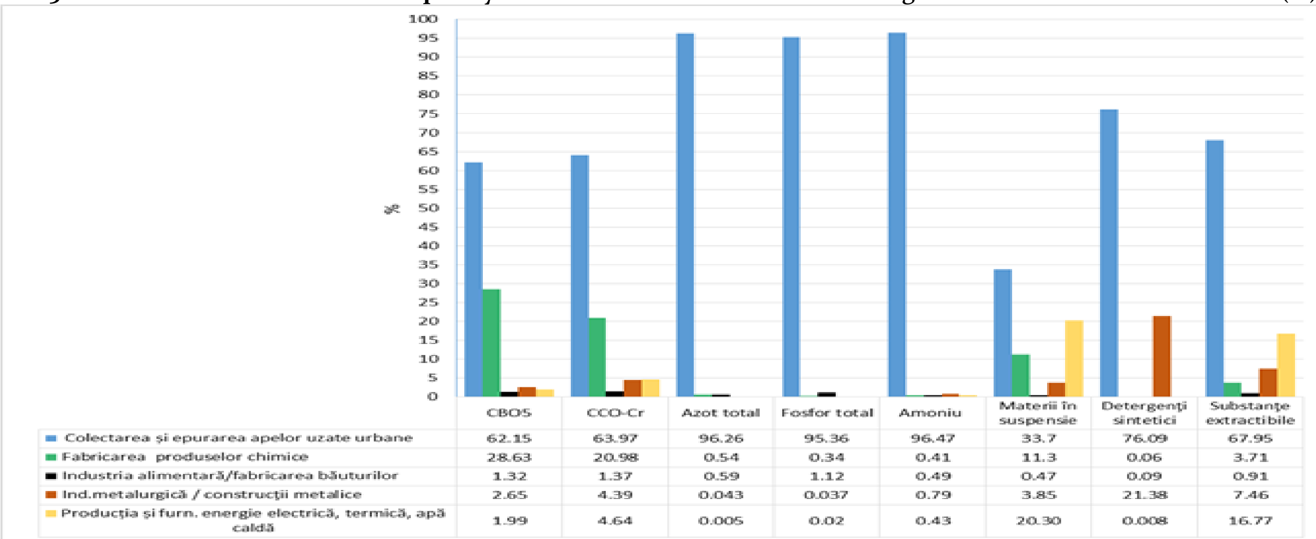
Regarding the proportion of the load of the main quality indicators from wastewater discharged into natural receptors, based on activities in the national economy, the situation is presented in Table II.23 and Figure II.53.

Table II.23 The share of loading of the main quality indicators from wastewater discharged into natural receivers in 2021 (%)

The main economic activities	The proportion of the load of the main quality indicators from wastewater discharged into natural receivers in 2021 (%)							
	CBO5	COD,	Total nitrogen	Total phosphorus	Ammonium	Matter in suspention	Synthetic detergents	Extractable substances
Collection and treatment of urban wastewater	62.15	63.97	96.26	95.36	96.47	33.7	76.09	67.95
Manufacturing of chemical products	28.63	20.98	0.54	0.34	0.41	11.3	0.06	3.71
Food industry/beverage manufacturing	1.32	1.37	0.59	1.12	0.49	0.47	0.09	0.91
Metallurgical industry / metal constructions	2.65	4.39	0.043	0.037	0.79	3.85	21.38	7.46
Production and suuply of electricity, heat, hot water	1.99	4.64	0.005	0.02	0.43	20.30	0.008	16.77

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Figure II.52 The share of load of the main quality indicators from wastewater discharged into natural receivers in 2021 (%)



Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

The statistics compiled and annually presented in the 'Synthesis of Water Quality in Romania' demonstrate that among the wastewater requiring treatment, the greatest impact comes from wastewater originating from urban agglomerations, particularly concerning pollution with organic substances (BOD5 and COD-Cr) and nutrients (total nitrogen and total phosphorus). Tables II.24 and II.25 highlight the statements mentioned above.

Table II.24 The total volume of urban wastewater discharged into natural receivers in 2021 (mil. m³/year)

Year	Volume of urban wastewater discharged into natural receivers (mil. m³/year)			
	Total	**Properly trated**	**Inadequately treated**	**It does not treat**
2021	1113,397	777,517	285,864	50,015

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

Table II.25 Pollutant load (tons/year) of effluents discharged from urban agglomerations into natural receivers in 2021

Pollutant	Amount of pollutants (tons/year)
	2021
CBO5	19712.66
COD,	58305.78
Total nitrogen	11275.13
Total phosphorus	1046.56
Ammonium	7470.58
Matter in suspention	24669.59
Synthetic detergents	561.59
Extractable substances	3462.10

Source: National Administration "Romanian Waters", Synthesis of water quality in Romania in 2021

The level of urban wastewater collection and treatment

According to the National Institute of Statistics, in 2021, a number of 11,012,187 inhabitants had their homes connected to the sewage systems, representing approx. 57.4% of the Romanian population. Regarding wastewater treatment, the population with homes connected to sewage systems equipped with treatment stations was 10,792,650 people, representing approx. 56.2% of the country's population. Also, the degrees of connection of the population to the wastewater collection and treatment systems, differentiated by treatment levels, are presented in figure II.56.

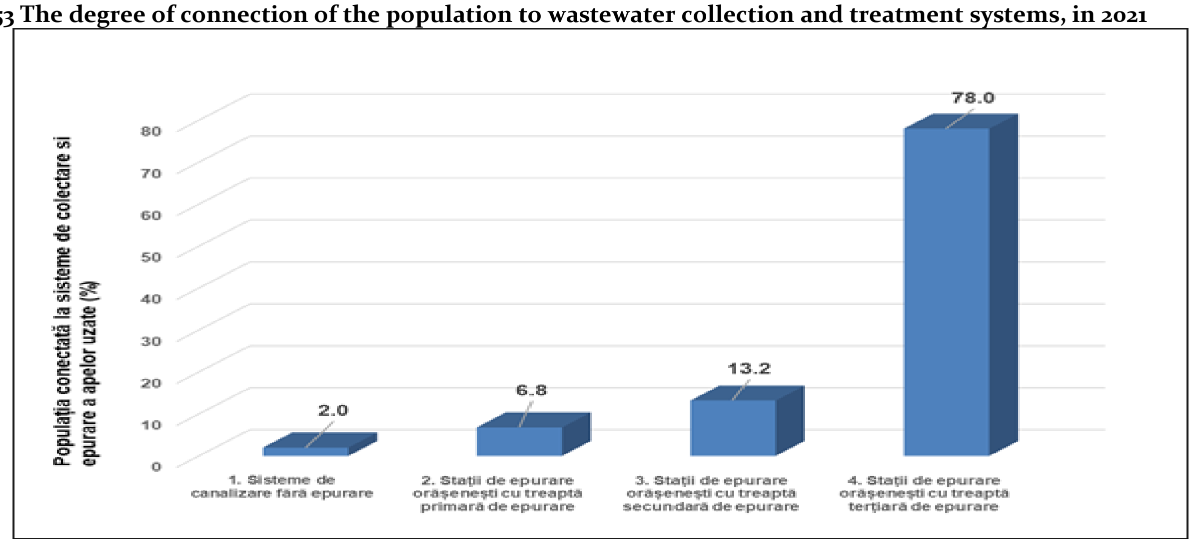
Also, the efficiency of the national programs regarding wastewater treatment, the effectiveness of the existing policies to reduce the discharge of nutrients and organic substances is evaluated by the stage of implementation of the requirements of

Directive 91/271/EEC regarding wastewater treatment, modified by Directive 98/15/EC. The proposed targets for the implementation of the provisions of Directive 91/271/EEC, 98/15/CE and 2000/60/CE are:

- increasing the degree of connection of human agglomerations by more than 2,000 to the sewerage systems by expanding the sewerage networks (from 69.1% of the equivalent inhabitants connected in 2013, up to 80.2% in 2015 and 100% in 2018) ;
- increasing the degree of connection of human agglomerations by more than 2,000 le to the sewage treatment systems by building new wastewater treatment stations and by rehabilitating and modernizing the existing ones, in order to achieve a coverage of 60.6% le in 2013, 76 .7% in 2015 and 100% in 2018.

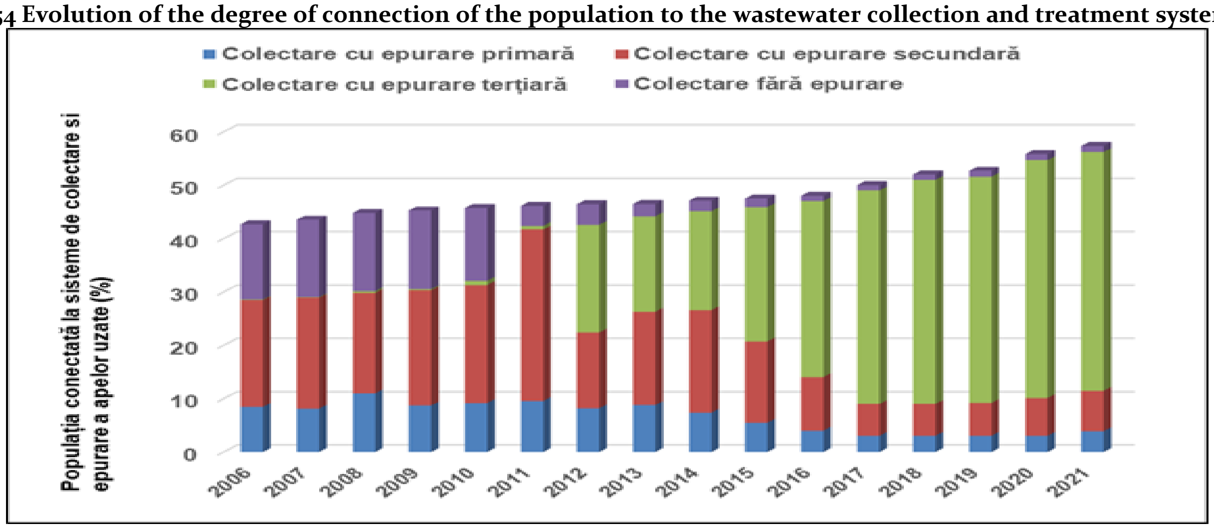
It is specified that the **notion of "inhabitant-equivalent**" is a specific term of Directive 91/271/EEC on wastewater treatment which represents the unit of measure for biodegradable pollution and establishes the size of pollution originating from a human agglomeration, respectively the pollution resulting from such population, as well as from industrial activities that discharge waste water into the agglomeration's sewerage network. Thus "***an equivalent inhabitant (le) means the biodegradable organic load with a five-day biochemical oxygen consumption (CBO5) of 60 grams of oxygen per day; it is expressed as the average of that pollution produced by a person in a day***.

Figure II. 53 The degree of connection of the population to wastewater collection and treatment systems, in 2021



Source: National Institute of Statistics,www.insse.ro

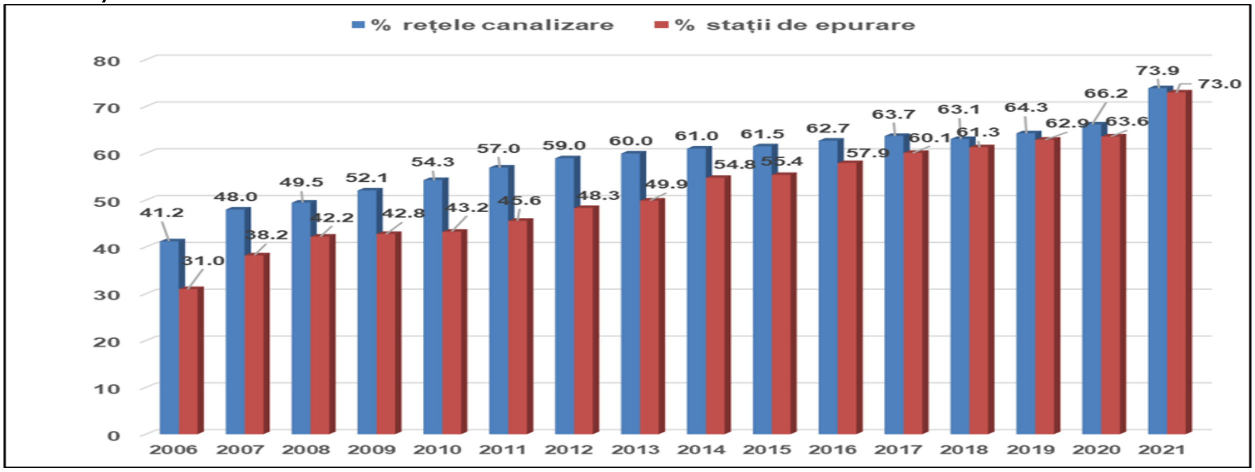
Figure II.54 Evolution of the degree of connection of the population to the wastewater collection and treatment systems



Source: National Institute of Statistics, www.insse.ro

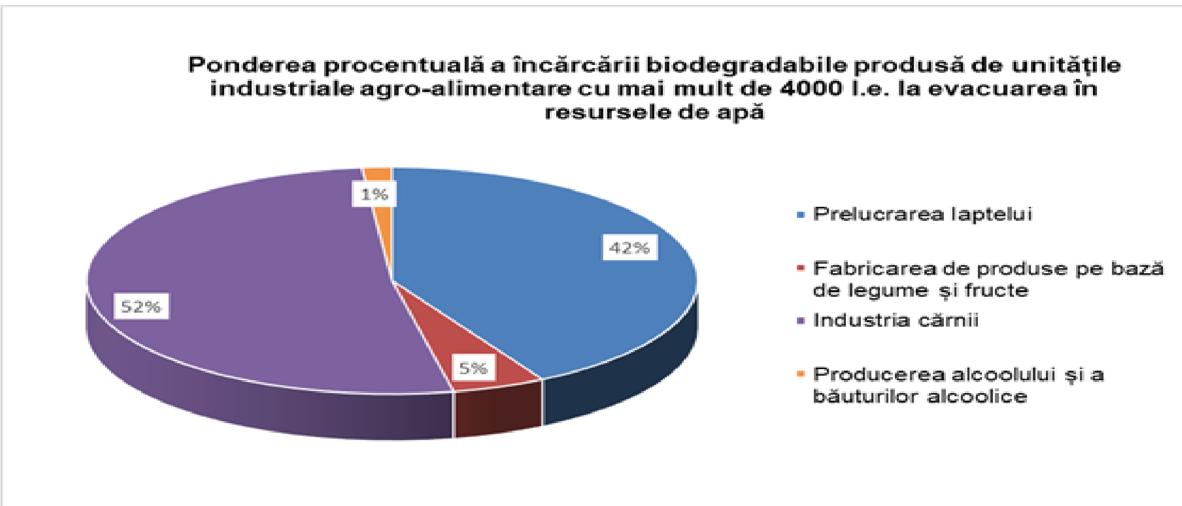
According to the report made by the National Administration "Romanian Waters", in the human agglomerations larger than 2000 l.e, the degree of connection to the waste water collection system registered an increase of approx. 26% at the end of 2021 compared to 2007(figure II.55). ***Regarding the degree of connection to urban sewage treatment plants, it increased by approx. 35% in the period 2007-2021***.

Figure II.55 Evolution of collection and treatment levels (%) of biodegradable organic loads (le) of wastewater at national level in the period 2007-2021



Source: "Romanian Waters" National Administration, report "Stage of works for the purification of urban waste water and capacities under execution and put into operation for human agglomerations"

Figure II.56 Share of biodegradable load produced by agri-food industrial units with more than 4000 l.e when discharged into water resources



Source: "Romanian Waters" National Administration, report "Stage of works for the purification of urban waste water and capacities under execution and put into operation for human agglomerations"

The implementation of the requirements of the Directive 91/271/EEC regarding the treatment of urban wastewater will implicitly lead to a significant increase in the volume of sludge resulting from urban wastewater treatment plants. From the situation provided by the National Institute of Statistics regarding the management of sludge from urban sewage treatment plants in 2019 (table II.26) it can be observed that, of the total amount of sludge generated in sewage treatment plants approx. 18.89% was used in agriculture.

Table II.26 National use of sludge from urban sewage treatment plants in 2020

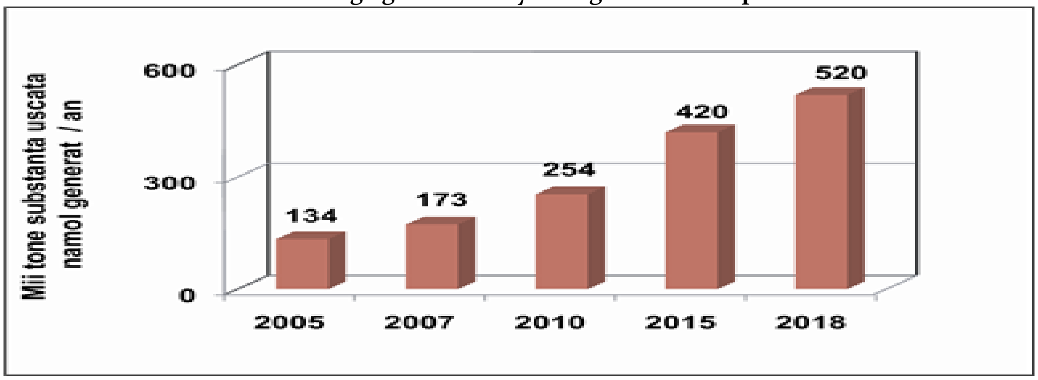
Uses of sludge	Amount of sludge (thousands of tons/year)
Total quantity produced	**254.22**
Use in agriculture	54.12
Composting and other applications	5.03
Storage on arranged platforms	140.69
Evacuation into the sea	0

Incineration (co-incineration)	2.15
Sludge treated by other processes	52.22

Data source: National Institute of Statistics, TEMPO online database, www.insse.ro

According to the first National Management Plan of the hydrographic basins/spaces in Romania (developed in 2009), it was estimated that at the end of the compliance period (year 2018) a quantity of sludge of approx. 520,850 tons of dry substance/year compared to approx. 172,529 tons of dry substance/year obtained in 2007 (figure II.57). This forecast corresponds to the planned situation regarding the compliance of agglomerations in 2004, according to the National Implementation Plan of Directive 91/271/CEE on the treatment of urban wastewater.

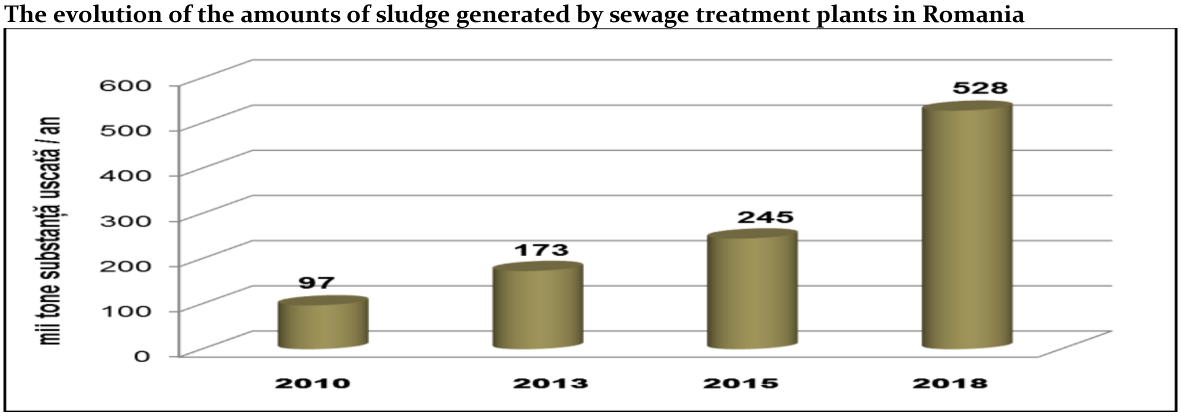
Figure II.57 The evolution of the amounts of sludge generated by sewage treatment plants in Romania



Source: National Administration"Romanian Waters", the National Management Plan of the hydrographic basins/spaces in Romania approved by GD no. 859/2016

In the ***National Strategy for Sewage Sludge Management***, developed within the technical assistance of the Environmental Operational Program (POS Mediu), it provides a framework for planning and implementing measures to manage the increasing volumes of sludge from existing, rehabilitated, and new urban wastewater treatment plants in Romania. The future estimated quantities of sludge produced have been assessed according to Figure II.58. This forecast corresponds to the planned situation regarding compliance of agglomerations as of the year 2011, considering the changes in delimitating human agglomerations and the type of treatment required for compliance.

Figure II.58 The evolution of the amounts of sludge generated by sewage treatment plants in Romania



Source: Ministry of the Environment, Water and Forests, National strategy for the management of sewage sludge - project POSM/6/AT/I.1.2010, "Elaboration of the national policy for the management of sewage sludge"

The main final results of the project consisted in: the elaboration of the "Report on strategic options for the consolidation and development of the water sector in Romania 2020-2035", the updating of the benchmarking platform (H2O BENCHMARK http://h2obenchmark.org/#!/Pages/Projects), report on the pricing methodology, etc.

Status of marine protected areas

RO 41

Indicator code Romania: RO 41
EEA indicator code: SEBI 07

TITLE: NATURAL PROTECTED AREAS OF NATIONAL INTEREST

DEFINITION: marine protected areas. The indicator describes the evolution of marine protected areas and the surfaces covered by them.

In Romania, sites of community importance were designated in several stages, as follows:

- The first stage, in 2007, when 273 sites of community importance were designated by MMDD Order no. 1964/2007 regarding the establishment of the protected natural area regime of sites of community importance, as an integral part of the European Natura 2000 ecological network in Romania;
- The second stage took place in 2011, when new sites were designated by Order no. 2387/2011 for the amendment of the order mentioned above, the number of sites of community importance reaching 408;
- Through the implementation of the third stage, currently, in accordance with the provisions of Order No. 46/2016 regarding the establishment of the regime for protected natural areas and the declaration of sites of community importance as an integral part of the European ecological network Natura 2000 in Romania, published in the Official Gazette No. 114/15.02.2016, the network of protected marine areas in Romania consists of the following sites of community importance:
    1. ROSCI0066 Rezervaţia Biosferei Delta Dunării - zona marină
    2. ROSCI0413 Lobul sudic al Câmpului de *Phyllophora* al lui Zernov
    3. ROSCI0197 Plaja submersă Eforie Nord - Eforie Sud
    4. ROSCI0273 Zona marină de la Capul Tuzla
    5. ROSCI0281 Cap Aurora
    6. ROSCI0293 Costinești - 23 August
    7. ROSCI0311 Canionul Viteaz
    8. ROSCI0094 Izvoarele sulfuroase submarine de la Mangalia
    9. ROSCI0269 Vama Veche - 2 Mai

Table II.27 Areas of sites of community importance in the Romanian sector of the Black Sea

Marine protected area	Area 2007 (km²)	Area 2011 (km²)	Area 2016 (km²)
ROSCI0066 Rezervaţia Biosferei Delta Dunării - zona marină	1216.97	1233.74	3362.91
ROSCI0094 Izvoarele sulfuroase submarine de la Mangalia	3.82	3.82	57.85
ROSCI0197 Plaja submersă Eforie Nord - Eforie Sud	1.4	1.4	57.17
ROSCI0237 Sf. Gheorghe	61,22	61,22	---
ROSCI0269 Vama Veche - 2 Mai	52.72	71.96	123.11
ROSCI0273 Zona marină de la Capul Tuzla	17.38	17.38	49.47
ROSCI0281 Cap Aurora	---	130.71	135.92
ROSCI0293 Costinești - 23 August	---	48.78	48.84
ROSCI0311 Canionul Viteaz	---	---	353.77
ROSCI0413 Lobul sudic al Câmpului de *Phyllophora* al lui Zernov	---	---	1868.15
TOTAL	1353.51	1569.01	6057.19

Source: NMRDI

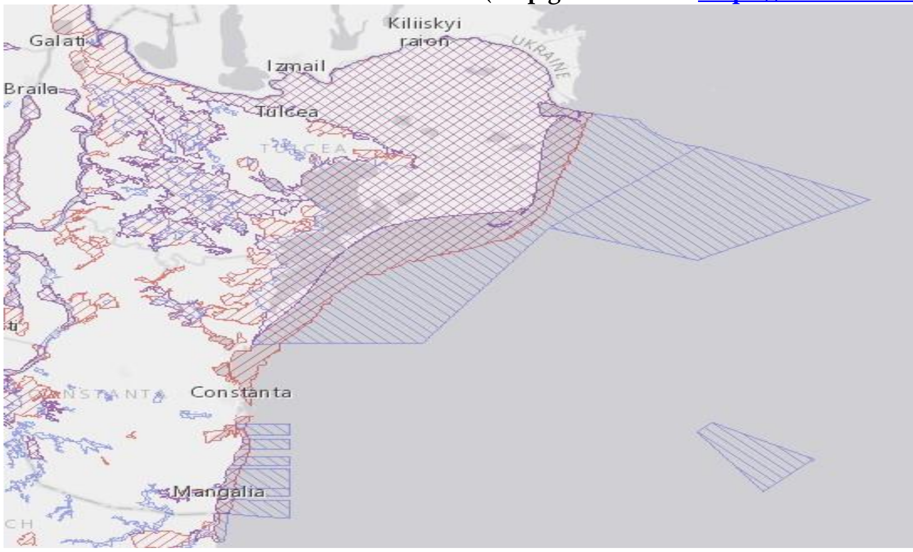
The share of marine sites of community importance in the Romanian sector of the Black Sea is recorded in table II.28.

Table II.28 Share of sites of community importance (SCI) in the Romanian sector of the Black Sea

Area	SCI area (km²)	SCI area (%)
Territorial waters (0-12 nautical miles)	3,529.09	84.95
Contiguous Zone and Exclusive Economic Zone	2,528.10	10.38

Source: NMRDI

Figure II.59 The network of Natura 2000 marine sites in Romania (map generated onhttps://natura2000.eea.europa.eu/#)



Source: NMRDI

In 2021, there were no changes in the areas of community importance in the Romanian sector, and likewise, there were no legislative changes. These areas remain under the custody of the ANANP.

The state of marine ecosystems and living resources

RO 09
Indicator code Romania: RO09 EEA indicator code: CSI 09
TITLE: SPECIES DIVERSITY
DEFINITION: The indicator describes the state and trends of biodiversity, more precisely the variation of biodiversity over time. in the context of the relevant environmental policies, especially the European Biodiversity Strategy and the Marine Environment Strategy Framework Directive; sustainable fishing is pursued until 2015 (establishing the maximum production to ensure the sustainable use of fish resources).

Phytoplankton

The identification of the qualitative and quantitative structure of phytoplankton, as an indicator of the state of the marine ecosystem according to DCSMM (Directive on Maritime Spatial Planning and Integrated Coastal Management), was carried out following the analysis of samples collected in June 2021 along profiles within the monitoring network of waters with variable salinity, coastal waters, and marine waters off the Romanian coast of the Black Sea (Sulina, Mila 9, Sfântu Gheorghe, Portița, Gura Buhaz, Cazino Mamaia, Constanța Nord, Est Constanța, Constanța Sud, Eforie Sud, Costinești, Mangalia, and Vama Veche). Based on the spatial distribution of mean salinity values over decades from available World Ocean Data and INCDM data, as well as from mean monthly chlorophyll "a" values for the period of 07.2002-10.2013, in accordance with Decision EC 848/2017, Romanian marine waters were classified into four marine reporting units:

- BLK_RO_RG_TT03 – waters with variable salinity (ASV), from the baseline to the 30m isobath,
- BLK_RO_RG_CT – coastal waters (AC), from the baseline to the 30m isobath,
- BLK_RO_RG_MT01 – marine waters (AM), from over the 30m isobath to the 200m isobath,
- BLK_RO_RG_MT02 – offshore waters (AL), from over the 200m isobath.

In addition, samples collected bi-weekly from the shallow water station in the Mamaia area throughout the year 2021 (111 samples) were analyzed to capture bloom phenomena.

Standard laboratory procedures were used for the analysis of the collected samples. Thus, 500 ml volume samples were preserved with 4% formaldehyde and processed through the sedimentation method. The determination and counting of cells by species in the analyzed sample fraction were carried out using an inverted plankton microscope with 20x or 40x objectives (Moncheva, 2008). With the primary data obtained in this way, numerical density (cells/L) and wet biomass (mg/m3) were calculated for each specific component, for each of the algal taxonomic classes, and for the total phytoplankton. Data processing and graphical representation were performed using PRIMER 7 (Clarke et al., 2014) and Microsoft Excel. Species names identified were updated according to WORMS (WoRMS Editorial Board, 2022). Distribution maps of phytoplankton quantities were created using the Ocean Data View program).

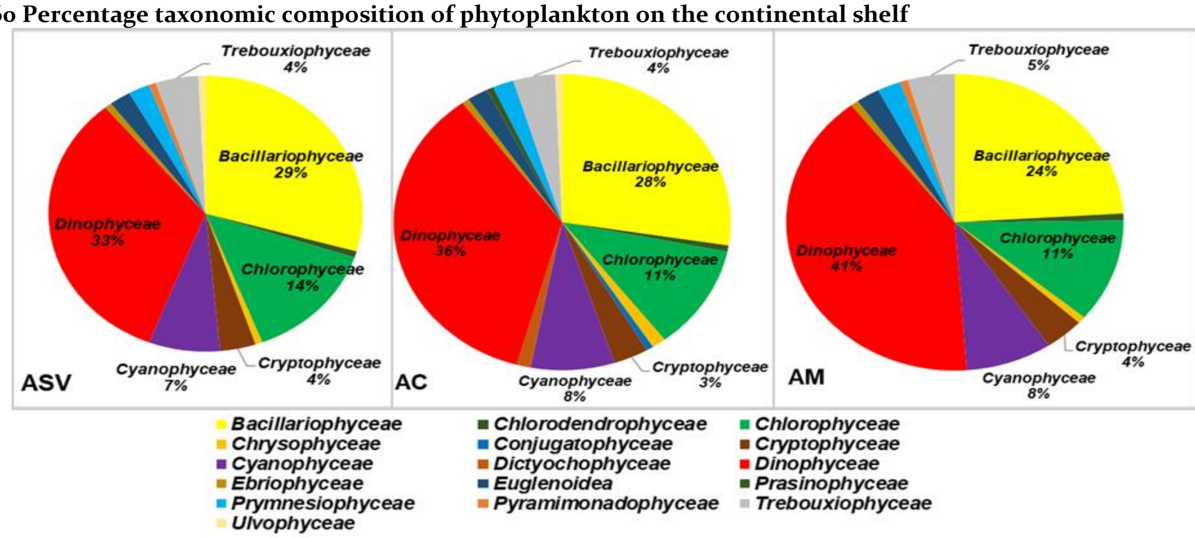
[1] ftp://ftp.nodc.noaa.gov/
[1] www.nodc.ro
[1] disc.sci.gsfc.nasa.gov/giovanni

Qualitative analysis of phytoplankton, in June 2021

In the phytoplankton composition of June 2021, 166 species were identified on the continental shelf of the Black Sea, belonging to 16 taxonomic classes (Bacillariophyceae, Chlorodendrophyceae, Chlorophyceae, Chrysophyceae, Cryptophyceae, Cyanophyceae, Conjugatophyceae, Dictyochophyceae, Dinophyceae, Ebriophyceae, Euglenoidea, Prasinophyceae, Prymnesiophyceae, Trebouxiophyceae, Ulvophyceae, and Xanthophyceae).

On the continental shelf of the Black Sea, in June 2021, the highest diversity was found in coastal waters (149 species), followed by waters with variable salinity and marine waters with 136 and 133 species, respectively. In all three marine reporting units, dinoflagellates were dominant, representing between 33% (in waters with variable salinity) and 41% (in marine waters) of the total number of species. They were followed by diatoms, representing between 24% (in marine waters) and 29% (in waters with variable salinity), and species from the Chlorophyceae class, representing up to 14% in waters with variable salinity, Cyanophyceae with 7-8%, Cryptophyceae with 3-4%, and Trebouxiophyceae with 4-5%. The remaining taxonomic classes (Chlorodendrophyceae, Chrysophyceae, Conjugatophyceae, Dictyochophyceae, Ebriophyceae, Euglenoidea, Prasinophyceae, Prymnesiophyceae, Ulvophyceae, and Xanthophyceae) together represented up to 9% of the total number of species in each unit, each having only 1-2 species (Figure II.60).

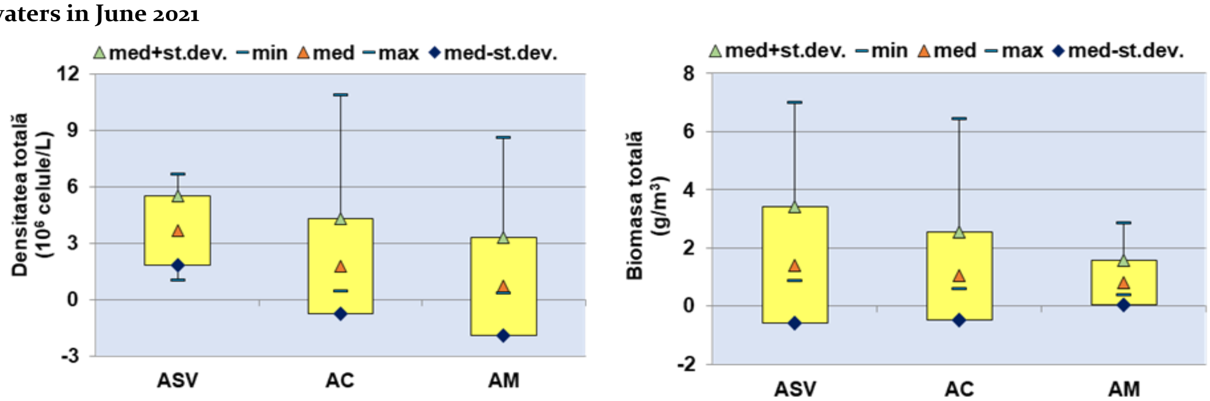
Figure II.60 Percentage taxonomic composition of phytoplankton on the continental shelf



Source: NMRDI

Quantitative analysis of phytoplankton, in June 2021

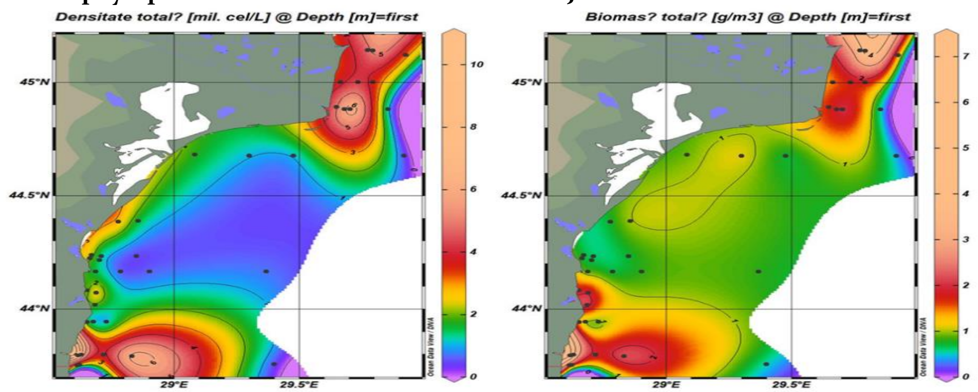
Figure II.61 Variation of phytoplankton densities and biomasses in waters with variable salinity, in Romanian coastal and marine waters in June 2021



Source: NMRDI

In June, the maximum values of phytoplankton densities and biomasses were recorded especially near the mouths of the Danube and in the south of the coast. In waters with variable salinity, values above 106 cel/L were recorded in all the stations in this marine unit, and the maximum values were recorded at Sulina 2 station (6.7·106 cel/L and 7 g/m3). In the coastal waters, the maximum values of 10.87·106 cel/L and 6.46 g/m^3 were recorded at Mangalia 1 station, with values above 106 cel/L found in all stations except Cazino Mamaia 2 and Est Constanța 2 In marine waters, values above 106 cel/L were recorded only in the stations near the mouths of the Danube, the maximum values being found at the Sf. Gheorghe 3 station (8.62·106 cel/L and 2.88 g/m^3) (figure II.62).

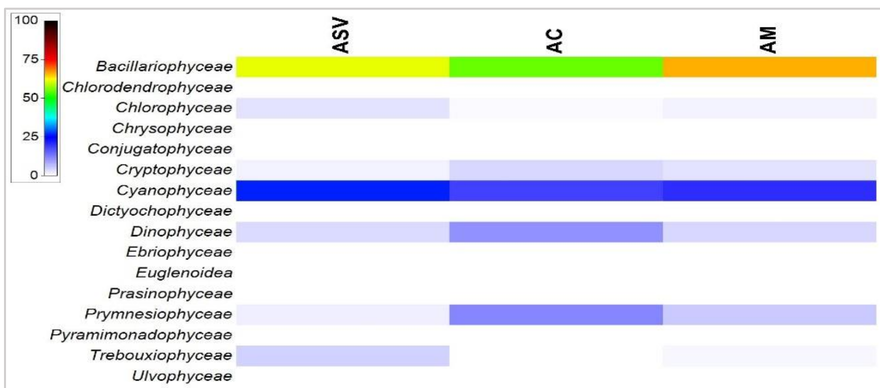
Figure II.62 Distribution of phytoplankton densities and biomasses in June 2021



Source: NMRDI

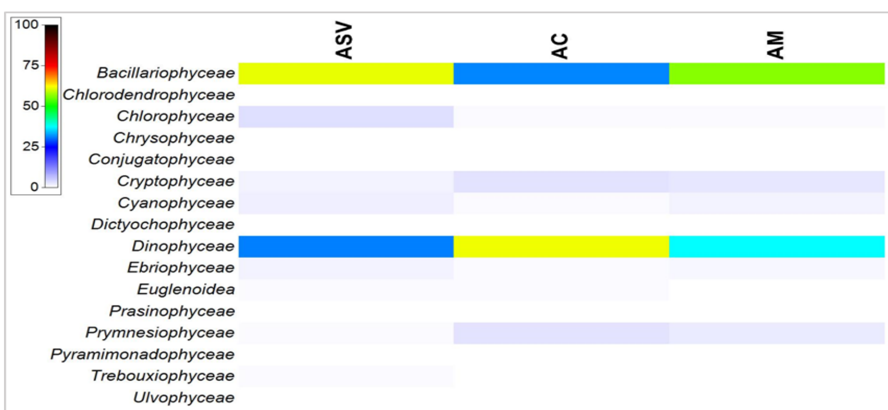
Regarding the quantitative structure of the phytoplankton according to the average density (figure II.33), the dominance of the classes Bacillaryophyceae (with 55-66% of the total) and Cyanophyceae (with 18-26%) in each marine unit can be noted.

Figure II.63 Matrix of the percentage quantitative structure of phytoplankton on water types according to average density, June 2021



Source: NMRDI

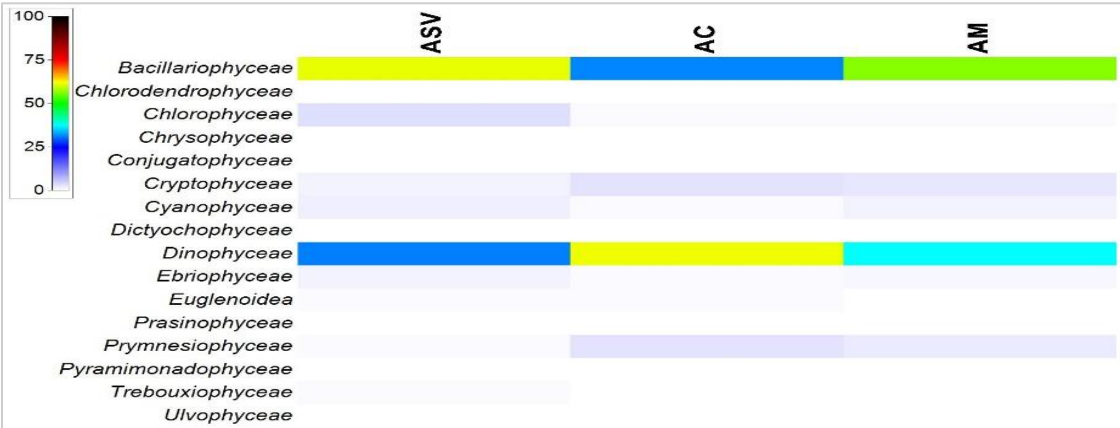
Figure II.64 The matrix of the percentage quantitative structure of phytoplankton by types of water depending on the average biomass



Source: NMRDI

In terms of phytoplankton structure (Figure II.65), up to 92-93% of the total was constituted by diatoms and dinoflagellates. The dominance of diatoms was noted in waters with variable salinity and marine waters (61% and 56% of the total, respectively), while in coastal waters, dinoflagellates were dominant (61%). Among the other classes, Chlorophyceae (3%) and Cyanophyceae (2%) were notable in waters with variable salinity, and the classes Cryptophyceae and Prymnesiophyceae each constituted 3% in coastal waters and 2% in marine waters.

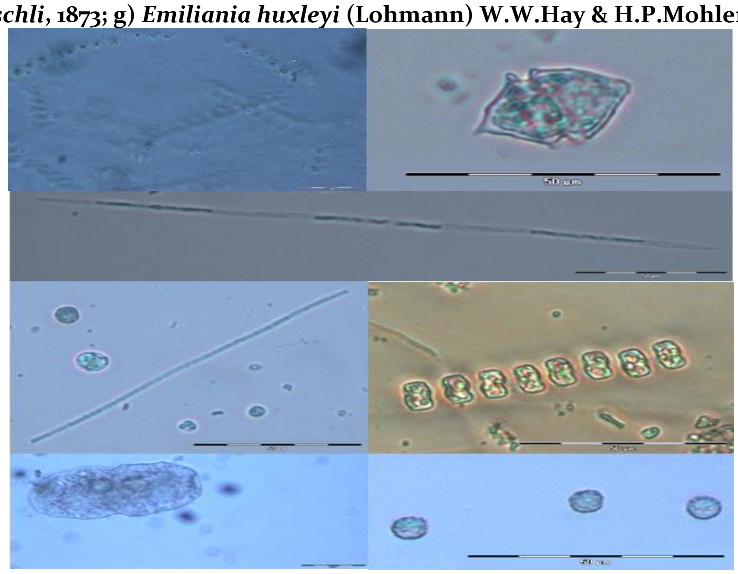
Figure II.65 Matrix of the percentage quantitative structure of phytoplankton on water types according to average biomass, June 2021



Source: NMRDI

Among diatoms, the species that reached significant biomasses were: *Chaetoceros socialis* (1678 mg/m³ - in coastal waters and 1165 mg/m³ - in marine waters), *Skeletonema subsalsum* (1641 mg/m³ - in marine waters and 960 mg/m³ - in waters with variable salinity), *Thalassiosira aestivalis* (686 mg/m³ - in marine waters), and *Thalassiosira subsalina* (624 mg/m³ - in waters with variable salinity). Among dinoflagellates, the notable ones were: *Kryptoperidinium triquetrum* (1201 mg/m³ - in waters with variable salinity), *Oblea rotunda* (1168 mg/m³ - in coastal waters), *Akashiwo sanguinea* (961 mg/m³ - in coastal waters), and *Polykrikos kofoidii* (824 mg/m³ - in waters with variable salinity and 518 mg/m³ - in coastal waters) (Figure II.66).

Figure II.66 Predominant species in the phytoplankton community, June 2021: a) *Chaetoceros socialis* H.S.Lauder, 1864; b) *Kryptoperidinium triquetrum* (Ehrenberg) U.Tillmann, M. Gottschling, M.Elbrächter, W.-H.Kusber & M.Hoppenrath, 2019; c) *Nitzschia delicatissima* Cleve, 1897; d) *Pseudanabaena limnetica* (Lemmermann) Komárek, 1974; e) *Cyclotella caspia Grunow*, 1878; f) *Polykrikos kofoidii Bütschli*, 1873; g) *Emiliania huxleyi* (Lohmann) W.W.Hay & H.P.Mohler, 1967 (original photos)



Source: NMRDI

The month of June 2021 was characterized by a wider development of the phytoplankton community, compared to the last year. Thus, the annual average of phytoplankton quantities in the surface horizon, in June 2021, was 2.7·106 cel/L and 1549 mg/m³, compared to the average values recorded in October 2020 (77.06·103 cel/ L and 197.56 mg/m³) and August 2019 (284.66·103 cel/L and 516.61 mg/m³).

Algal blooms

During 2021, eight phytoplankton species recorded growth of over one million cells per liter, of which three species only in the shallow waters of Mamaia. The magnitude of these phenomena was much lower this year, compared to the maximum value of 2019 (8.65·106 cells/L) and that of 2018 (23.44·106 cells/L).

Table II.29Species that caused bloom phenomena in the phytoplankton community, in 2021 (density – 106 cells/L)

	2021	June 2021		
Species	Mamaia	Waters with variable salinity	Coastal waters	Marine waters
Skeletonema costatum	4.62 (II); 1.53 (III)			
Planktolyngbya circumcreta	1.17 (III)		2	
Pseudanabaena limnetica	1.07 (III); 9.74 (V); 1.25 (VII); 4.06 (XI)	2		2.7
Chaetoceros socialis	4.42 (VI)		7.56	5.25
Skeletonema subsalsum		3.2		5.47
Hillea fusiformis	1.28 (VIII)			
Nitzschia delicatissima	2.47 (IX)		1.12	1.01
Spirulina sp.	2.1 (IX)			

Source: NMRDI

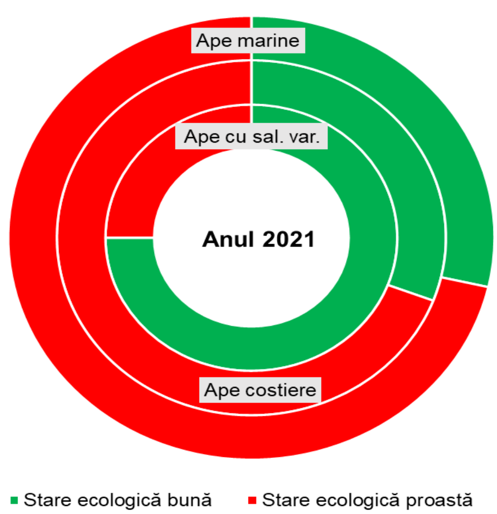
The assessment of the ecological status of the marine reporting units delimited according to the Marine Strategy Framework Directive (Government Emergency Ordinance 71/2010) is based on the biomass element (mg/m3) in the year 2021

Phytoplankton is one of the fundamental biological elements in the Water Framework Directive (WFD) and is also considered in 4 descriptors of the Marine Strategy Framework Directive (MSFD): Biological diversity is maintained (D1), non-indigenous species (D2), trophic network (D4), and eutrophication (D5).

The phytoplankton biomass indicator presents the level and trends of biomass values (mg/m³) during the warm season (August) in the waters off the Romanian coast. The assessment of ecological status was conducted for waters with variable salinity (8 stations), coastal waters (13 stations), and marine waters (14 stations) by calculating the 90th percentile for biomass values corresponding to the surface layer (0 m) of each station and comparing them with the threshold value in the methodology (variable salinity waters – 3000 mg/m³, coastal waters – 950 mg/m³, and marine waters – 800 mg/m³).

Thus, it can be observed that the values obtained in 2021 for waters with variable salinity, coastal waters, and marine waters exceed the target value set for these marine reporting units (3000, 950, and 800 mg/m³, respectively) and do not reflect a good ecological status, at percentages of 25, 69, and 71%, respectively (Figure II.67).

Figure II.67 Ecological status of marine reporting units on the Black Sea continental shelf based on phytoplankton biomass indicator, June, 2021



Source: NMRDI

Table II.30 Ecological status of marine reporting units by phytoplankton biomass element, June, 2021 (mg/m^3)

Marine reporting unit	Profile	Target value (mg/m3)	Value obtained 2021 (90th percentile)	Ecological status
Waters with variable salinity				
BLK_RO_RG_TT03	Sulina	3000	6444	
	Mila 9	3000	1598	
	Sf. Gheorghe	3000	1734	
	Portița	3000	1193	
Coastal waters				
BLK_RO_RG_CT	Gura Buhaz	950	1012	
	Cazino Mamaia	950	729	
	Est Constanța	950	662	
	Eforie Sud	950	2698	
	Costinești	950	1039	
	Mangalia	950	6185	
	Vama Veche	950	1970	
Marine waters				
BLK_RO_RG_MT01	Sulina	800	1196	
	Mila 9	800	1774	
	Sf. Gheorghe	800	2631	
	Portița	800	676	
	Cazino Mamaia	800	724	
	Est Constanța	800	803	
	Costinești	800	817	
	Mangalia	800	2249	

Good ecological status | **Bad ecological status**

Source: NMRDI

Conclusions

In June 2021, 166 species were identified as part of the phytoplankton on the continental shelf of the Black Sea, with varieties and forms belonging to 16 taxonomic classes, the greatest diversity being found in coastal waters (149 species). In all three marine reporting units dinoflagellates were dominant (33%-41%) followed by diatoms (24%-29%).

The maximum density of phytoplankton was recorded in coastal waters (10.87·106 cel/L), and the maximum biomass (7 g/m3) in waters with variable salinity.

Regarding the quantitative structure of the phytoplankton according to the average density, the dominance of the Bacillaryophyceae (with 55-66% of the total) and Cyanophyceae (with 18-26%) classes was noted in each marine unit. From the point of view of phytoplankton structure, depending on the average biomass, up to 92-93% of the total was constituted by diatoms and dinoflagellates.

During 2021, isolated but frequent blooming phenomena of low and medium intensity were observed, compared to the maximum value of 2019 (8.65·106 cel/L) and that of 2018 (23.44· 106 cel/L). Thus, eight phytoplankton species recorded growth of over one million cells per liter, of which three species only in the shallow waters of Mamaia. The bloom of the potentially toxic species, *Nitzschia delicatissima*, is noted both in marine waters (Portița 4 station) and in coastal waters (in the shallow waters of Mamaia in September and at Constanța Sud 2 and Mangalia 1 stations in June).

Following the assessment of the ecological status of marine reporting units based on the phytoplankton biomass element element in the warm season, the values obtained in 2021 for waters with variable salinity, coastal waters and marine waters exceed the target value established for these marine reporting units (3000, respectively , 950 and 800 mg/m3) and do not reflect good ecological status in percentages of 25, 69 and 71%, respectively.

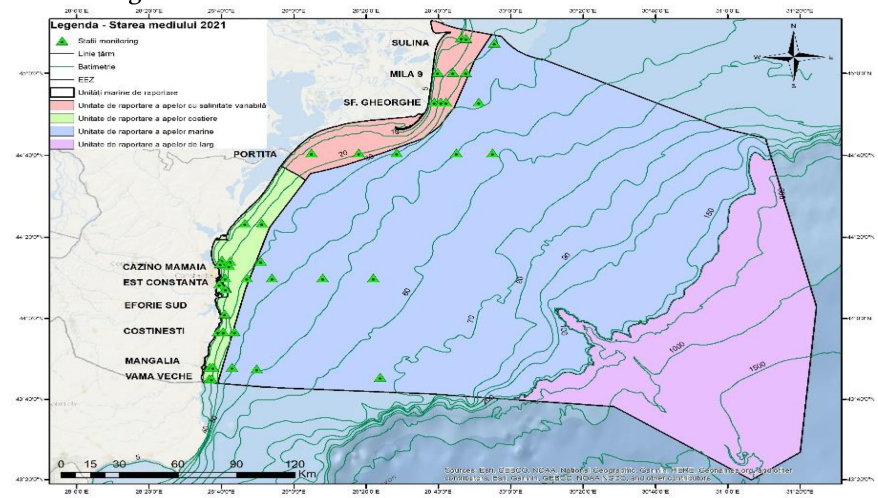
Zooplankton

Mesozooplankton

In order to assess the ecological status of mesozooplankton populations along the Romanian coast of the Black Sea, a set of samples collected in June 2021 was analyzed within the marine environment monitoring program.

The mesozooplankton samples collected during the warm season cover the three marine reporting units according to the MSFD (waters with variable salinity, coastal, and marine waters) as represented in Figure II.68.

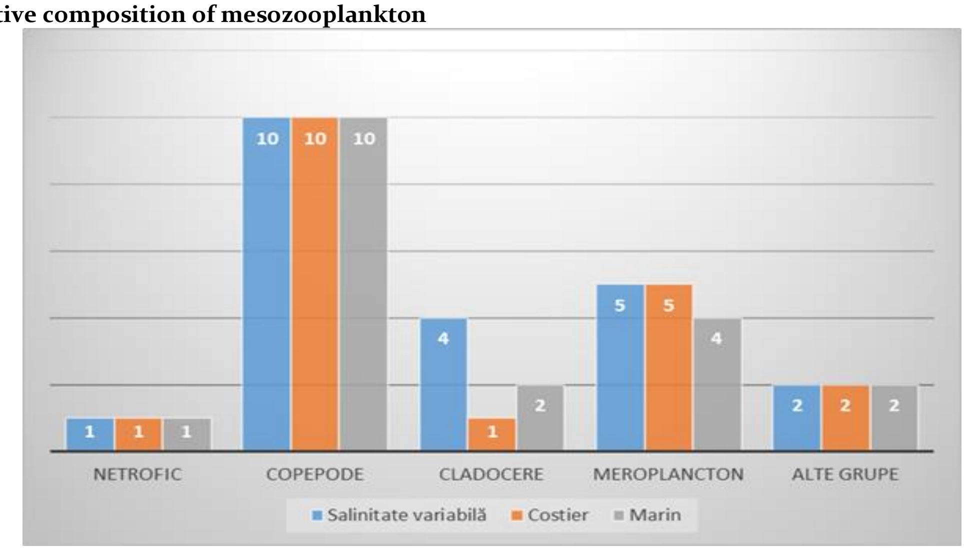
Figure II.68 The national monitoring network of NMRDI



Source: NMRDI

The qualitative composition of the mesozooplankton population in June 2021 consisted of a total of 22 taxa, with copepods dominating with ten species, followed by the meroplankton component with five taxa. Copepods reached the maximum number of species in all three marine reporting units, and the meroplankton was better represented in waters with variable salinity. Cladocerans reached the maximum number of species in waters with variable salinity, being poorly represented in coastal and marine waters. In the category of other groups, the maximum number of species was reached by two species in all three marine reporting units, and the dinoflagellate *Noctiluca scintillans* (nurtrophic) was identified in waters with variable salinity as well as in coastal and marine waters.

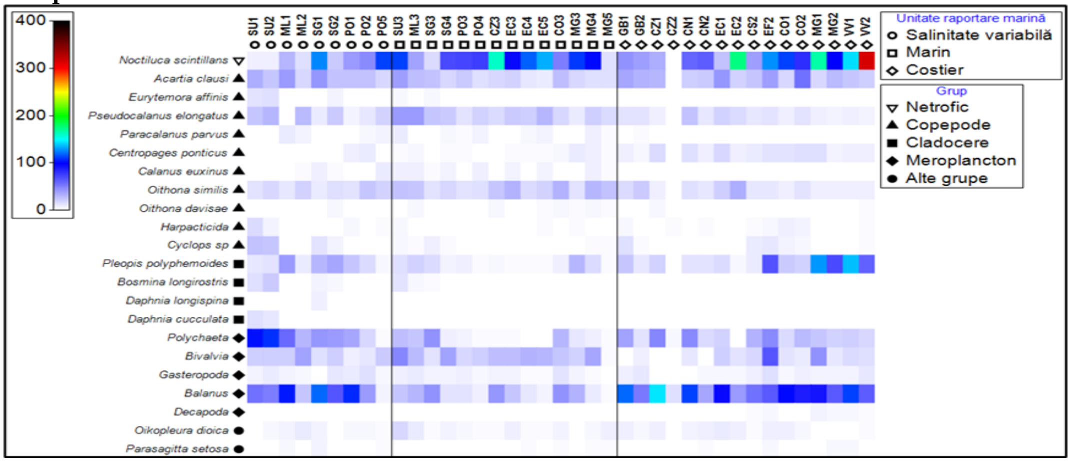
Figure II.69 Qualitative composition of mesozooplankton



Source: NMRDI

In terms of the quantitative structure of mesozooplankton during the warm season, the highest average densities were recorded for the species Noctiluca scintillans, a representative of the netrotrophic component, with the peak in coastal waters at station Vama Veche 2 (VV2). Among copepods, Acartia clausi recorded the highest average density values, with the peak development at station CO2 within coastal waters, followed by Pseudocalanus elongatus with the peak at station SU3 and Oithona similis with the highest density at station EC2. It is noteworthy that the copepod Eurytemora affinis, a freshwater and brackish species, was identified in samples from waters with variable salinity. The cladoceran Pleopis polyphemoides reached the highest average density values at stations MG1 and VV1 within coastal waters, while the species Bosmina longirostris, Daphnia longispina, and Daphnia cucculata showed low density values and were only present in waters with variable salinity, being exclusively freshwater species. Meroplanktonic elements were better represented at stations in waters with variable salinity and coastal waters, while marine waters recorded lower average density values. Other groups (Oikopleura dioica and Parasagitta setosa) were quantitatively poorly represented.

Figure II.70 Mesozooplankton abundance matrix



Source: NMRDI

In terms of the contribution of taxa for each marine reporting unit based on the mean density values, it can be observed that within waters with variable salinity, *Balanus* contributed with 24.5%, followed by *Polychaeta* and the copepod *Acartia clausi*. In marine waters, *Noctiluca scintillans* recorded the highest contribution (42.06%), followed by *Bivalvia* and species from the copepod group (Table II.31).

In coastal waters, *Balanus* followed by *Noctiluca scintillans* showed the highest contribution (Table II.31).

Table II.31 Contribution of mesozooplanktonic taxa for each marine reporting unit

Waters with variable salinity					
Species/taxa	**Average density (ind/m^3)**	**Sim average**	**SIM/SD**	**Contrib %**	**Cum. %**
Balanus	65.15	14.98	2.27	24.5	24.5
Polychaeta	49.52	10.54	2.29	17.25	41.75
Acartia clausi	26.84	7.82	6	12.8	54,55
Noctiluca scintillans	35.3	6.18	1.39	10.1	64,65
Pleopis polyphemoides	20.55	4.93	2.37	8.06	72.71
Marine waters					
Noctiluca scintillans	87.62	27.7	1.89	42.06	42.06
Bivalvia	23.72	7.44	2.22	11.3	53.35
Oithona similis	18.99	6.92	2.86	10.5	63.86
Pseudocalanus elongatus	18.83	6.89	3.21	10.46	74.32
Coastal waters					
Balanus	77.53	17.77	2.37	31.2	31.2
Noctiluca scintillans	93.97	14.98	1.56	26.3	57.5
Acartia clausi	24.98	5.7	1.83	10	67.49
Polychaeta	22.58	4.45	1.49	7.81	75.31

Source: NMRDI

The quantitative structure of the mesozooplankton community was characterized by the trophic component in waters with variable salinity, where it contributed 80.64%, and in coastal waters with 62.11% (Table II.31). In contrast to waters with variable salinity and coastal waters, in marine waters, the netrophic component of the zooplankton community was dominant, with a contribution of 54.07% (Table II.32).

Table II.32 Contribution of trophic and non-trophic mesozooplankton (ZPK) for each marine reporting unit

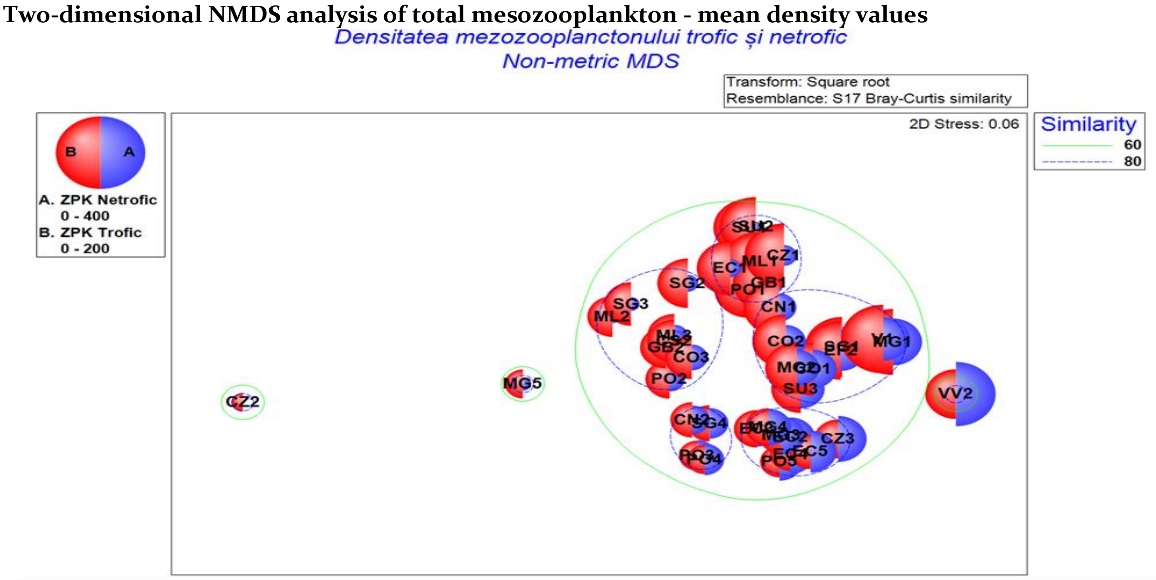
Waters with variable salinity					
Category	Average density (ind/m3)	Sim average	SIM/SD	Contrib%	Cum.%
Trophic ZPK	99.70	54,53	2.65	80.64	80.64

Marine waters					
Non trophic ZPK	82.31	39.00	1.99	54.07	54.07
Trophic ZPK	53.42	33.13	3.40	45.93	100.00
Coastal waters					
Non trophic ZPK	90.44	23.95	1.68	37.89	100.00
Trophic ZPK	103.72	39.26	2.42	62.11	62.11

Source: NMRDI

The two-dimensional NMDS analysis for the mean density values of netrophic and trophic zooplankton indicates similarities of 60% and 80% among the analyzed stations. Stations MG5 and CZ2 stand out, where the lowest density values for netrophic zooplankton were recorded, possibly due to the presence of diatom fragments identified in the collected samples from these stations. Station VV2, where netrophic zooplankton was dominant with very high density values (Figure II.71), did not cluster in similarity with the other stations.

Figure II.71 Two-dimensional NMDS analysis of total mesozooplankton - mean density values



Source: NMRDI

The trophic component of zooplankton was best represented by meroplankton and copepods in all three marine reporting units (Table II.32). In waters with variable salinity and in coastal waters, meroplankton was the main contributor to the trophic component of mesozooplankton, while marine waters were characterized by higher mean density values for copepods (Table II.33).

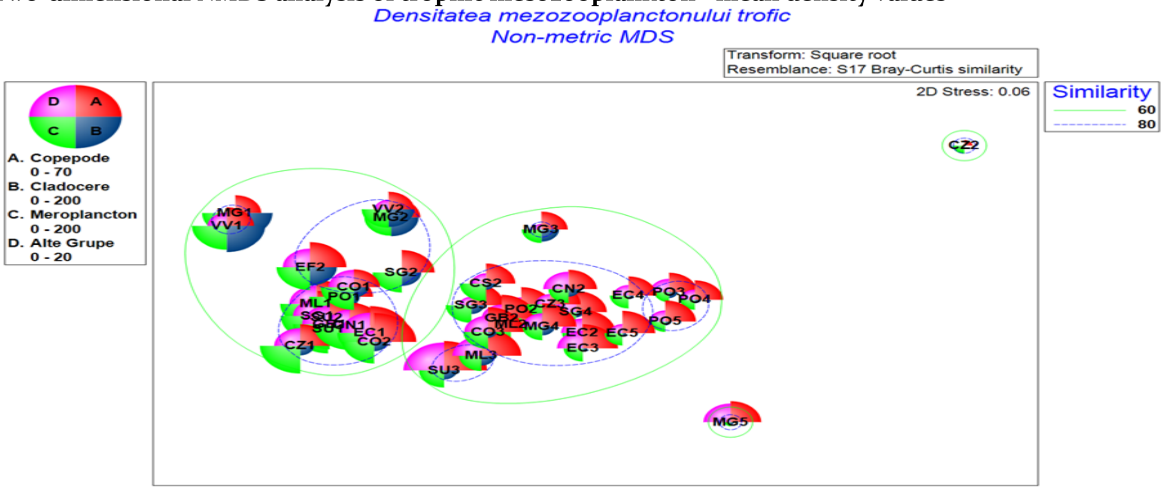
Table II.33 Contribution of trophic mesozooplankton for each marine reporting unit

Waters with variable salinity					
Group	Average density (ind/m3)	Sim average	SIM/SD	Contribute%	How.%
Merozooplankton	96.20	46.01	3.70	57.91	57.91
Copepods	38.73	21.50	4.96	27.06	84.97
Marine waters					
Copepods	34.89	36,46	4.44	49.14	49.14
Merozooplankton	35.71	30.57	2.53	41.20	90.34
Coastal waters					
Merozooplankton	84.01	37.86	2.87	59.77	59.77
Copepods	31,367	15.64	2.02	24.68	84.45

Source: NMRDI

A two-dimensional NMDS analysis of the mean density values for trophic zooplankton indicates 60% and 80% similarities between the analyzed stations. Stations CZ2 and MG5 stand out, where the lowest mean density values for the trophic component were recorded. Diatom fragments Proboscia alata and Pseudosolenia calcar-avis identified in the samples suggest a previous phytoplankton bloom, potentially influencing the reduction of trophic mesozooplankton (Figure II.72).

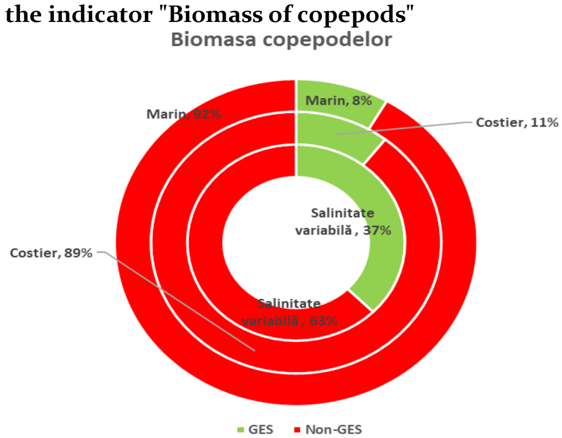
Figure II.72 Two-dimensional NMDS analysis of trophic mesozooplankton - mean density values



Source: NMRDI

In the case of the copepod biomass indicator, values exceeding the good ecological status threshold were not recorded. Poor ecological status was reached in 63% of waters with variable salinity, 89% in coastal waters, and 92% in marine waters did not achieve GES (Figure II.73).

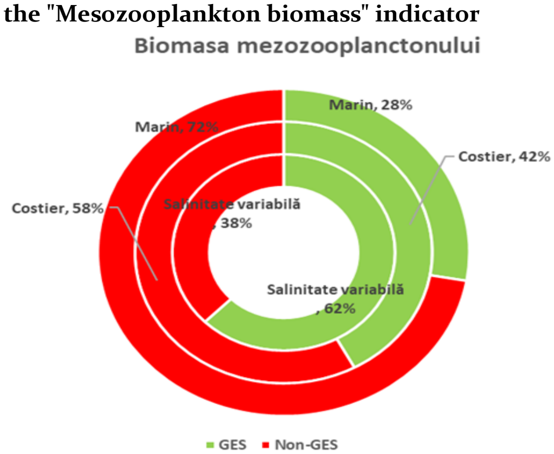
Figure II.73 Ecological status based on the indicator "Biomass of copepods"



Source: NMRDI

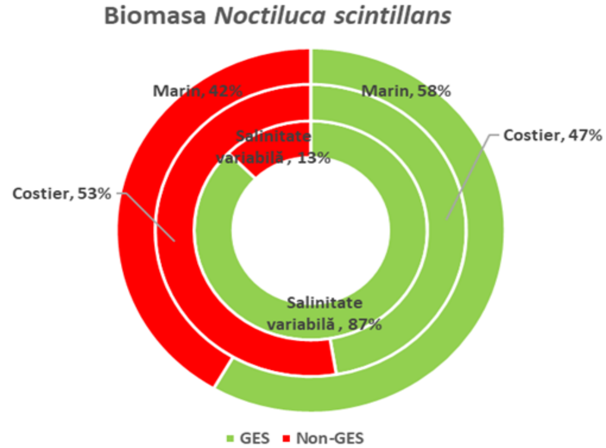
For the mesozooplankton biomass indicator, the good ecological status was achieved only in 62% of waters with variable salinity (Figure II.74). Poor ecological status was reached at a rate of 58% in coastal waters, and in marine waters, a percentage of 72% was reached, classifying the body of water in a poor ecological state (Figure II.74).

Figure II.74 Ecological status based on the "Mesozooplankton biomass" indicator



Source: NMRDI

Figure II.75 Ecological status based on the indicator "Biomass Noctiluca scintillans"



Source: NMRDI

Conclusions

In qualitative terms, the mesozooplankton in the year 2021 was represented by a total of 22 species, with copepods, meroplankton, and cladocerans being dominant in waters with variable salinity. Larvae of Balanus and Polychaeta had the highest contribution in terms of density of mesozooplankton taxa in waters with variable salinity, followed by the copepod *Acartia clausi*. In marine waters, *Noctiluca scintillans* had the highest contribution (42.06%), followed by veliger larvae of Bivalvia, while in coastal waters, Balanus followed by *Noctiluca scintillans* were the dominant taxa.

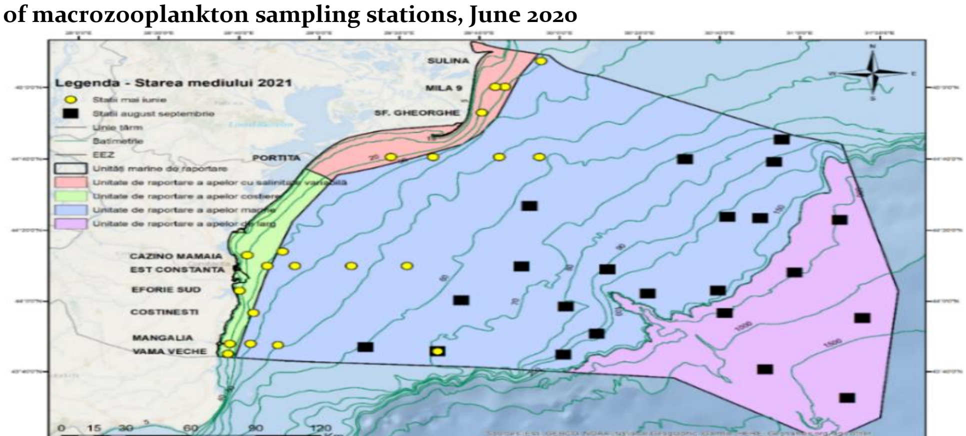
The mesozooplankton community was characterized by trophic dominance in waters with variable salinity and coastal waters, while in marine waters, the non-trophic component dominated with a contribution of 54.07%, with trophic contribution being 45.93%. The trophic zooplankton component was best represented by meroplankton and copepods in all three marine reporting units.

Analyzing the ecological status of water bodies, it was observed that during the warm season, for the copepod biomass indicator, good ecological status values were not achieved in any marine reporting unit. For the mesozooplankton biomass indicator, good ecological status values were achieved only in coastal waters, with waters with variable salinity and marine waters *not achieving good ecological status (GES)*. The biomass of *Noctiluca scintillans* achieved good ecological status in waters with variable salinity and marine waters, while coastal waters were characterized by a poor ecological status.

Macrozooplankton

In order to determine the state of the macrozooplankton populations, 2 expeditions were carried out in 2021. The first expedition was carried out with the ship "Steaua de mare 1" between May and June. The maximum depth of the sampling areas on the Romanian continental platform of the Black Sea was up to the bathymetric line of 60 m. The second expedition was carried out during August - September with the ship "Mare Nigrum", having a distribution area of more extensive stations, up to the line.

Figure II.76 Network of macrozooplankton sampling stations, June 2020



Source: NMRDI

Figure II.77 Hansen net for macrozooplankton sampling

Source: NMRDI

The density and wet biomass of gelatinous organisms was expressed in ind/m³ and g/m³ respectively. The calculation of these parameters was carried out in accordance with the recommendations of the Guide for monitoring macrozooplankton (or gelatinous plankton) (Shiganova et al., 2015) (table II.34).

Table II.34 Formulas used to calculate the wet weight of organisms (Shiganova et al., 2015)

Species	GU (mg)	References
Aurelia aurita	GU =0.053 D 2.98	-
Pleurobrachia pileuscot	GU =0.682 L 2.52	Happy, 1994; Anninsky, 1994
Mnemiopsis leidyi	GU (L<45mm) (total length) = 3.100·L ^2.22 GU (L≥45mm) (total length) = 3,800·L^2,22	Vinogradov et al., 2000
Beroe ovata	GU =0.85 L 2.47	Finenko et al., 2003; Anninsky et al., 2005

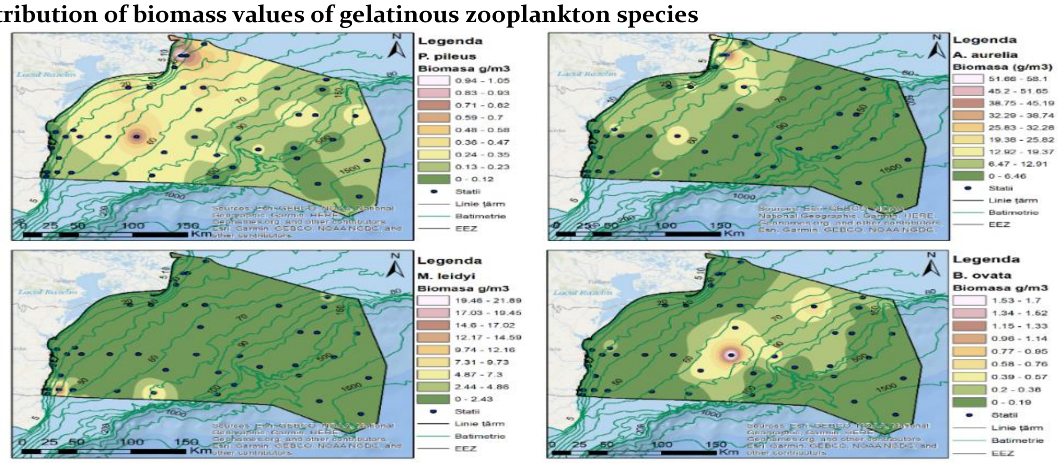
Source: NMRDI

**GU - wet weight*

In **marine** waters, the species *Aurelia aurita* reaching the maximum biomass value of 4.55 g/m³, the species *Mnemiopsis leidyi* registering the biomass value of 1.46 g/m³, followed by *Beroe ovata* with 0.31 g/m³, and the lowest value being recorded by *Pleurobrachia pileus* 0.25 g/m³ (figure II.78, table II.34, figure II.79).

In **offshore waters**, the *Aurelia aurita* species reaching the maximum biomass value of 0.82 g/m³, the *Pleurobrachia pileus* species recording the biomass value of 0.11 g/m³, followed by *Beroe ovata* with 0.09 g/m³, and the most low value being recorded by *Mnemiopsis leidyi* 0.02 g/m³ (figure II.78, table II.35, figure II.79).

Figure II.78 Distribution of biomass values of gelatinous zooplankton species



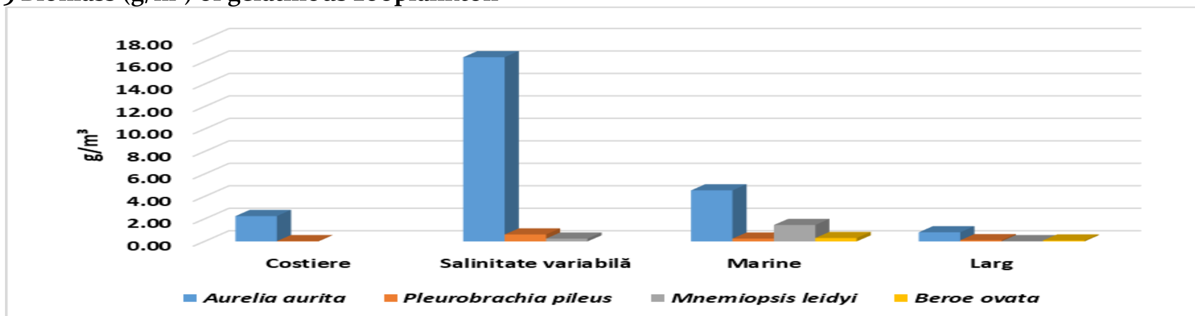
Source: NMRDI

Table II.35 Average biomass (g/m3) of gelatinous zooplankton in the analyzed areas

Water reporting unit	Coastal waters	Waters with variable salinity	Marine waters	Deep waters
Aurelia aurita	2.26	16.40	4.55	0.82
Pleurobrachia pileus	0.03	0.62	0.25	0.11
Mnemiopsis leidyi	0.00	0.26	1.46	0.02
Beroe ovata	0.00	0.00	0.31	0.09

Source: NMRDI

Figure II.79 Biomass (g/m3) of gelatinous zooplankton



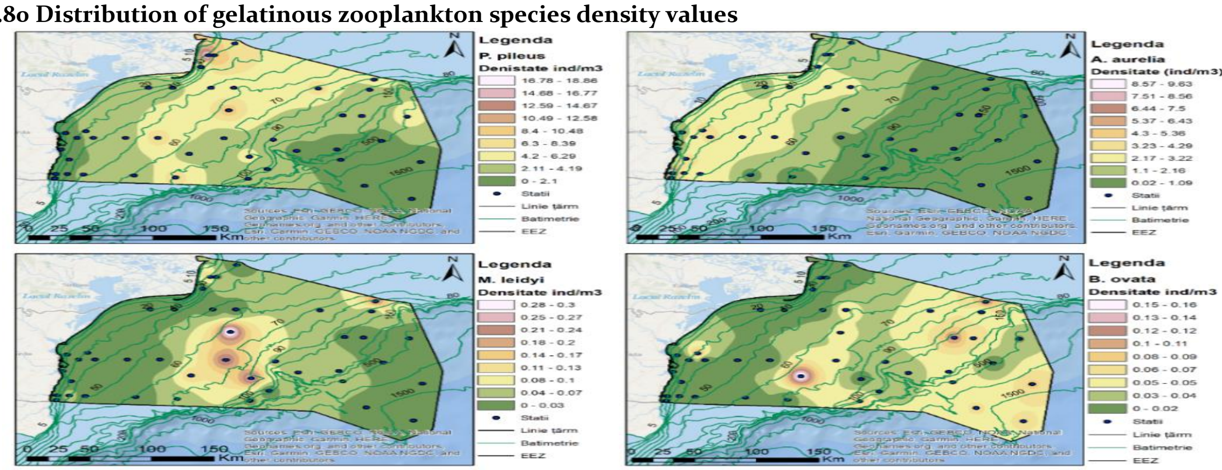
Source: NMRDI

In **waters with variable salinity**, the species *Pleurobrachia pileus* reached the maximum density of 8.28 ind/m³, with a lower density observed for the species *Aurelia aurita* at 1.98 ind/m³, followed by the species *Mnemiopsis leidyi* with a density value of 0.04 ind/m³. The species *Beroe ovata* was not identified in the analyzed samples (Figure II.80, Table II.36, Figure II.81).

In **marine waters**, the species *Pleurobrachia pileus* reached the maximum density of 3.77 ind/m³, followed by the species *Aurelia aurita* with a density value of 1.46 ind/m³. The species *Mnemiopsis leidyi* was identified at 0.06 ind/m³, and *Beroe ovata* at 0.04 ind/m³, both having low density values.

In **offshore waters**, the species *Pleurobrachia pileus* reached the maximum density of 1.54 ind/m³, followed by the species *Aurelia aurita* with a density value of 0.06 ind/m³. The species *Beroe ovata* was identified at 0.04 ind/m³, and *Mnemiopsis leidyi* at 0.01 ind/m³.

Figure II.80 Distribution of gelatinous zooplankton species density values



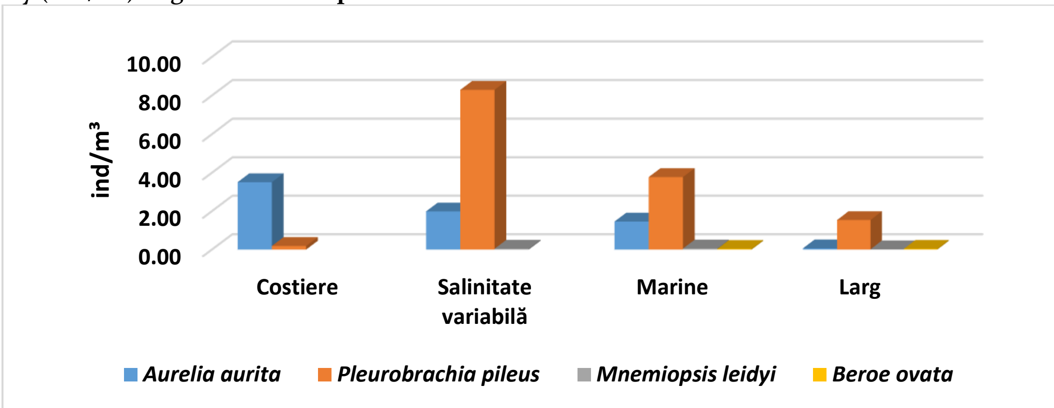
Source: NMRDI

Table II.36 Average density (ind/m3) of gelatinous zooplankton

Water reporting unit	Coastal waters	Waters with variable salinity	Marine waters	Offshore waters
Aurelia aurita	3.51	1.98	1.46	0.06
Pleurobrachia pileus	0.19	8.29	3.77	1.54
Mnemiopsis leidyi	0.00	0.04	0.06	0.01
Beroe ovata	0.00	0.00	0.04	0.04

Source: NMRDI

Figure II.81 Density (ind/m3) of gelatinous zooplankton



Source: NMRDI

In terms of species distribution, distribution maps were created (using ArcGIS software). Data analysis revealed that the species *Pleurobrachia pileus* had a significant presence in waters with variable salinity, coastal waters, and marine waters, with low values of biomass and density in offshore waters. The highest abundance of the species was observed in the area with variable salinity, at the mouths of the Danube, where the input of freshwater and nutrients is higher compared to the other analyzed areas. Additionally, the depths are shallower, and the food supply is greater (Figure II.93, Figure II.95).

Conclusions

In the year 2021, four jellyfish species were identified in the zooplankton samples: the scyphozoan *Aurelia aurita*, and the ctenophores *Pleurobrachia pileus, Mnemiopsis leidyi*, and *Beroe ovata*.
In all analyzed samples, the species *Aurelia aurita* was dominant in terms of biomass due to its large size, with distribution concentrated in the southern and central parts of the Romanian continental shelf in the Black Sea.
The spatial distribution of the density of *Pleurobrachia pileus* showed high values, being dominant along the Romanian continental shelf in the Black Sea, with the highest values identified in the north and between the isobaths of 40-80 m.
The ctenophore *Mnemiopsis leidyi* was more prevalent in the southern and central areas of the Romanian continental shelf in the Black Sea, between the isobaths of 60-100 m, and in the rest of the analyzed areas, it was identified in small quantities or was even absent.
During August to September, in terms of density, the ctenophore Beroe ovata had a widespread distribution, ranging from the isobath of 60 m to a depth of 1580 m.

Ichthioplankton

Ichthyoplankton is an important component in assessing fish stocks, as the abundance of eggs and larvae of various species has proven to be a suitable indicator for characterizing the population size of adult breeders. Additionally, ichthyoplankton samples can highlight preferences for specific breeding areas of commercial species.
During the period of June to September 2021, ichthyoplankton samples were collected at sea using a Bongo net during marine expeditions. The species were determined using the identification key by Dekhnik, 1973, and the FAO guide by Rodriguez et al., 2017.
Laboratory analysis of the samples revealed the presence of eggs and larvae belonging to a total of 7 species (sprat, anchovy, cod, small dragonet, horse mackerel, red mullet, and mullet) (Table II.37). The predominant species was anchovy.

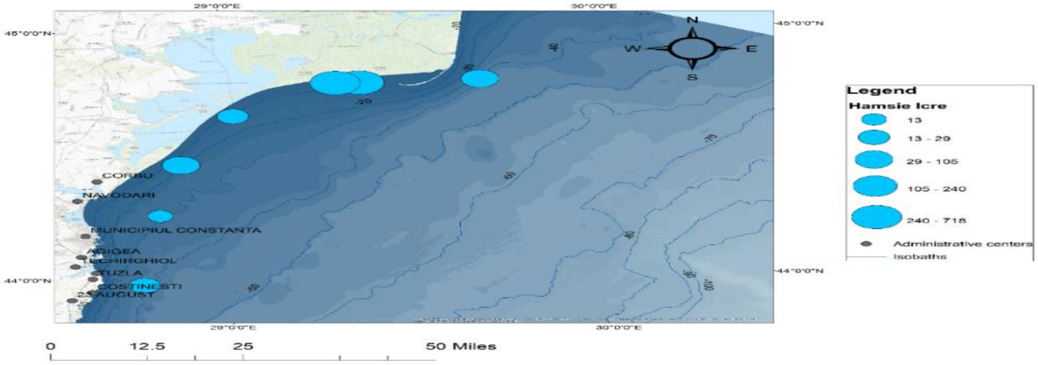
Table II.37 Taxonomic classification of the species identified in the ichthyoplankton samples

Order	Famuly	Species	Popular name
Clupeiformes	Clupeidae	*Sprattus sprattus*	sprat
	Engraulidae	*Engraulis encrasicolus*	anchovy
Gadiformes	Gadidae	*Merlangius merlangus*	cod
Perciformes	Callionymidae	*Callionymus pusillus*	dragonet
	Carangidae	*Trachurus mediterraneus*	mackerel
	Gobiidae	*Neogobius melanostomus*	garfish
	Mullidae	*Mullus barbatus*	mullet
Mugiliformes	Mugilidae	*Chelon auratus*	sea bream

Source: NMRDI

In the samples taken in May, anchovy eggs predominated with an average number of 42.31 ex./m² and the estimated relative abundance of $281.32 \cdot 10^9$ specimens.
Regarding the distribution of anchovy eggs, in the northern area of the Romanian coast (figure II.82), the relative abundance had a high value, being estimated at $392.37 \cdot 10^9$ specimens. In the samples taken in June 2021, anchovy spawn and larvae also predominated with an average number of 227.5 ex./m².

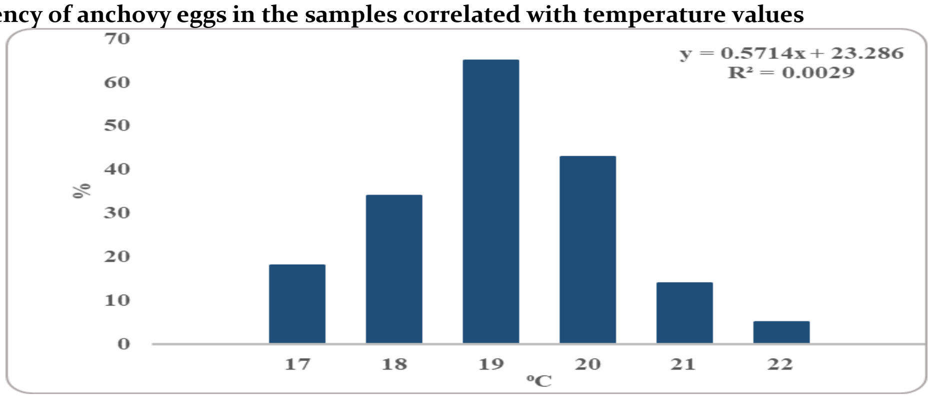
Figure II.82 Distribution of anchovy eggs (average number of specimens/m²) in the analyzed area



Source: NMRDI

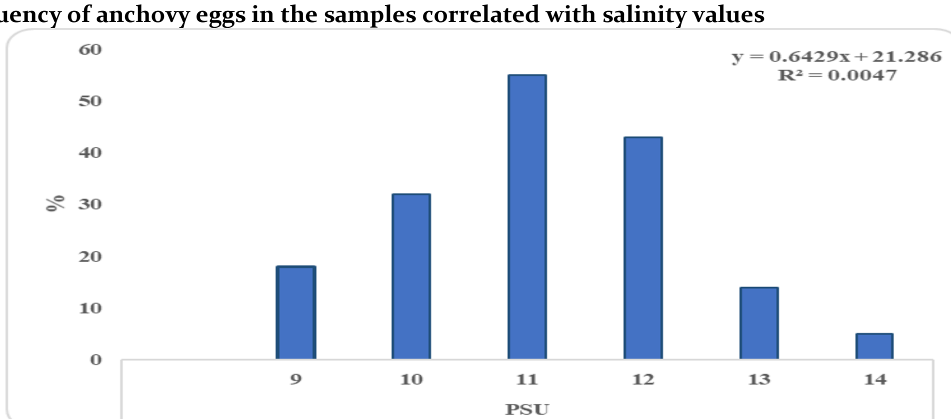
Analyzing the temperature and salinity data from the studied area, it was observed that the frequency of anchovy eggs and larvae in the samples differs depending on the level of temperature and salinity (figure II.83 and figure II.84).

Figure II.83 The frequency of anchovy eggs in the samples correlated with temperature values



Source: NMRDI

Figure II.84 The frequency of anchovy eggs in the samples correlated with salinity values



Source: NMRDI

Thus, it can be observed that anchovy prefers a water temperature for egg deposition ranging from 18-20°C and a salinity value of 10-12 PSU.

Conclusions based on the analysis of ichthyoplankton samples taken between May and September 2021:

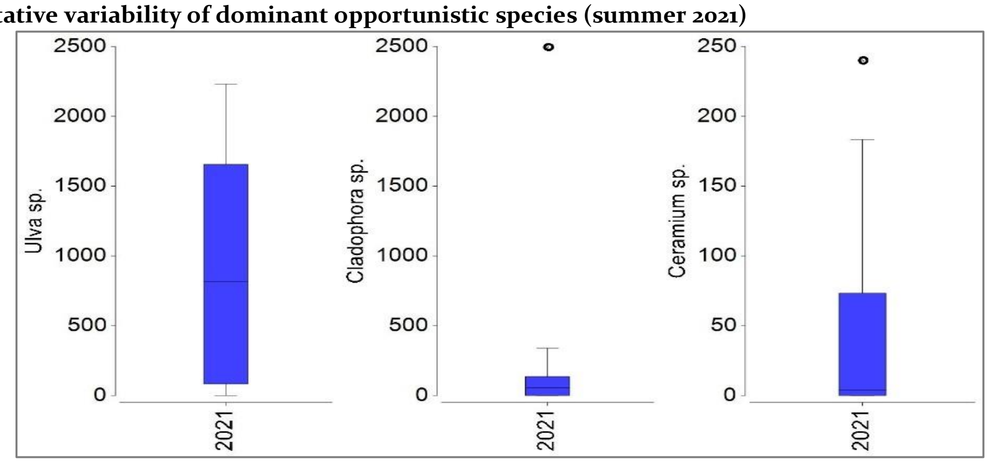
- anchovy eggs were dominant, the relative abundance being estimated at $281.32 \cdot 10^9$ specimens in the samples from May;
- a preference of the species for the central and northern area of the Romanian coastal waters of the Black Sea was highlighted;
- the anchovy reproduction process is influenced by environmental factors; anchovy prefers, for egg deposition, a water temperature between 18-20 °C and a salinity value of 10-12 PSU;
- the qualitative structure of ichthyoplankton during May-September 2021 included, in addition to anchovy eggs and larvae, other species such as sprat, mullet, mackerel, sea bream, cod, dragonet, and garfish.

Ichthyoplankton, as one of the components of the pelagic food web (Raymont, 1983), can represent an important link between smaller planktonic organisms and nektonic organisms. Additionally, the survival of fish larvae can directly influence the future abundance of adult fish stocks. The latter has been and remains the most important reason for studying ichthyoplankton, as most processes determining recruitment and spatial distribution of fish populations occur during the planktonic stage, resulting in significant interannual fluctuations in fish stock biomasses.

Phytobenthos

In the warm season of 2021, benthic phytoplankton communities were qualitatively and quantitatively analyzed based on 71 samples collected from the sublittoral zone (coastal area from Năvodari to Vama Veche, depths ranging from 0 to 8 meters). Priority habitats were analyzed, including the Infralittoral Rock and Biogenic Reef and Infralittoral Sands, along with their respective subtypes: Upper infralittoral rock dominated by green and red algae with a short developmental cycle, Upper infralittoral rock dominated by *Cystoseira barbata*, Upper infralittoral rock dominated by *Coccotylus brodiei*, and Meadows with *Zostera noltei*. While the Upper infralittoral rock dominated by green and red algae with a short developmental cycle is a common habitat found along the entire coastal zone, the other three subtypes have a punctiform distribution, limited in area, and hold significant ecological value. The habitat of Upper infralittoral rock with C. barbata is found in the southern part of the coast, in the Jupiter – Mangalia – 2 Mai – Vama Veche area, the Upper infralittoral rock with *C. brodiei* is present only in the Northern Constanta area, and the meadows with *Z. noltei* are only found in Năvodari and the Mangalia - 2 Mai area.
In the Upper infralittoral rock dominated by green and red algae with a short developmental cycle, the dominance of the photophilic association *Ulva – Cladophora – Ceramium* was maintained (a characteristic of the summer season), consisting exclusively of opportunistic species that generate algal deposits. In the summer of 2021, green algae from the genera *Ulva* and *Cladophora* exhibited more abundant growth compared to red algae. The wet biomasses of these algae exceeded 2,000 g/m² in certain locations (e.g., *Ulva ssp*. – 2,300 g/m² at 2 Mai; *Cladophora ssp*. – 2,500 g/m² at Mangalia – *an extreme value*).

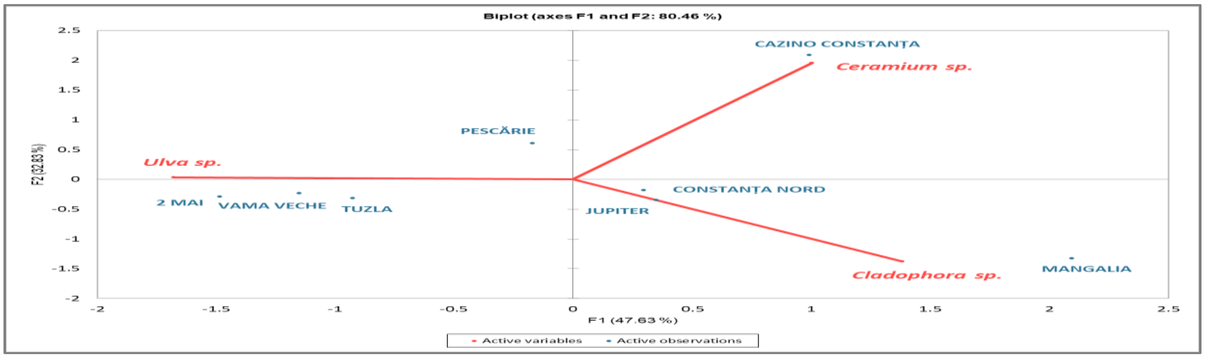
Figure II.85 Quantitative variability of dominant opportunistic species (summer 2021)



Source: NMRDI

The Principal Component Analysis (PCA) indicates that *Ulva ssp*. (especially U. *rigida and U. intestinalis*) predominantly developed in the southern zone of the coastline, specifically along the Tuzla – Vama Veche coastal strip. In comparison, during the summer of 2021, Ulva species showed slightly higher values of fresh biomass compared to the same period in the previous year. Regarding *Cladophora* species, lower values of fresh biomass were recorded in 2021 compared to 2020. Among the red algae, *Ceramium* ssp. (especially C. *virgatum*) was notable, with no abundant growth in 2021, except for an extreme value at Cazino Constanța (240 g/m²).

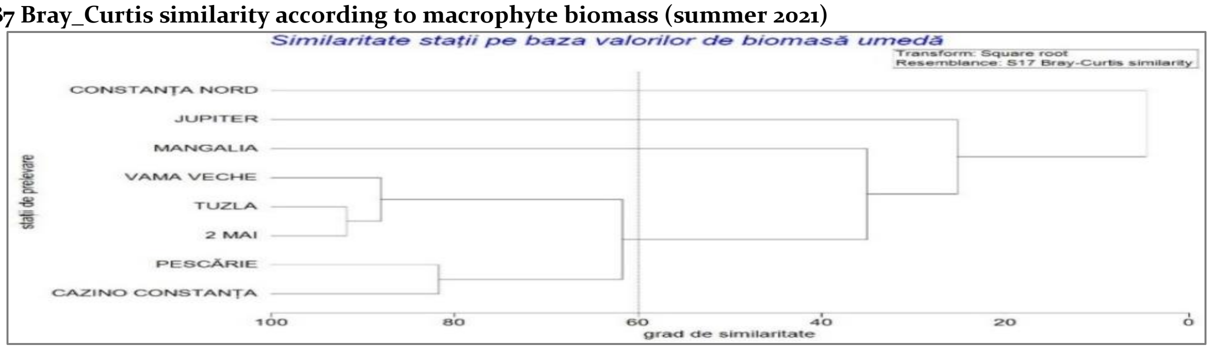
Figure II.86 PCA (Principal Component Analysis) based on the quantitative distribution of dominant opportunistic species (summer 2021)



Source: NMRDI

Regarding the level of similarity between stations based on the dominant algal association type and biomass values, a high similarity was observed between the Pescărie - Cazino Constanța stations and between Tuzla – 2 Mai – Vama Veche stations. This was due to the dominance of the photophilic association characteristic of the summer season, Ulva - Cladophora – Ceramium, and the uniformity of algal structure in these areas (Figure II.87).

Figure II.87 Bray_Curtis similarity according to macrophyte biomass (summer 2021)

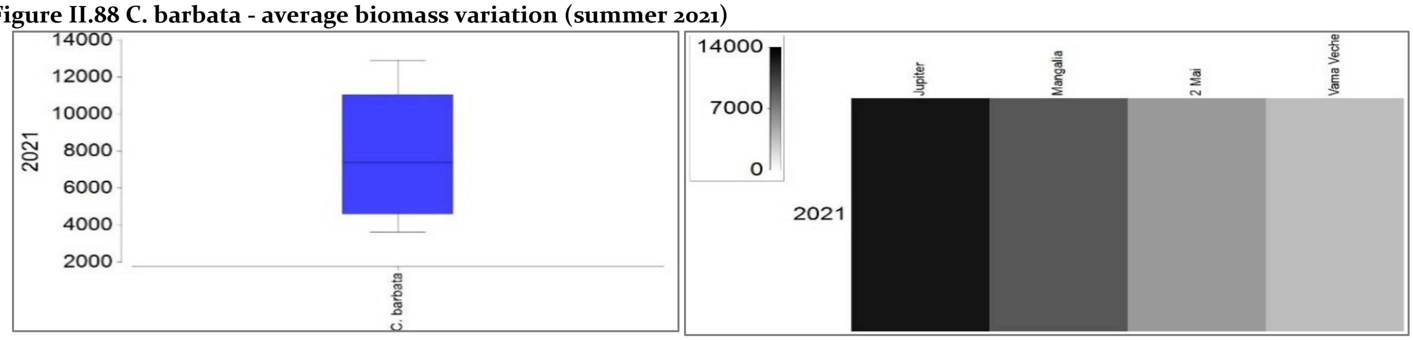


Source: NMRDI

Habitat-forming species such as Cystoseira barbata, Cystoseira brodiei, and Zostera noltei have shown a favorable trend in recent years along the Romanian coast of the Black Sea, both qualitatively and quantitatively. However, it is necessary to consider that the special habitats generated by these species, namely Upper infralittoral rock dominated by C. barbata, Upper infralittoral rock dominated by C. brodiei, and Meadows with Z. noltei, have a punctiform distribution and very limited distribution areas of the key species, drawing attention to the ecological value of these areas.

The brown alga C. barbata varied in 2021, ranging from a minimum of 3,600 g/m² recorded in Vama Veche to a maximum of 13,000 g/m2 in the Jupiter area (Figure II.88). The red alga C. brodiei was reported in the Constanta area, at depths between 6 – 8 meters, with a quantitative variability between 450 – 1,000 g/m².

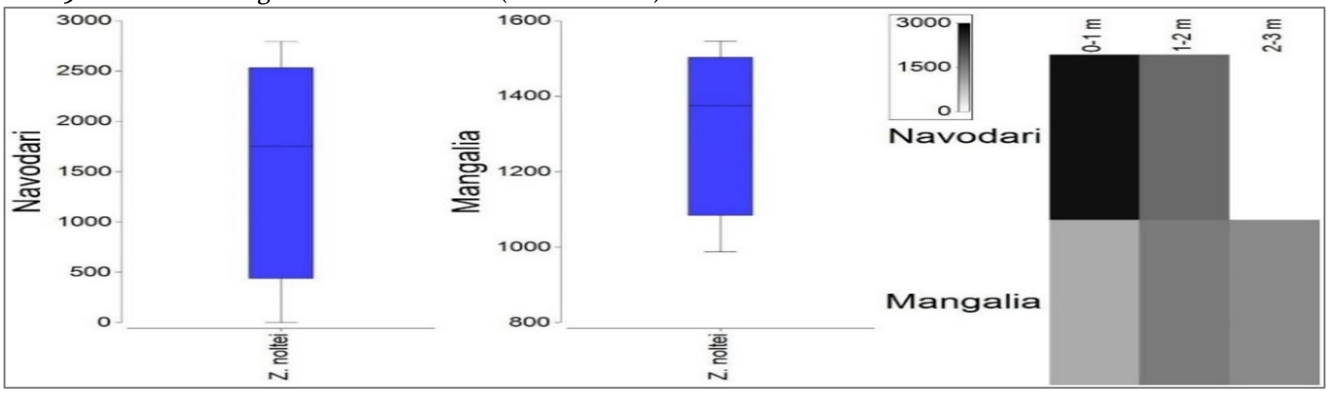
Figure II.88 C. barbata - average biomass variation (summer 2021)



Source: NMRDI

The monospecific meadows of *Zostera noltei* in Mangalia maintained their distribution range between 1 and 3 meters depth. Z. noltei was also reported in Năvodari, at depths between 1 – 2 meters, in association with *Zannichellia palustris*. The key species *Z. noltei* was observed during the reproductive period, with numerous seeds in the specimens. In Mangalia, the wet biomass of *Zostera* varied from a minimum of 1,000 g/m² (recorded at 1 meter depth) to a maximum of 1,600 g/m² (towards 3 meters depth). In Năvodari, the quantitative variation ranged between 1,700 g/m² (recorded at 2 meters depth) and 2,800 g/m² (towards the 1-meter horizon).

Figure II.89 Z. noltei - average biomass variation (summer 2021)



Source: NMRDI

Analyzing the ecological status of coastal habitats through benthic phytoplankton communities, it was observed that the good ecological status was not achieved for the hard substrate habitat Upper infralittoral rock dominated by green and red algae with a short developmental cycle. The special habitats determined by key ecologically important host benthic species, *C. barbata, C. brodiei, and Z. noltei*, were found to be in good ecological status in 2021 (Table II.38).

Table II.38 Ecological status of special habitats (2021)

Water body	Habitat	Realized value 2021	Target value good ecological status	Ecological status 2021
BLK_RO_RG_CT Coastal waters	Upper infralittoral rock dominated by green and red algae with a short developmental cycle	4,54	EI ≥ 6	poor ecological status
	Upper infralittoral rock dominated by *Cystoseira barbata*	7,61		good ecological status
	Upper infralittoral rock dominated by *Coccotylus brodiei*	9,97		good ecological status
	Meadows with *Zostera noltei*	7,64		good ecological status

Source: NMRDI

Conclusions

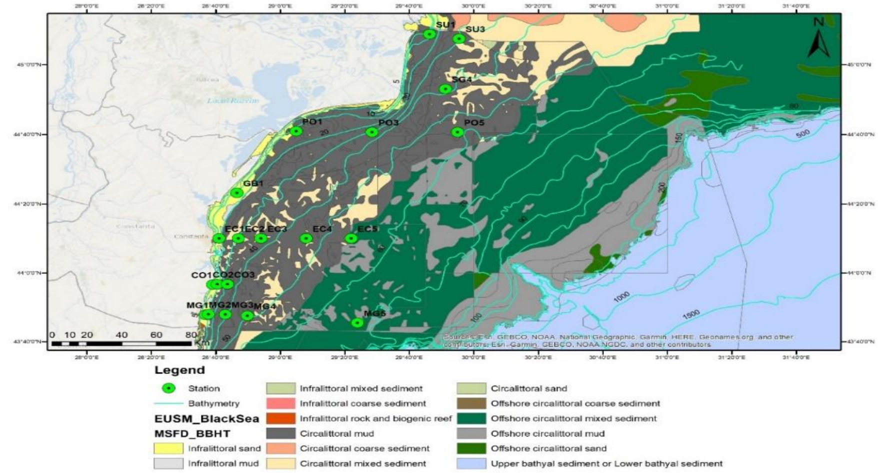
During the summer season of 2021, it was noted that within the habitat of Upper infralittoral rock dominated by green and red algae with a short developmental cycle, there was a dominance of the photophilic association *Ulva – Cladophora – Ceramium*, consisting exclusively of opportunistic species that generate algal deposits. Green algae from the *Ulva and Cladophora* genera exhibited more abundant growth compared to red algae during the summer season of 2021. Concerning green algae, *Ulva* species showed slightly higher values of fresh biomass in 2021 compared to 2020, while for *Cladophora* species, lower values of fresh biomass were recorded in 2021 compared to 2020. The habitat-forming species *C. barbata, C. brodiei, and Z. noltei* have shown a favorable trend in the past two years along the Romanian coast of the Black Sea, both qualitatively and quantitatively.

Zoobenthos

In 2021, the macrozoobenthos was monitored on the entire continental platform near the Romanian shore. 20 stations were established where 60 samples were taken. Stations were distributed across the major types of sedimentary habitats as well as across all three marine reporting units (variable salinity waters, coastal waters and marine waters).

For the M-AMBI*(n) results, the ecological quality ratio (EQR) was calculated. Thus, EQR=0.68 was established as a Good/Moderate limit for DCA, and is used as a threshold value for Good Ecological Status (GES), within the DCSMM.

Figure II.90 Map of sampling stations superimposed on the main habitat types according to DCSMM

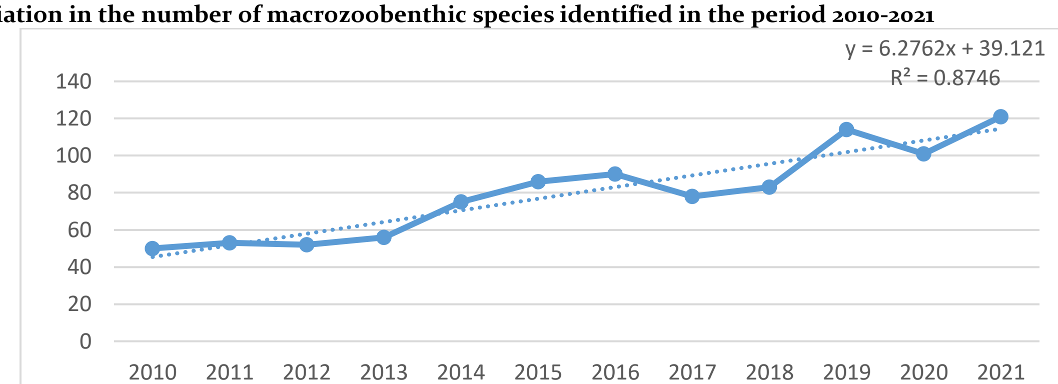


Source: NMRDI

Following the processing of the samples, 121 animal species were identified. From the analysis of the variation in the number of species during the period 2010-2021, a positive trend is observed (R2 =0.87). Four groups of benthic invertebrates dominated in terms of the number of species: Polychaeta – 42 species; Malacostraca –27 species; Bivalvia – 15 species and Gastropoda – 11 species.The largest number of species (100 species) was identified in the samples taken at depths between 20 and 54 m, in the circumlittoral zone on mixed sediments and mud. In the infralittoral, at depths below 20 m, 61 species were identified and in the deep circumlittoral zone (over 54 m), 38 species. By habitat types, the diversity was distributed as follows:

- 25 species on infralittoral mudflats;
- 54 species on the infralittoral sands;
- 89 species on circumlittoral mudflats;
- 70 species on mixed circumlittoral sediments;
- 38 species on mixed sediments in the deep circumlittoral zone.

Figure II.91 Variation in the number of macrozoobenthic species identified in the period 2010-2021

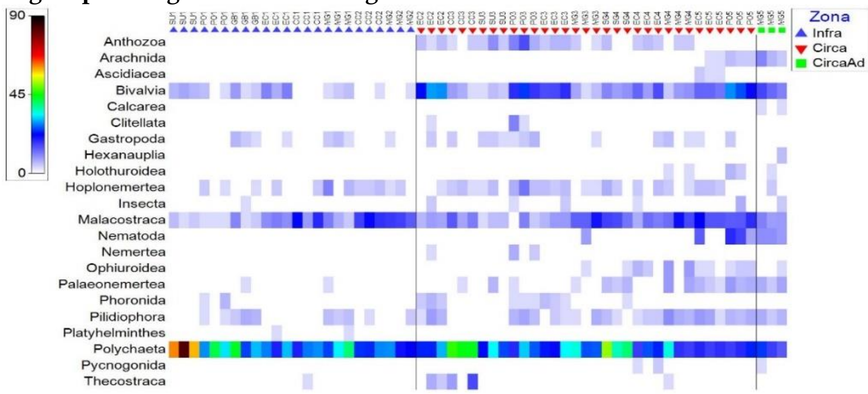


Source: NMRDI

Regardless of depth, three major groups of macrozoobenthic organisms dominated numerically: Polychaeta, Malacostraca, and Bivalvia (Figure II.92). The highest abundances were recorded for polychaete worms, which had maximum values, especially in the northern extremity of the infralittoral zone where muddy sediment (SU1) prevails. Additionally, the macrozoobenthic fauna was more diverse and abundant in the circalittoral zone.

In the infralittoral zone, up to the isobath of approximately 20 m, two types of habitats are present: **infralittoral mud and infralittoral sand. In the infralittoral mud zone**, the average density was 3008 ind/m², and the average biomass was 105.820 g/m². Similar to 2020, the highest density was recorded for two species of polychaetes: *Alitta succinea* (837 ind/m²) and *Heteromastus filiformis* (733 ind/m²). Biomass was dominated by the alien bivalve *Anadara kagoshimensis* (79.776 g/m²) and the decapod crustacean thalassinid *Upogebia pusilla* (21.560 g/m²). The community in the infralittoral sand zone had an average density of 1099 ind/m² and an average biomass of 61.805 g/m². Compared to 2020, in 2021, the density was no longer dominated by the two bivalve species *Lentidium mediterraneum* and *Chamelea gallina*; however, *Micronephthys longicornis* (258 ind/m²) continued to dominate, followed by another polychaete species, *Heteromastus filiformis* (213 ind/m²). Regarding biomass, larger species such as *Upogebia pusilla* (26.954 g/m²) and *Chamelea gallina* (17.189 g/m²) remained dominant.

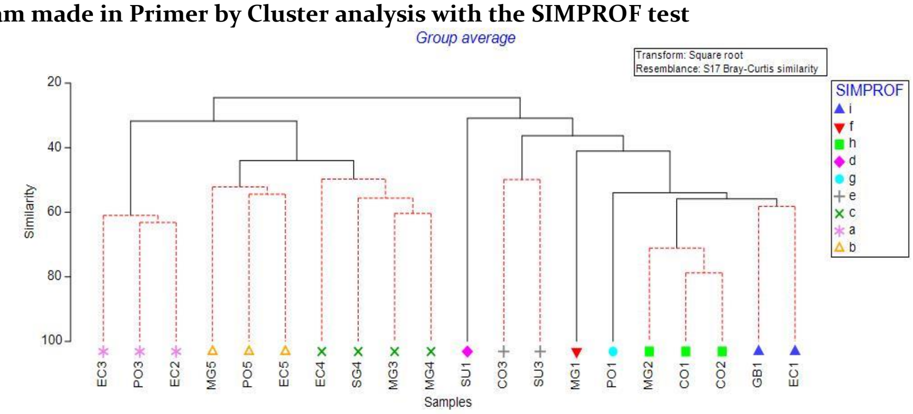
Figure II.92 Distribution of groups of organisms according to abundance



Source: NMRDI

The dendrogram generated by cluster analysis provides a complex view of the relationship between the 20 stations. Applying the SIMPROF test resulted in six main groups that can be interpreted as distinct communities.

Figure II.93 Dendrogram made in Primer by Cluster analysis with the SIMPROF test



Source: NMRDI

To identify taxa with the highest contribution, each SIMPROF group was investigated using SIMPER analysis. The ecological status of benthic invertebrate communities was assessed based on the M-AMBI*(n) index for each station. The results obtained from calculating the M-AMBI*(n) index showed that 19 out of the 20 stations are in good ecological status.
Thus, the communities from the infralittoral sandy habitat have achieved a good ecological status, while those from the infralittoral mud habitat have not achieved a good ecological status. The zoobenthic communities from the circalittoral and deep circalittoral habitats were in good ecological status.

Conclusions

Following the assessment of the macrozoobenthic communities in 2021, based on 60 samples, the following conclusions resulted:

- Samples were taken and analyzed from five types of sedimentary habitats, according to the DCSMM.
- 121 species were identified. The specific diversity recorded in 2021 was higher compared to 2020 when 101 species were recorded. The trend in the period 2010-2021 was positive.
- The greatest abundance and diversity was recorded in the circumlittoral zone.
- The studied habitats were dominated by diverse communities consisting mainly of polychaetes, bivalves and crustaceans.
- The ecological status of the macrozoobenthos was evaluated by applying the M-AMBI*(n) index. With the exception of the zoobenthic communities on the mud habitat in the infralittoral zone, the other communities were in good ecological condition.

Living marine resources

Marine biodiversity provides a multitude of valuable ecosystem goods and services and is appreciated for its direct utility to humans. However, marine ecosystems are subject to a variety of anthropogenic threats: pollution, climate change, overexploitation, and invasive species.

The primary objective in fisheries management is to maintain species diversity within the marine ecosystem. Thus, studying the composition of ichthyofauna is crucial. In recent years, an increase in the number of identified species has been observed along the Romanian coast of the Black Sea.

Table II.39 Ecological indicators regarding the composition of ichthyofauna, period 2017-2021

	2017	2018	2019	2020	2021
The wealth of species	36	43	44	46	48
Dominant species	9	7	7	6	7
Constant species	10	8	8	6	7
Accessory species	13	21	21	24	22
Rare species	4	7	8	10	12

Source: NMRDI

Using tools and sampling techniques as diverse as possible, the species composition within the organized expeditions was diverse.

Figure II.94 Species captured during the expeditions organized in 2021 (original photos RMV, NMRDI)

Source: NMRDI

Thus, in 2021, 48 fish species were identified within the ichthyofauna (table II.40).

Table II.40 Systematic distribution of ichthyofauna species, 2017-2021

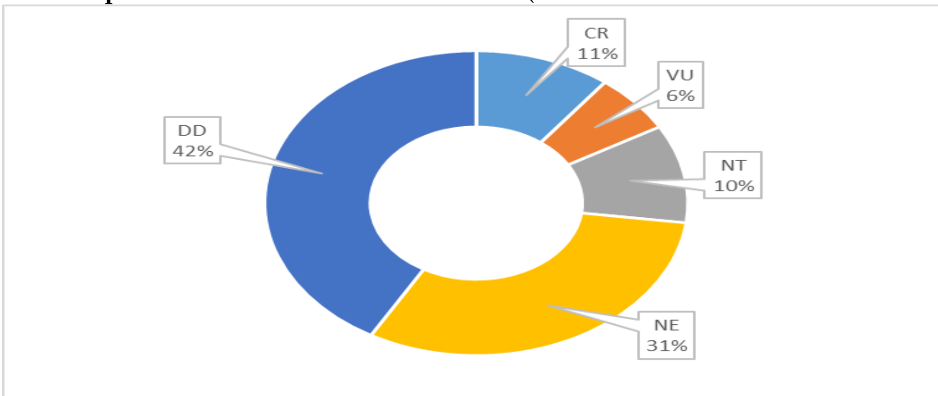
Family	Species	Popular name
Acipenseridae	*Acipenser gueldenstaedti*	garfish
	Acipenser stellatus	garfish
	Huso huso	wels catfish
Atherinidae	*Atherina hepsetus*	big-scale sand smelt
Belonidae	*Belone belone euxini*	garfish
Blenniidae	*Coryphoblennius galerita*	sea robin
Callionymidae	*Callionymus pusillus*	shore crab
Carangidae	*Trachurus mediterraneus ponticus*	horse mackerel
Centracanthidae	*Spicara smaris*	anchovy
Clupeidae	*Sprattus sprattus*	Danube herring
	Alosa immaculata	bleak

	Alosa tanaica	black-sea sprat
	Clupeonella cultriventris	bleak
Engraulidae	*Engraulis encrasicolus*	anchovy
Salmoniidae	*Salmo trutta labrax*	sea trout
Anguillidae	*Anguilla anguilla*	eel
Gadidae	*Merlangius merlangus euxinus*	cod
	Gaidropsarus mediterraneus	jellyfish
Gasterosteidae	*Gasterosteus aculeatus*	pipefish
Gobiidae	*Neogobius melanostomus*	mullet
	Mesogobius batrachocephalus	gudgeon
	Gobius niger	topknot
	Pomatoschistus microps leopardinus	black goby
Labridae	*Ctenolabrus rupestris*	sand goby
Moronidae	*Dicentrarchus labrax*	flounder
Mugilidae	*Mugil cephalus*	red mullet
	Liza aurata	sea bass
Mullidae	*Mullus barbatus*	scorpion fish
Ophididae	*Ophidion rochei*	greater weever
Pleuronectidae	*Platichthys flesus*	sole
Pomatomidae	*Pomatomus saltatrix*	gilthead seabream
Rajidae	*Raja clavata*	shark
	Dasyatis pastinaca	sea needle
Sciaenidae	*Umbrina cirrosa*	sea needle
	Sciaena umbra	dragonet
Scombridae	*Sarda sarda*	sea swallow
Scophthalmidae	*Psetta maxima*	sea bull
Scorpaenidae	*Scorpaena porcus*	garfish
Serranidae	*Serranus cabrilla*	garfish
Soleidae	*Pegusa nasuta*	wels catfish
Sparidae	*Boops boops*	big-scale sand smelt
Squalidae	*Squalus acanthias*	garfish
Syngnathinae	*Syngnathus variegatus*	sea robin
	Syngnathus typhle	shore crab
	Hippocampus guttulatus	horse mackerel
Trachinidae	*Trachinus draco*	anchovy
Triglidae	*Chelidonichthys lucerna*	Danube herring
Uranoscopidae	*Uranoscopus scaber*	bleak

Source: NMRDI

The consistently predominant species were: anchovy, mullet, sea bream, sprat, cod, big-scale sand smelt, and gobies, with slight variations from month to month.
Regarding species with special status (IUCN Red List), 5 critically endangered (CR) species, 3 vulnerable (VU) species, and 5 near threatened (NT) species were identified, while the remaining species belong to the data deficient (DD) and not evaluated (NE) categories.

Figure II.95 Categories of fish species included in the IUCN Red List (% of the total number of identified species)



Source: NMRDI

It is estimated that there is a decrease in species diversity globally under the threat of pressures (Manel et al., 2020). Thus, it is increasingly necessary to implement specific measures for a sustainable management of living marine resources at the level of the entire Black Sea basin with the main objective of maintaining the diversity of species.

Marine mammals (G. Harcota)

In order to determine the state of cetacean populations, monitoring expeditions were carried out on the entire continental platform of the Romanian coast. The observations were carried out in the framework of several projects (SIPOCA 608, POIM 120009, POIM 123322) in the period February-September 2021.

The species of marine mammals in the Black Sea identified from the observations are:

- *Tursiops truncatus ssp. Ponticus* (Barabasch-Nikiforov, 1940)
- *Delphinus delphis ssp. Ponticus* (Barabasch-Nikiforov, 1935)
- *Phocoena phocoena ssp. Relicta* (Abel, 1905)

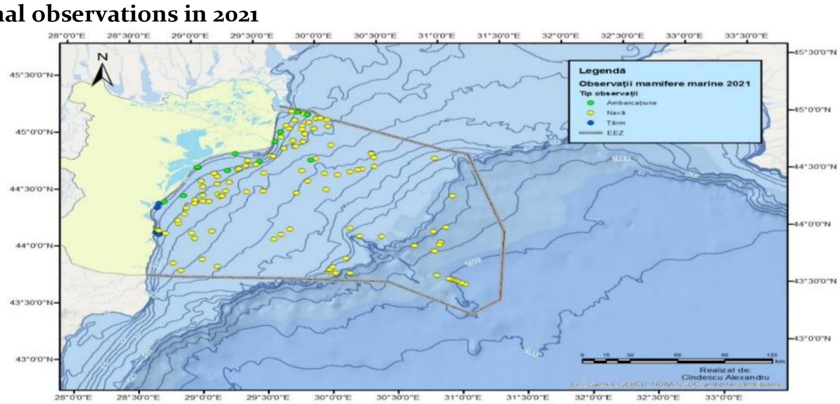
Monitoring method

Observations were made according to the principles of remote sampling, visual observations with binoculars and the linear transect method (Buckland et al., 2001; Thomas et al., 2010), opportunistic observations were also made during expeditions by sea.

According to the methodology, data collection from the field for the three species of cetaceans in the Black Sea was done by:

- Aquatic monitoring - observations made at sea with a research vessel or craft;
- Ground monitoring - observations made from the shore.

Figure II.96 Map of mammal observations in 2021



Source: NMRDI

Observations are not made in low visibility (below 1000 m) if there is precipitation or strong waves (> 4 at Beaufort). During the observations a constant speed of the vessel, the craft of about 6-10 knots is maintained. Observations take place during the day from 8:00 to 18:00, 10 hours per day or daylight. It is recommended that the frequency of ship observations be at least once a year, and if possible, that aerial observations be carried out at least once every 2 or 3 years.

Recommended techniques and parameters for establishing requirements for defining the conservation status of marine mammal populations relate to population abundance, dynamics and structure, as well as habitat requirements (table II.41).

Table II.41 D1 cetacean indicators

Criteria (2017/848/EU)	The target objective
D1C1 - Accidental capture by species	Accidental capture should not exceed 1.7% of the population abundance for each species (ASCOBANS, 2015; CeNoBS Project, 2019; Moffat et al., 2011).
D1C2 - Abundance (number of individuals) by species	No targets and thresholds have been established.
D1C3 - Demographic characteristics by species	No targets and thresholds have been established.
D1C4 - Species distribution range	No targets and thresholds have been established.
D1C5 - Habitat suitability and extent to support various life stages in the species' life history	No targets and thresholds have been established

Source: NMRDI

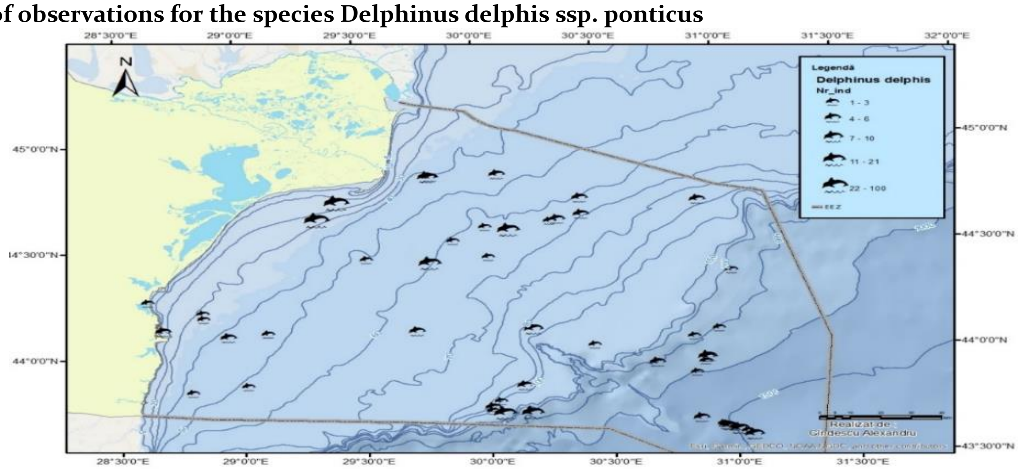
***Delphinus delphis ssp. ponticus*(1350*Code Natura 2000)**

In 2021, a greater number of specimens of the species Delphinus delphis ssp. ponticus were observed, identifying 324 specimens (figure II.102), compared to 2020 when only 130 specimens were identified (figure II.98).

Figure II.97 Delphinus delphis ssp. ponticus (Barabasch-Nikiforov, 1935) (Photo:Emil Todorov)

Source: NMRDI

Figure II.98 Map of observations for the species Delphinus delphis ssp. ponticus



Source: NMRDI

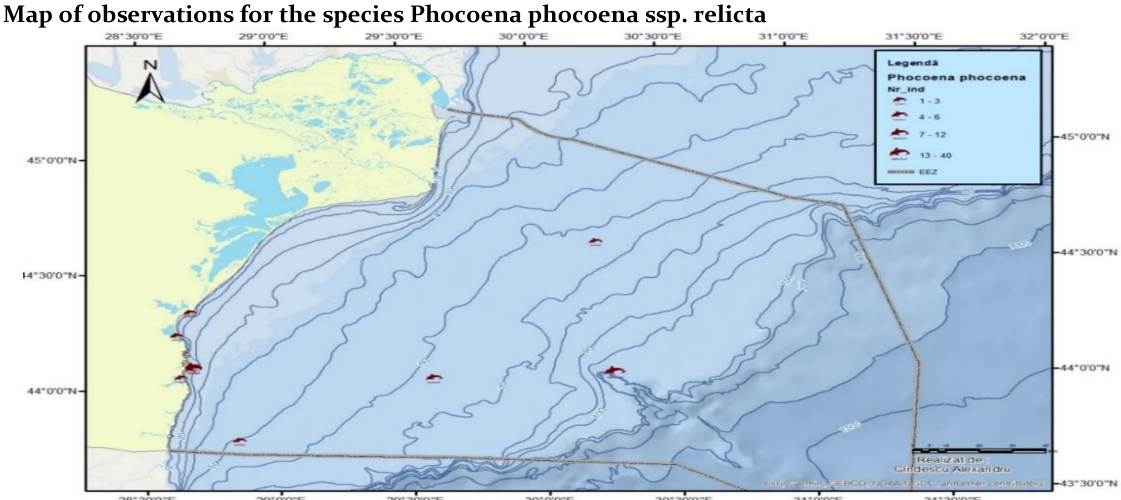
Phocoena phocoena ssp. Relicta **(1351*Code Natura 2000)**

Phocoena phocoena ssp. relicta (Figure II.99) is a species found in the Black Sea and the Sea of Azov. It lives solitarily or in small groups of 8-10 individuals, with a clear gender separation observed. They swim along the coast and are very difficult to approach. During observations, this species had lower visibility compared to other species (Figure II.99). Generally, they dive briefly at intervals of 3-6 minutes. They are ichthyobenthophagous, feeding on fish and invertebrates (turbot, flounder, whiting, anchovy, gastropods). The daily ration is 3-5 kg (POIM, 2019).
In 2021, a smaller number of individuals from the Phocoena phocoena ssp. relicta species were observed, identifying 70 individuals, compared to 229 individuals in 2020 (Figure II.100).

Figure II.99 Phocoena phocoena ssp. relicta (Abel, 1905) (ANEMONE Deliverable 1.3, 2021)

Source: NMRDI

Figure II.100 Map of observations for the species Phocoena phocoena ssp. relicta



Source: NMRDI

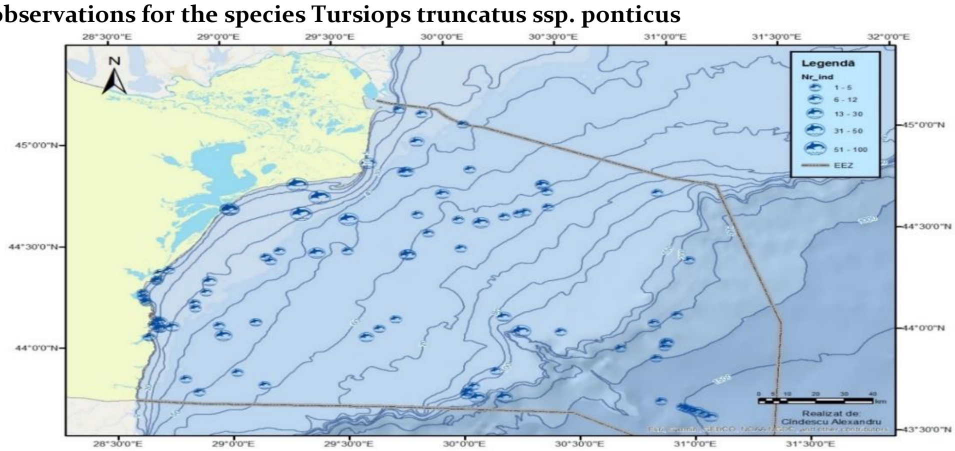
Tursiops truncatus ssp. ponticus **(1349*Code Natura 2000)**

Tursiops truncatus ssp. ponticus (Figure II.116) is a common species in the Mediterranean Sea and the Black Sea. It is a nektonic species, predominantly benthophagous, and tends to approach the shore, especially in the spring. As seen in the map above, the presence of the species is predominant in coastal areas and at depths of up to 50-60 m, rarely encountered at greater depths (Figure II.101). It is found in small groups of 4-10 individuals. Mature individuals feed on benthic and pelagic fish, shrimp, crabs, and mollusks. They can also feed on larger fish (gilthead seabream). An adult dolphin can consume between 8 and 15 kg of food daily (POIM, 2019).
In 2021, a larger number of individuals from the Tursiops truncatus ssp. ponticus species were observed, identifying 410 individuals, compared to 130 individuals in 2020 (Figure II.102).

Figure II.101 Tursiops truncatus ssp. ponticus (Barabasch-Nikiforov, 1940) (Todorova, 2021) (ANEMONE Deliverable 1.3, 2021)

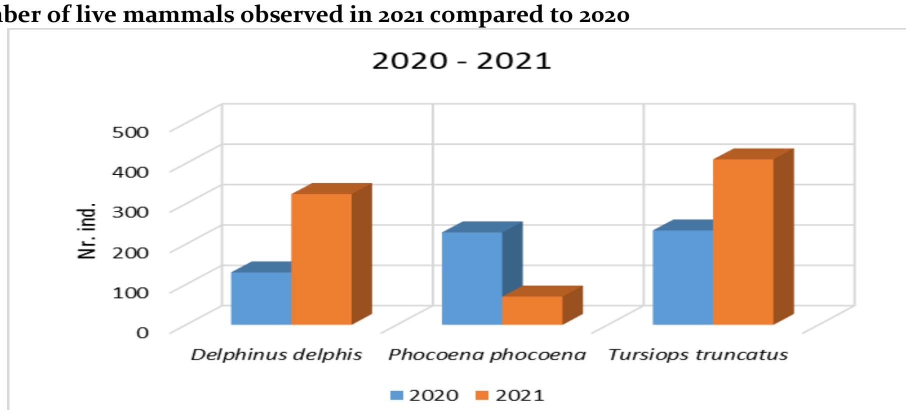
Source: NMRDI

Figure II.102 Map of observations for the species Tursiops truncatus ssp. ponticus



Source: NMRDI

Figure II.103 Total number of live mammals observed in 2021 compared to 2020



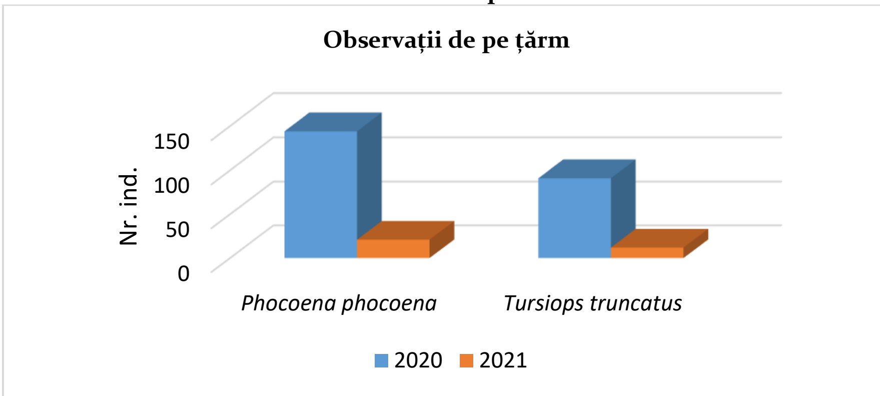
Source: NMRDI

In 2021, the species Delphinus delphis ssp. ponticus (324 individuals) and Tursiops truncatus ssp. ponticus (410 individuals) experienced an increase in the number of identified individuals compared to 2020 (Figure II.103).

The species Phocoena phocoena ssp. relicta saw a significant decrease in the number of identified individuals, with 70 individuals identified compared to 229 in 2020 (Figure II.103).

In 2021, several expeditions were conducted for the observation of marine mammals, and the observations were categorized as follows: from the shore, from boats, from ships, and strandings.

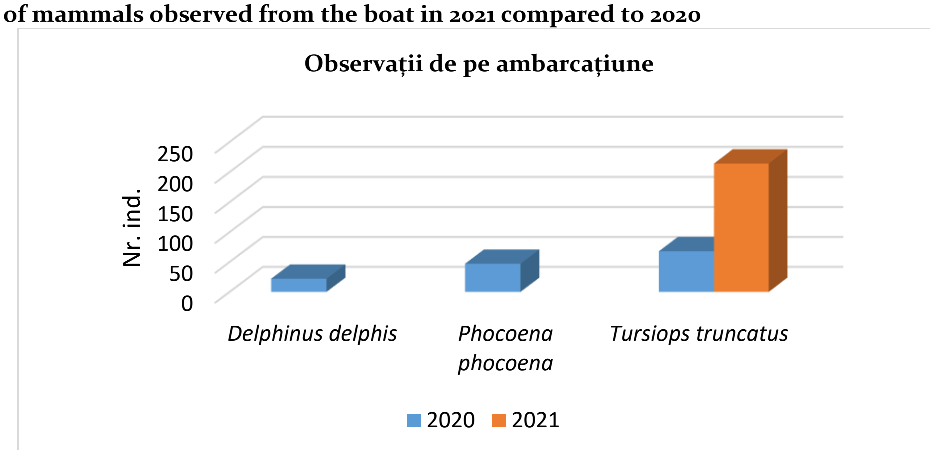
Figure II.104 Number of mammals observed from shore in 2021 compared to 2020



Source: NMRDI

In 2021, the species Phocoena phocoena ssp. relicta was observed during monitoring expeditions from the shore, and 21 individuals were identified, compared to 144 individuals identified in 2020. The species Tursiops truncatus ssp. ponticus was also observed, with a total of 12 individuals identified in 2021, showing a significant decrease compared to 2020 when 91 individuals were identified (Figure II.104).

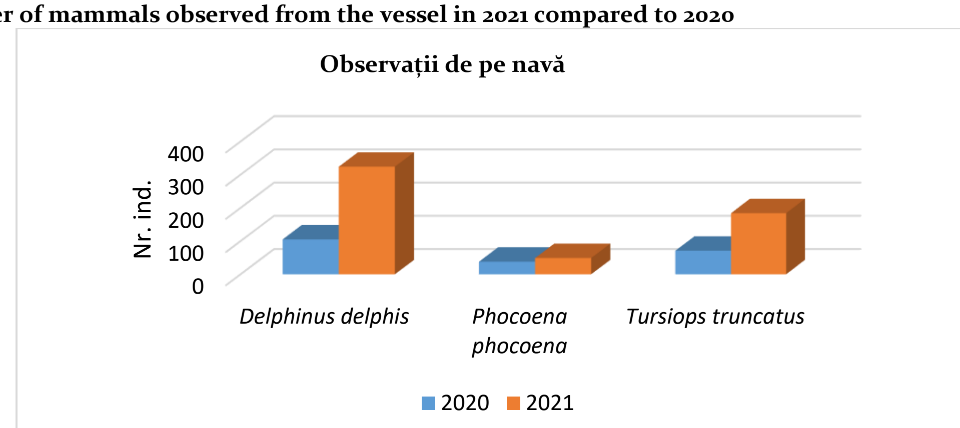
Figure II.105 Number of mammals observed from the boat in 2021 compared to 2020



Source: NMRDI

In 2021, the species *Tursiops truncatus ssp. ponticus*, the only species observed during boat-based monitoring, had a total of 214 individuals identified, a significant increase compared to 68 individuals identified in 2020.
The species Delphinus delphis ssp. ponticus and Phocoena phocoena ssp. relicta were not observed during boat-based expeditions in 2021 (Figure II.105).

Figure II.106 Number of mammals observed from the vessel in 2021 compared to 2020



Source: NMRDI

Conclusions

In 2021, the species *Delphinus delphis ssp. ponticus* and *Tursiops truncatus ssp. ponticus* showed an increase in the number of individuals observed compared to 2020. On the other hand, the species *Phocoena phocoena ssp. relicta* experienced a significant decrease in the number of individuals identified compared to 2020.

Following observations from the ship in 2021, all three marine mammal species exhibited an increasing trend in appearances compared to 2020.

Source: NEG

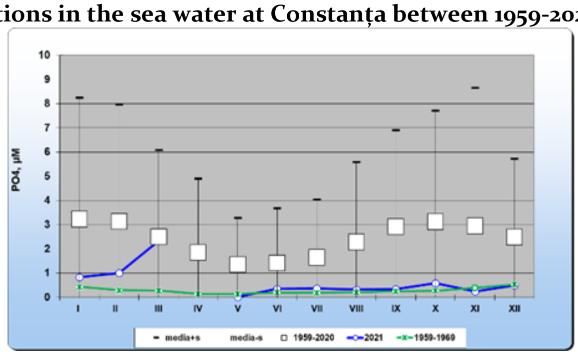
Eutrophication indicators

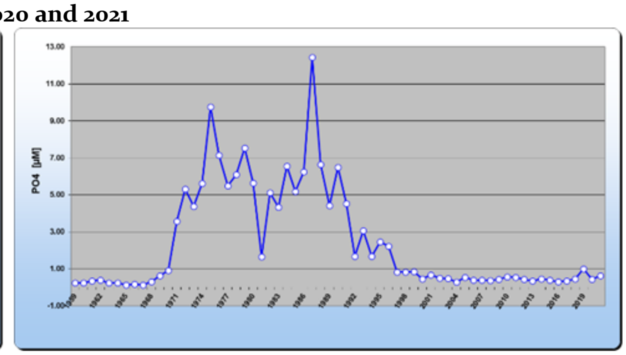
Nutrients

RO 21
Indicator code Romania: RO 21 AEM indicator code: CSI 21
NAME: NUTRIENTS IN TRANSIENT, COASTAL AND MARINE WATERS
DEFINITION: The indicator presents annual trends of concentrations of soluble nitrates and orthophosphates (during winter, expressed in micrograms/L) and the N/P ratio in the sea, concentration levels (low, moderate, high), and trends of oxidized nitrogen during winter (nitrate + nitrite) and concentration of soluble orthophosphates (expressed in micromol/L) in the Black Sea water.

In the long term, the monthly averages of dissolved phosphates in seawater in 2021 are significantly lower (t-test, 95% confidence interval, $p<0.0001$, $t=6.4676$, $df=21$, Dev. St. of difference=0.276) compared to the multi-year period of 1959-2020 and are statistically comparable to those of the reference period 1959-1969. However, the maximum deviation from the 1959-1969 period, 2.05 µM, was observed in March, when the absolute maximum of 9.45 µM was recorded (Figure II.107 a), due to the very high flow of the Danube. Thus, phosphate concentrations in March 2021 reached mean values comparable to those during the period of intense eutrophication.

Figure II.107 The comparative situation of multi-year monthly averages (a) and annual averages (b) of phosphate concentrations in the sea water at Constanța between 1959-2020 and 2021

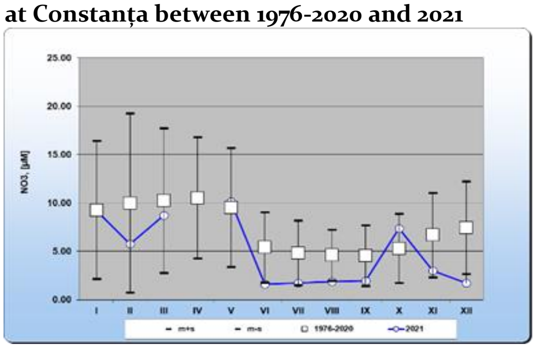


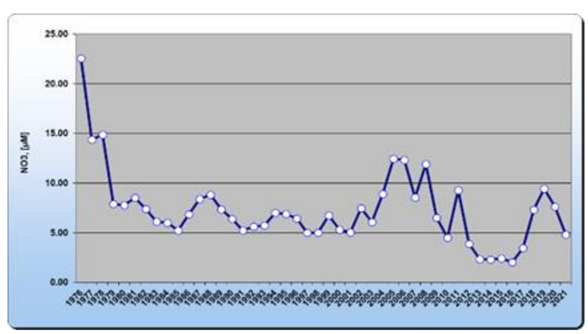


(a) *(b)*

Source: NMRDI

Figure II.108 The comparative situation of multi-year monthly averages (a) and annual averages (b) of nitrate concentrations in the sea water at Constanța between 1976-2020 and 2021



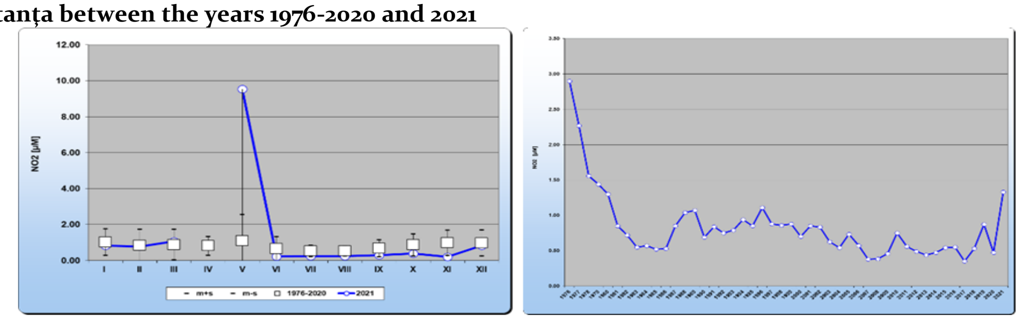


(a) *(b)*

Source: NMRDI

Nitrites - The multi-year monthly averages for 1976-2020 and the monthly averages for 2021 do not significantly differ (t-test, 95% confidence interval, $p=0.5315$, $t=0.6362$, $df=21$, difference standard deviation=0.791) (figure II.109 a). In the long term (1976-2021), the average of 1.33 μM was reached in 2021 (figure II.108 b). The extreme average for the month of May, 9.45 μM, stands out.

Figure II.109 The comparative situation of monthly multi-year (a) and annual (b) averages of nitrogen concentrations in the Black Sea at Constanța between the years 1976-2020 and 2021

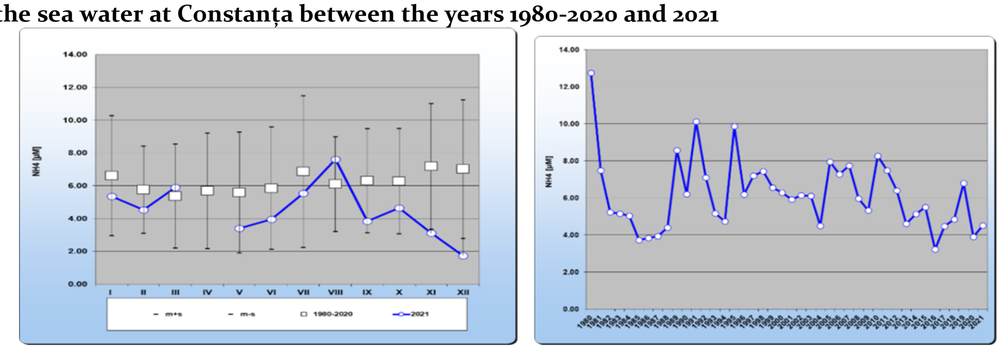


(a) *(b)*

Source: NMRDI

Ammonium - The multi-year monthly averages from 1980-2020 and the monthly averages of 2021 significantly differ (t-test, 95% confidence interval, $p=0.0022$, $t=1.7118$, $df=21$, difference standard deviation=0.49) due to lower concentrations in 2021 (Figure II.110 a). Long-term (1980-2020), in 2021, the annual average concentration of 4.51 μM was reached (Figure II.110 b).

Figure II.110 Comparative situation of multi-year monthly averages (a) and December monthly averages (b) of ammonium concentrations in the sea water at Constanța between the years 1980-2020 and 2021

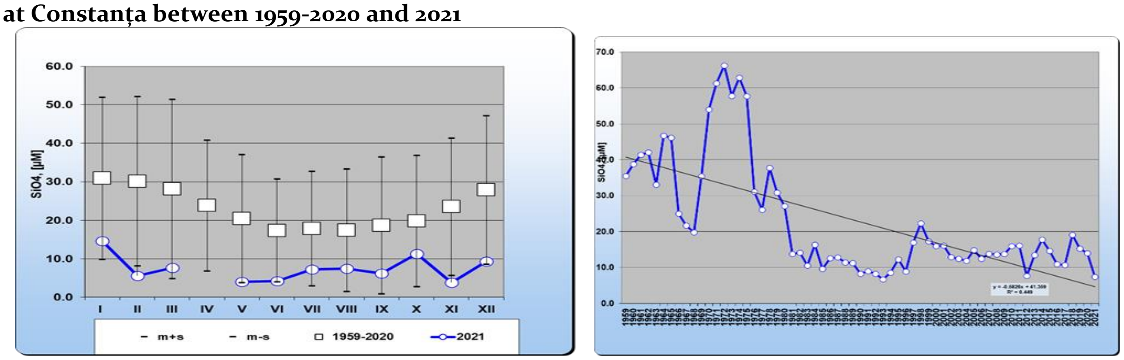


(a) *(b)*

Source: NMRDI

The monthly averages of silicates in 2021, $(SiO_4)^{4-}$, are significantly lower than the multi-year averages of 1959-2020 (t-test, 95% confidence interval, $p=0.0011$, $t=8.5624$, $df=21$, Difference Dev. St.=1.82) (figure II.111 a).
The annual mean concentrations of silicates in the Black Sea water at Constanța range from 6.7 μM (1993) to 66.3 μM (1972) and recorded an average of 7.4 μM in 2021, representing only 20% of the silicate stock from the 1959-1969 reference period (figure II.111 b).

Figure II.111 The comparative situation of multi-year monthly averages (a) and annual averages (b) of silicate concentrations in the sea water at Constanța between 1959-2020 and 2021



(a) *(b)*

Source: NMRDI

Conclusions

In 2021, the coastal waters of the Romanian coastline exhibited heterogeneous levels of nutrient concentrations, which varied seasonally. Consequently, during the first part of the year, along with very high Danube river discharges, extreme monthly average concentrations of phosphates were observed, characteristic of the period of intense eutrophication. This indicates the risk of not achieving the target values for good ecological status of the coastal waters of the Romanian Black Sea coastline regarding Descriptor 5 - Eutrophication.

Chlorophyll "a"

RO 23
Indicator code Romania: RO23 AEM indicator code: CSI 23
NAME: CHLOROPHYLL A FROM TRANSIENT, COASTAL AND MARINE WATERS
DEFINITION: The indicator describes: annual average summer concentrations (expressed in micrograms/L), classification of concentration levels (low, moderate, high), summer average surface concentration trends for chlorophyll a (expressed in micrograms/L). Chlorophyll"A"is the most frequently determined biochemical parameter in oceanography, being a unique indicator of plant biomass and marine productivity. During the summer, when primary production is limited only by nutrients, the concentration of chlorophyll "a" is related to the nutrient stock.

The analysis of chlorophyll "a" concentration utilized bi-weekly collected samples from the shallow depth station in the Mamaia area throughout the year 2021 (111 samples), with the dataset being interrupted in April due to coastal erosion reduction activities. Additionally, samples collected in June 2021 from profiles within the monitoring network of waters with variable salinity, coastal, and marine waters from the Romanian Black Sea coast (Sulina, Mila 9, Sfântu Gheorghe, Portița, Gura Buhaz, Cazino Mamaia, Constanța Nord, Est Constanța, Constanța Sud, Eforie Sud, Costinești, Mangalia, and Vama Veche) were analyzed.

Chlorophyll "a" was determined using the method based on pigment extraction with 90% acetone (after separation on cellulose filter) and measuring the sample's absorbance at four wavelengths (λ = 750nm; λ = 630nm; λ = 645nm, and λ = 663nm). The calculation of chlorophyll concentration was done using trichromatic equations (SCOR-UNESCO, 1966):

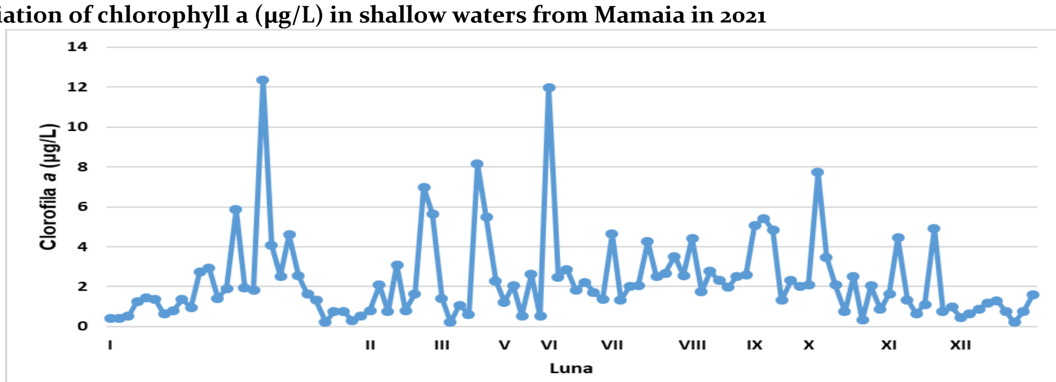
$$c = \frac{(11.64 \times A_{663} - 2.16 \times A_{645} + 0.10 \times A_{630}) \times v}{V} \mu g/l$$

where:

1.64, 2.16, 0.10 represent the molar extinction coefficients,
v is the volume of the extract in 90% acetone, and
V is the volume of the seawater sample being worked on.

Chlorophyll content"*A*"determined in the shallow waters of Mamaia varied between 0.21 and 12.35 µg/L in 2021, with lower values being recorded compared to the values recorded in 2020 (0.45 and 25.98 µg/L) . The average value of the chlorophyll *„a"* concentration recorded in 2021 (2.35 µg/L) is comparable to that of 2019 (2.56 µg/L).

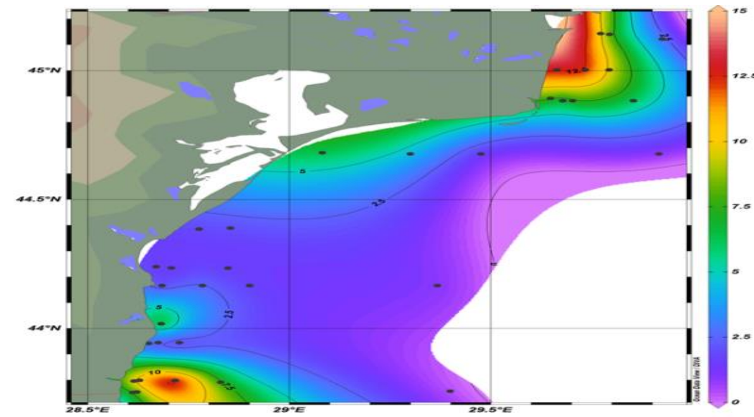
Figure II.112 Variation of chlorophyll a (µg/L) in shallow waters from Mamaia in 2021



Source: NMRDI

The lowest value was recorded in marine waters, MG5 station (0.41 µg/L), and in coastal waters and with variable salinity, the minimum values were 0.88 µg/L (EC1 station), respectively 1.10 µg/L (station SG2).

Figure II.113 The spatial distribution of mean surface chlorophyll-a values (µg/L) along the Romanian coast of the Black Sea in June 2021



Source: NMRDI

Conclusions

The chlorophyll-a content determined in 2021 in the shallow waters of Mamaia ranged from 0.21 to 12.35 µg/L, showing lower values compared to those recorded in 2020 (ranging from 0.45 to 25.98 µg/L). The average concentration of chlorophyll-a in 2021 (2.35 µg/L) is comparable to that of 2019 (2.56 µg/L).

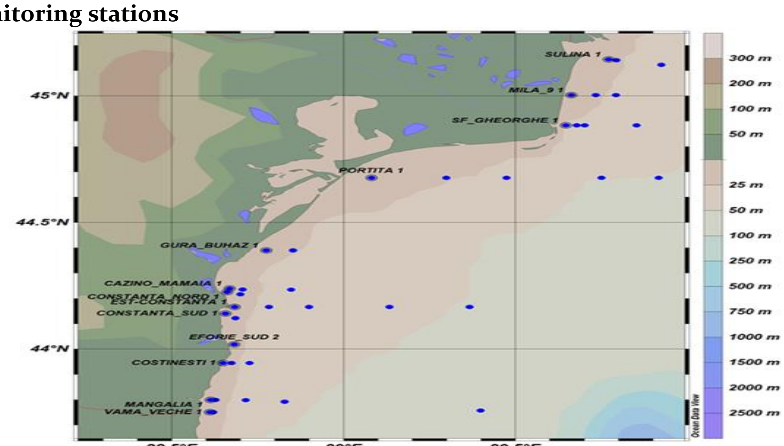
On the continental shelf of the Black Sea, the chlorophyll-a concentration determined in June 2021 varied between 0.41 (marine waters, station MG5) and 14.60 µg/L (station ML2), with the highest value found near the Danube estuary in waters with variable salinity.

Contamination indicators

Heavy metals

The heavy metals monitoring in 2021 was conducted through the analysis of samples from marine water (surface layer), sediments, and mollusks collected during May-June from the marine monitoring network. The network covers national marine waters (territorial waters and part of the EEZ) and consists of 40 permanently stationed sites located along 13 transects spanning the entire length of the Romanian coastline. The stations are as follows: Sulina, 3 stations (10-30 m depth), Mila 9, 3 stations (10-30 m), Sfântul Gheorghe, 4 stations (10-40 m), Portița, 5 stations (10-57 m), Gura Buhaz, 2 stations (10-20 m), Cazino Mamaia, 3 stations (10-30 m), Constanța Nord, 2 stations (10-20 m), Constanța Est, 5 stations (14-54 m), Constanța Sud, 2 stations (10-20 m), Eforie Sud, 2 stations (10-20 m), Costinești, 3 stations (10-30 m), Mangalia, 5 stations (10-70 m), Vama Veche, 2 stations (10-20 m) (Figure II.114). The stations in the shallow area allow assessment of the direct impact exerted by land-based pressures, such as the Danube River mouths, discharges from municipal and industrial wastewater treatment plants, ports, urban agglomerations, hydraulic works, etc.

Figure II.114 Network of monitoring stations



Source: NMRDI

The analytical determination of the content of copper, cadmium, lead, nickel, chromium and cobalt was carried out by the method of atomic absorption spectrometry, using Solaar M6 Dual Zeeman, Thermo Electron and HR-CS ContrAA 800 G equipment, Analytik Jena.

Results and discussion

Sea water

The heavy metal concentrations determined in 2021 in marine waters (surface layer) were characterized by a high degree of variability but overall with mean values within normal ranges: 7.29 (1.12 – 41.62) μg/L Cu; 0.25 (0.01 – 3.32) μg/L Cd; 2.55 (0.01 – 23.58) μg/L Pb; 3.12 (0.03 – 32.48) μg/L Ni; 6.89 (1.17 – 26.59) μg/L Cr (Table II.42).

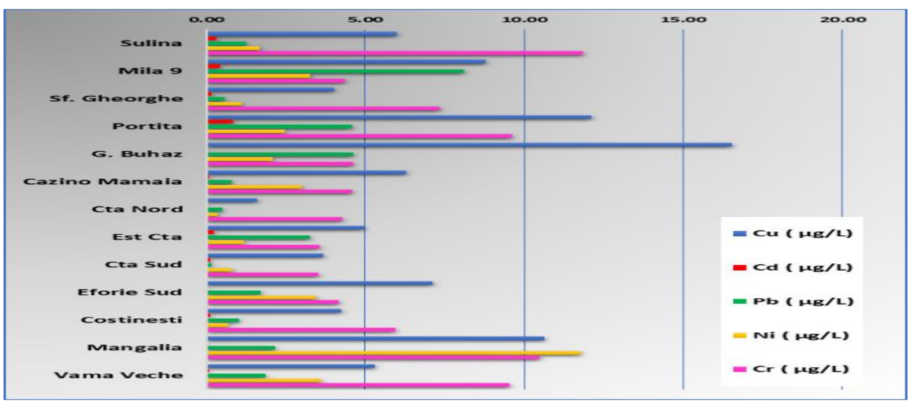
Table II.42Concentrations of heavy metals in surface marine waters in 2021

	Valid N	Mean	Median	Minimum	Maximum	Percentiles – 25th	Percentiles – 75th	EQS
Cu (μg/L)	40	7,299	5,015	1,119	41,616	3,697	6,800	30
Cd (μg/L)	40	0.249	0.081	0.011	3,320	0.049	0.204	1.5
Pb (μg/L)	40	2,553	0.763	0.001	23,583	0.389	1,974	14
Ni (μg/L)	40	3.115	1,781	0.026	32,481	0.614	3,369	34
Cr (μg/L)	40	6,899	4,704	1,173	26,599	3,807	7,283	100

Source: NMRDI

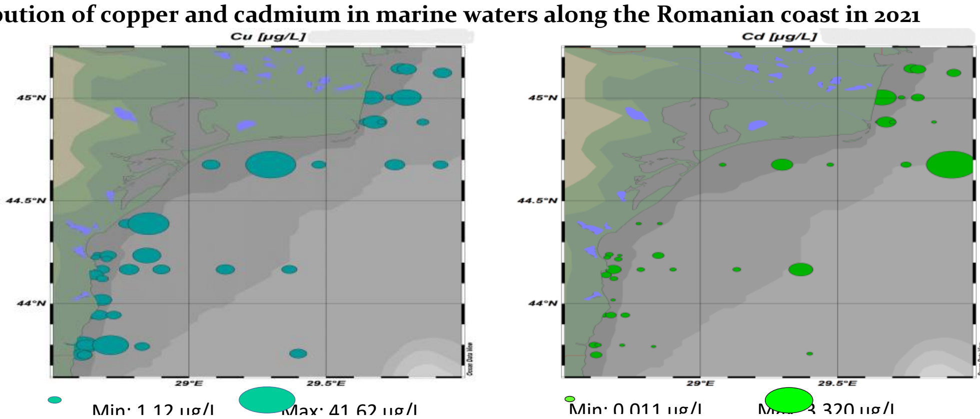
Copper and chromium showed a more uniform distribution along the coast. The maximum value of copper was measured at the Portița 2 station (41.62 μg/L), followed by Gura Buhaz (28.35 μg/L) and Mangalia 3 (21.41 μg/L). Regarding nickel, the concentrations measured in the southern coast (Mangalia transect) were higher compared to other areas, with a maximum of 32.48 μg/L measured at Mangalia 3 (Figures II.115 – II.118).

Figure II.115 The distribution of the mean concentration values of heavy metals in marine waters along the 13 monitored transects in 2021



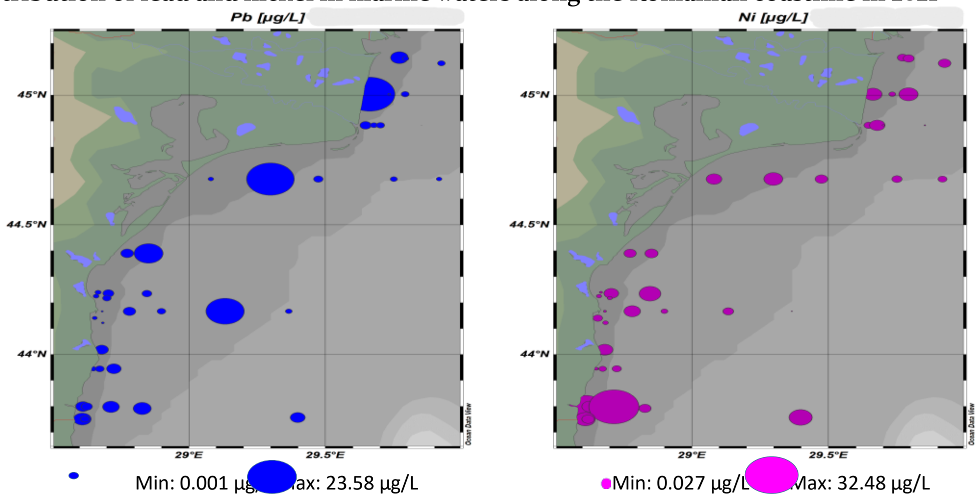
Source: NMRDI

Figure II.116 Distribution of copper and cadmium in marine waters along the Romanian coast in 2021



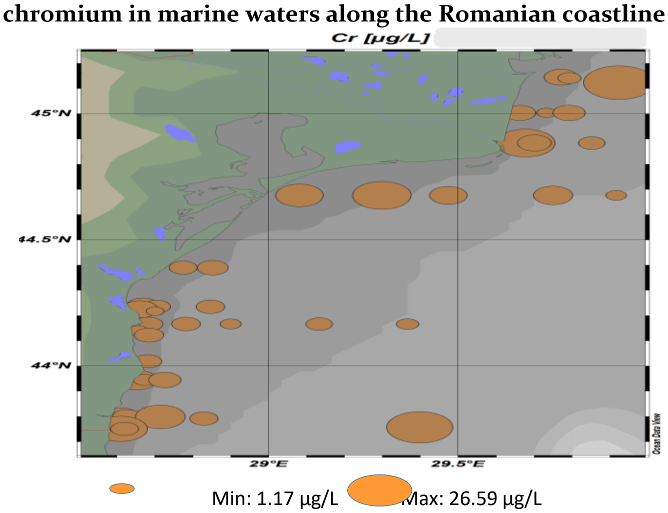
Source: NMRDI

Figure II.117 The distribution of lead and nickel in marine waters along the Romanian coastline in 2021



Source: NMRDI

Figure II.118 The distribution of chromium in marine waters along the Romanian coastline in 2021



Source: NMRDI

SEDIMENTS

The concentrations of heavy metals determined in 2021 in surface marine sediments were characterized by a high degree of variability, but overall with average values comparable to those observed in the previous year: 22.89 (2.36-79.14) µg/g Cu; 0.26 (0.06-1.12) µg/g Cd; 22.61 (5.04-95.63) µg/g Pb; 28.98 (9.69-59.35) µg/g Ni; 31.72 (9.76-69.77) µg/g Cr; 7.78 (3.40-15.41) µg/g Co (Table 1.3.2 Heavy Metal Concentrations in Marine Sediments in 2021).

Table II.43 Concentrations of heavy metals in marine sediments in 2021

	Valid N	Mean	Median	Minimum	Maximum	25th percentiles	75th percentile	EQS
Cu (µg/g)	40	22,898	21,810	2,362	79,140	10,429	32,760	40
Cd (µg/g)	40	0.266	0.226	0.059	1,124	0.134	0.346	1,2
Pb (µg/g)	40	22,615	20,060	5,042	95,630	9,258	31,060	47
Ni (µg/g)	40	28,989	28,150	9,693	59,350	16,385	38,920	35
Cr (µg/g)	40	31,719	29,850	9,760	69,770	19,870	45,770	81
Co (µg/g)	40	7,789	7,486	3,403	15,410	5.103	9,999	

Source: NMRDI

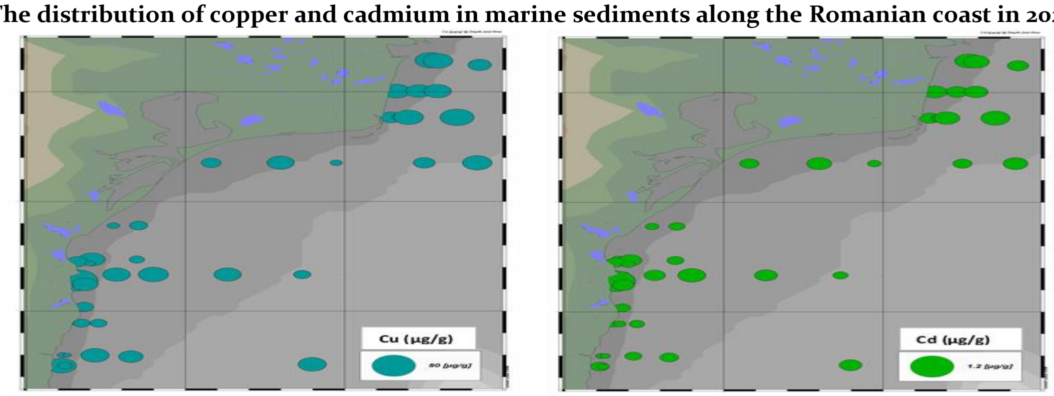
The highest anthropogenic load of heavy metals was observed in sediments within the port of Constanța, where maximum values of copper (79.14 µg/g), cadmium (1.12 µg/g), and lead (95.63 µg/g) were measured. Elevated values were also measured in the area adjacent to the outer harbor of the port (Est Constanța transect, stations 2 and 3), especially for Pb, Ni, Cr, and Co.

Moreover, most investigated elements showed higher accumulation values in sediments in front of the Danube River mouths (Sulina, Mila 9, and Sf. Gheorghe transects), as well as in the offshore zone (depth >50 m) of the Portița transect. Ni, Cr, and Co also exhibited slightly elevated values in sediments at the Cazino Mamaia 20m station, as well as in the offshore zone (depth >50 m) of the Mangalia profile.

Figure II.119 The distribution of average concentration values of heavy metals in marine sediments along the 13 monitored transects in 2021.1

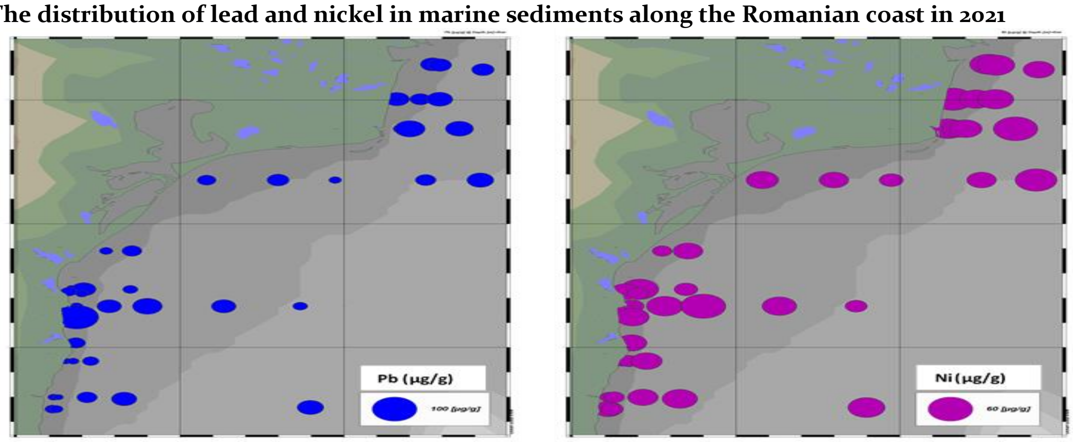
Source: NMRDI

Figure II.120 The distribution of copper and cadmium in marine sediments along the Romanian coast in 2021



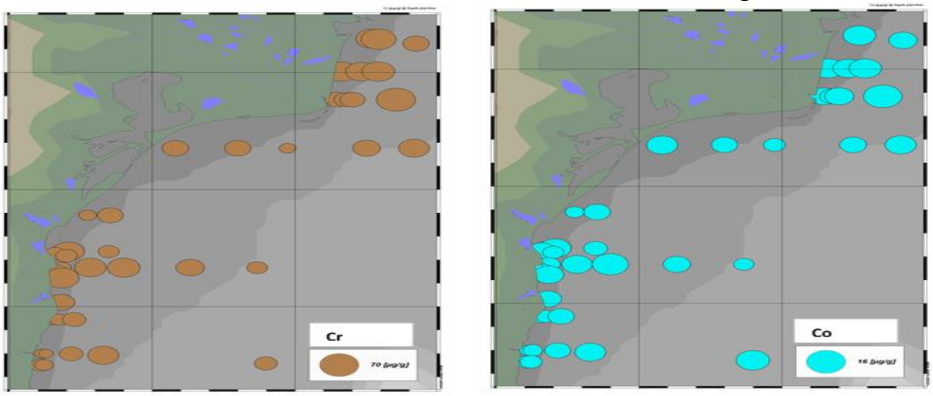
Source: NMRDI

Figure II.121 The distribution of lead and nickel in marine sediments along the Romanian coast in 2021



Source: NMRDI

Figure II.122 The distribution of chromium and cobalt in marine sediments along the Romanian coast in 2021

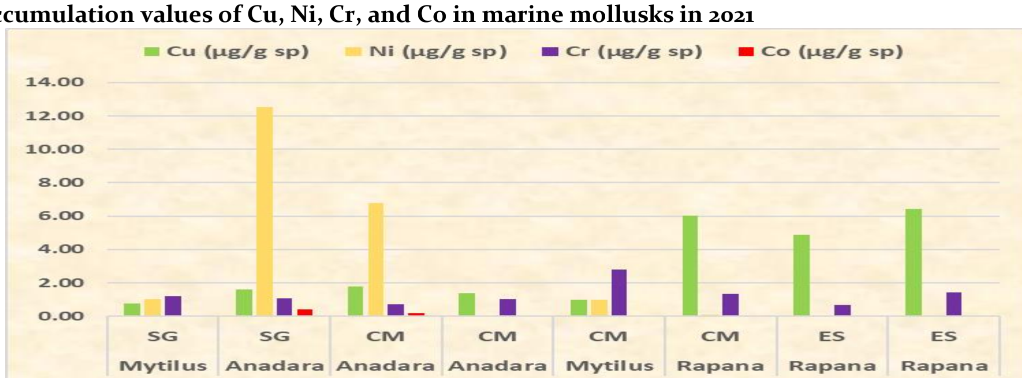


Source: NMRDI

Biota

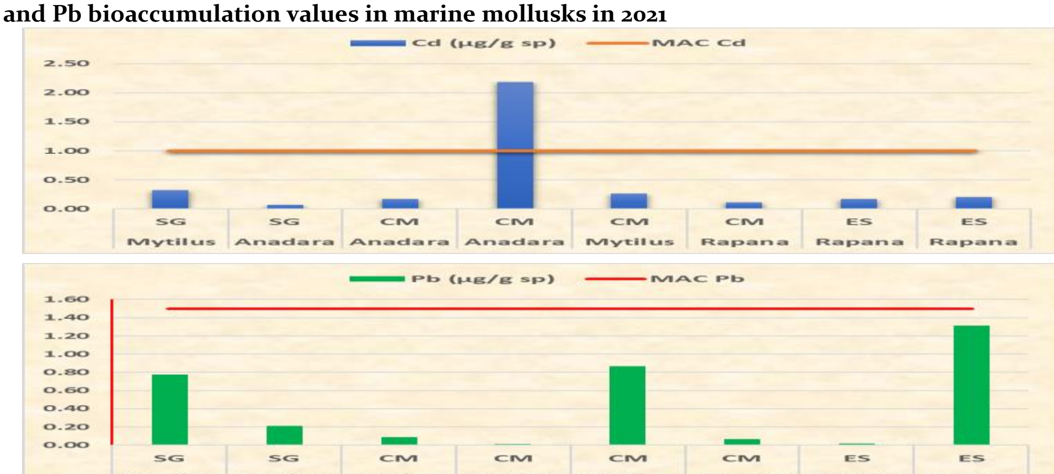
The average concentrations of heavy metals in samples of Mytilus galloprovincialis, Rapana venosa, and Anadara inaequivalvis from the Sf. Gheorghe, Cazino Mamaia, and Eforie Sud stations investigated in 2021 generally fell within normal ranges of variation, as follows: 2.99 (0.77 – 6.43) µg/g dry weight Cu; 0.44 (0.07-2.19) µg/g dry weight Cd; 0.42 (0.01-1.31) µg/g dry weight Pb; 2.68 (0.01 – 12.53) µg/g dry weight Ni; 1.29 (0.70-2.80) µg/g dry weight Cr; 0.09 (0.01-0.43) µg/g dry weight Co. The Cd and Pb levels measured in marine mollusks in 2021 were well below the maximum allowable levels (MAC) stipulated for human consumption by European regulations (EC Regulation No 1881/2006), with only one sample of Anadara from the Cazino Mamaia station exceeding the regulated Cd value (1 µg/g dry weight). Elevated Pb bioaccumulation values were noted in a Rapana sample from the Eforie station, followed by the values measured in mussels from the Sf. Gheorghe and Cazino Mamaia stations. All Rapana samples had higher Cu concentrations compared to other mollusk species, while Anadara samples exhibited elevated Ni and Co levels (Figure II.123; Figure II.124).

Figure II.123 Bioaccumulation values of Cu, Ni, Cr, and Co in marine mollusks in 2021



Source: NMRDI

Figure II.124 Cd and Pb bioaccumulation values in marine mollusks in 2021



Source: NMRDI

Conclusions

The results of the investigations conducted in 2021 on heavy metals in water, sediments, and biota demonstrate distribution differences across various sectors of the Romanian coast, reflecting the potential impact of natural and anthropogenic pressures stemming from coastal and offshore sources and activities.

The distribution of concentrations of certain elements (especially cadmium and lead) in marine waters exhibits a gradient from north to south, highlighting the significant influence of the Danube and other major rivers in the NW Black Sea. Additionally, in some cases, metals showed a degree of enrichment around hotspots, likely resulting from localized influences (wastewater treatment plants, port activities, shipping traffic, etc.).

The state of marine waters in 2021, in relation to the quality standards for marine waters (EQS), is deemed good, with the percentage of EQS exceedances ranging from 2-5% for Cu, Cd, Pb, while no exceedances were recorded for the other elements (Ni, Cr).

The highest anthropogenic load of heavy metals (Cd, Pb, Cu) was observed in the sediments within the port area of Constanța, as well as in the vicinity of the outer harbor. Furthermore, most investigated elements showed higher accumulation values in sediments near the Danube River mouths (Sulina – Portița).

The state of marine sediments in 2021, with respect to the quality standards for marine sediments (ERL), is considered good, with the percentage of ERL exceedances below 25% of the total monitored sediment samples, as follows: Cu (6% exceedances), Cd (0% exceedances), Pb (3% exceedances), and Cr (0% exceedances). The criteria for good ecological status (GES) were not met for Ni, with 31% of the samples exceeding the ERL value (35 µg/g Ni).

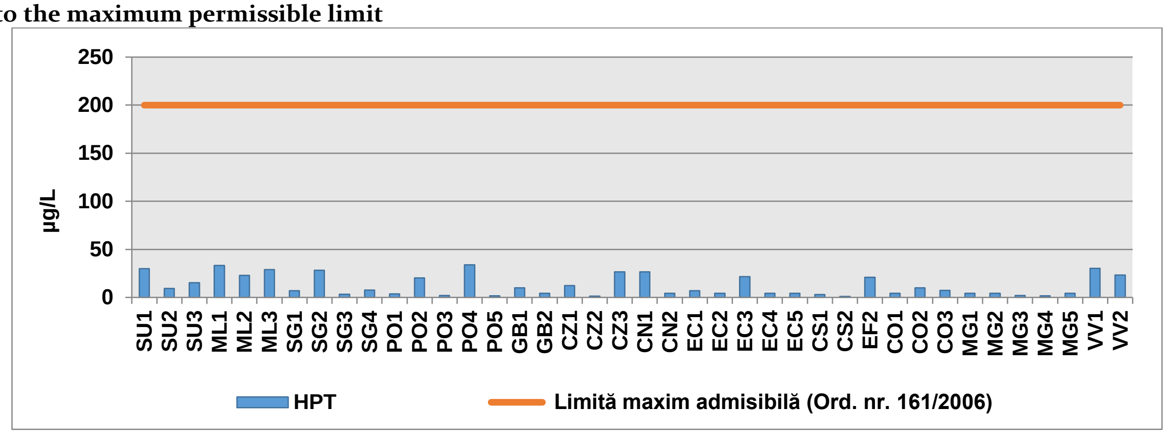
The average concentrations of heavy metals in samples of *Mytilus galloprovincialis, Rapana venosa, and Anadara inaequivalvis* investigated in 2021 generally fell within normal variability ranges. The levels of Cd and Pb measured in marine mollusks were well below the maximum allowable levels (MAC) prescribed for human consumption by European regulations (Regulation EC No 1881/2006), with the only Cd exceedance (1 µg/g s.w.) observed in a sample of *Anadara* from the Cazino Mamaia station.

Total Petroleum Hydrocarbons (TPH)

The analysis of total petroleum hydrocarbons (TPH) was performed on water and sediment samples collected from a network of stations located between Sulina and Vama Veche, during the period of May to September 2021.

In 2021, the content of total petroleum hydrocarbons (TPH) in the waters of the Romanian sector of the Black Sea ranged from 0.208 to 34.040 µg/L (Figure II.125). The determined concentrations were generally low, well below the maximum permissible limit of 200 µg/L as per Order No. 161/2006 "Norm for the Classification of Surface Water Quality for the Determination of the Ecological State of Water Bodies". The highest values were observed at the Portița 50m (P04) station – 34.04 µg/L, Mila 9 10m (ML1) – 33.21 µg/L, Vama Veche 10m (VV1) – 30.41 µg/L, and Sulina 10m (SU1) – 29.87 µg/L.

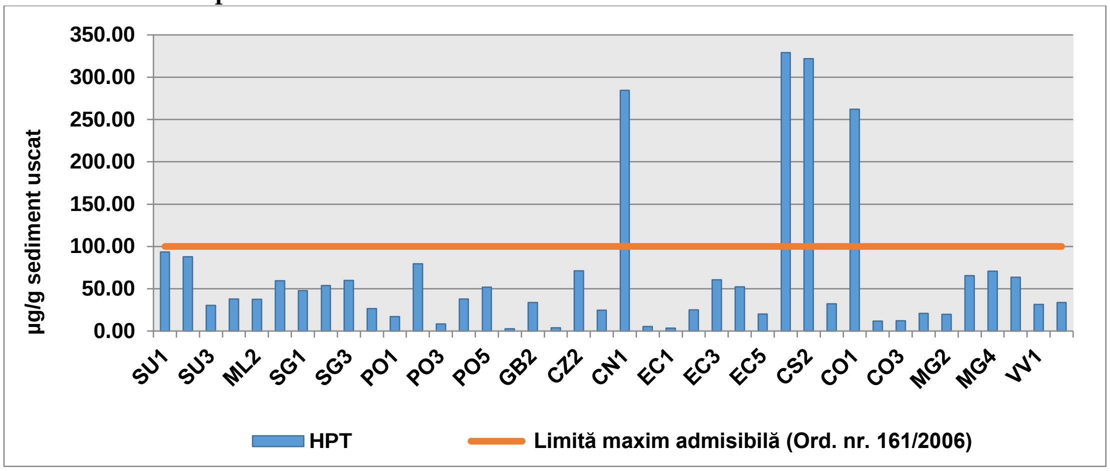
Figure II.125 The concentrations of total petroleum hydrocarbons in the waters of the Romanian sector of the Black Sea in 2021, in relation to the maximum permissible limit



Source: NMRDI

The concentrations of total petroleum hydrocarbons in sediment samples collected between May and September ranged from 0.48 to 329.97 µg/g dry sediment. These values were significantly lower compared to those recorded in 2020, where the maximum value recorded was 512.470 µg/g dry sediment. The majority of determined concentrations (96%) were below the maximum permissible limit of 100 µg/g set by 'Order No. 756/1997 for the Approval of the Regulation on Environmental Pollution Assessment' (Figure II.126). The highest value (329.97 µg/g dry sediment) was recorded at the Constanța-Sud 10m (CS1) station. Similar values were recorded at the Constanța-Sud 20m (CS2) station – 321.97 µg/g dry sediment, Constanța-Nord 10m (CN1) – 284.57 µg/g dry sediment, and Costinești 10m (CO1) – 262.21 µg/g dry sediment.

Figure II.126 The concentrations of total petroleum hydrocarbons in sediments from the Romanian sector of the Black Sea in 2021, in relation to the maximum permissible limit



Source: NMRDI

Polynuclear aromatic hydrocarbons (PAHs)

The analysis of polycyclic aromatic hydrocarbons was conducted on water, sediment, and biota samples.

In water, out of a total of 16 investigated compounds, chrysene, benzo[b]fluoranthene, and benzo[k]fluoranthene were below the detection limit. The other analyzed compounds (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, dibenzo[a,h]anthracene, indeno[1,2,3-c,d]pyrene) had concentrations ranging from the detection limit to 1.201 µg/L. Values above the detection limit were occasionally measured for anthracene, acenaphthene, benzo[a]anthracene, chrysene, dibenzo[a,h]anthracene, and benzo[g,h,i]perylene (Figure II.127), while naphthalene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, and indeno[1,2,3-c,d]pyrene frequently had concentrations greater than 0.01 µg/L (Figure II.127). Exceedances of the maximum allowable values set by current legislation (Order No. 161/2006) were observed for phenanthrene, anthracene, fluoranthene, benzo[a]anthracene, and benzo[g,h,i]perylene in 2 - 27% of the samples (Table II.44).

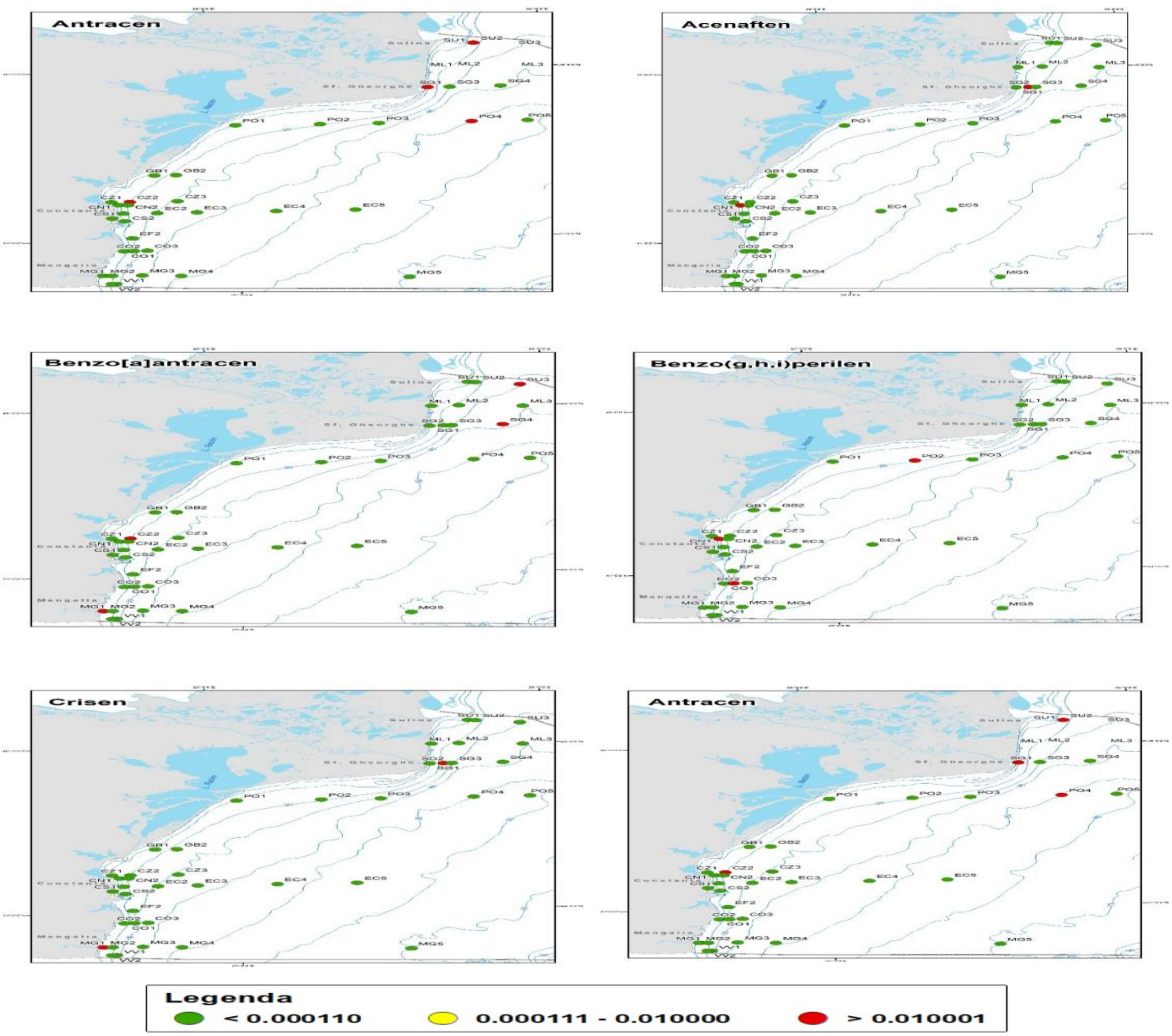
Table II. Exceedances of the maximum allowable values prescribed by Order No. 161/2006 for polycyclic aromatic hydrocarbons in the waters of the Romanian Black Sea coast in the year 2021

Compound name	Maximum admissible limits provided by Order 161/2006	Exceeding the maximum admissible values provided by Order 161/2006 (%)
Naphthalene	2.4	0
Acenaphthylene	-	-
Acenaphthene	-	-
Fluorene	-	-
Phenanthrene	0.03	27
Anthracene	0.063	10
Fluoranthene	0.09	2
Pyrene	-	-
Benzo[a]anthracene	0.01	4
Chrysene	-	-
Benzo[b]fluoranthene	0.03	0
Benzo[k]fluoranthene	0.025	0
Benzo[a]pyrene	0.05	0

Benzo(g,h,i)perylene	0.025	3
Dibenzo(a,h)anthracene	-	-
Indeno(1,2,3-c,d)pyrene	-	-

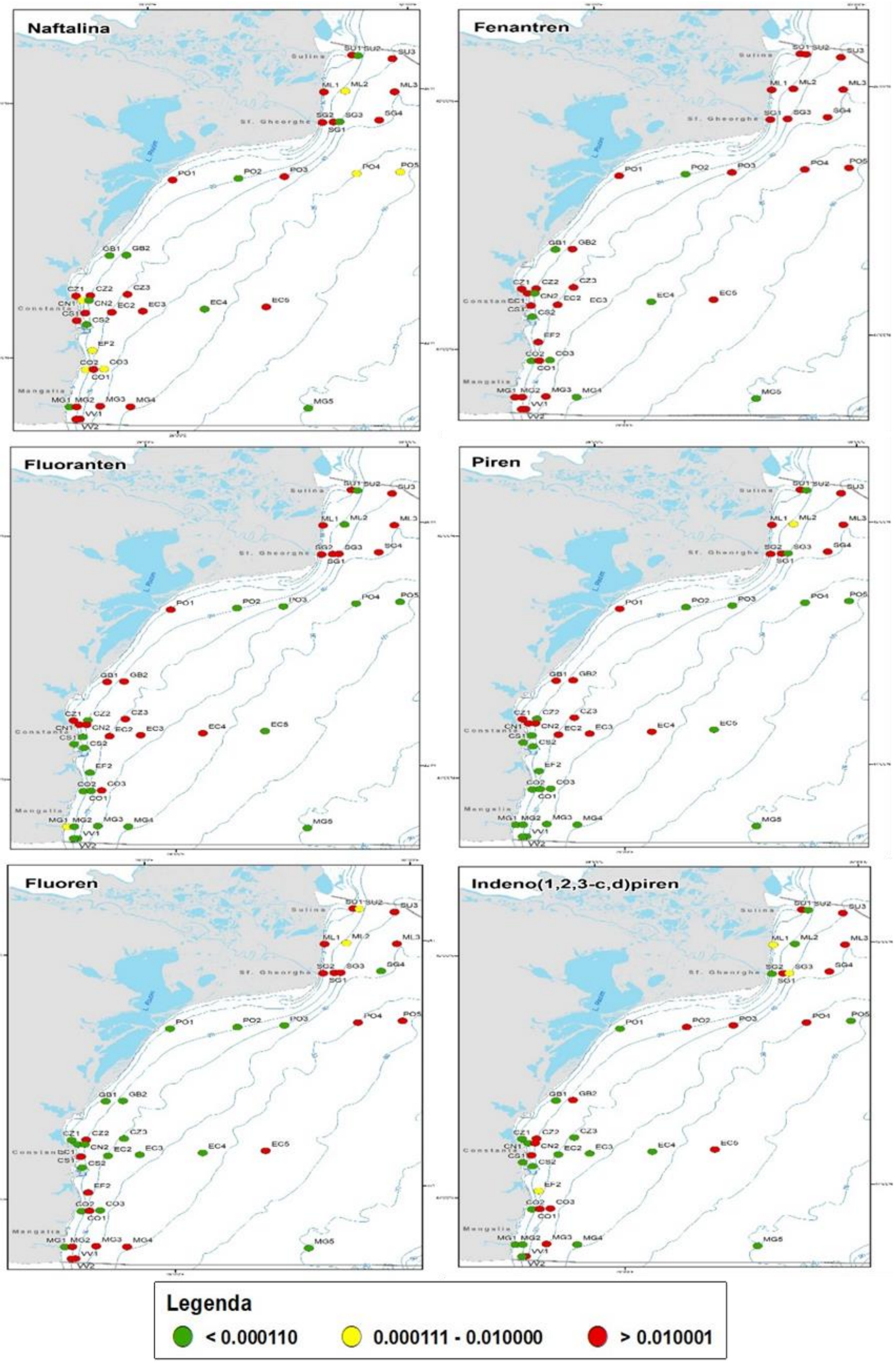
Source: NMRDI

Figure II.127 The concentrations of anthracene, acenaphthene, benzo[a]anthracene, chrysene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene (µg/L) in the waters of the Romanian sector of the Black Sea in 2021



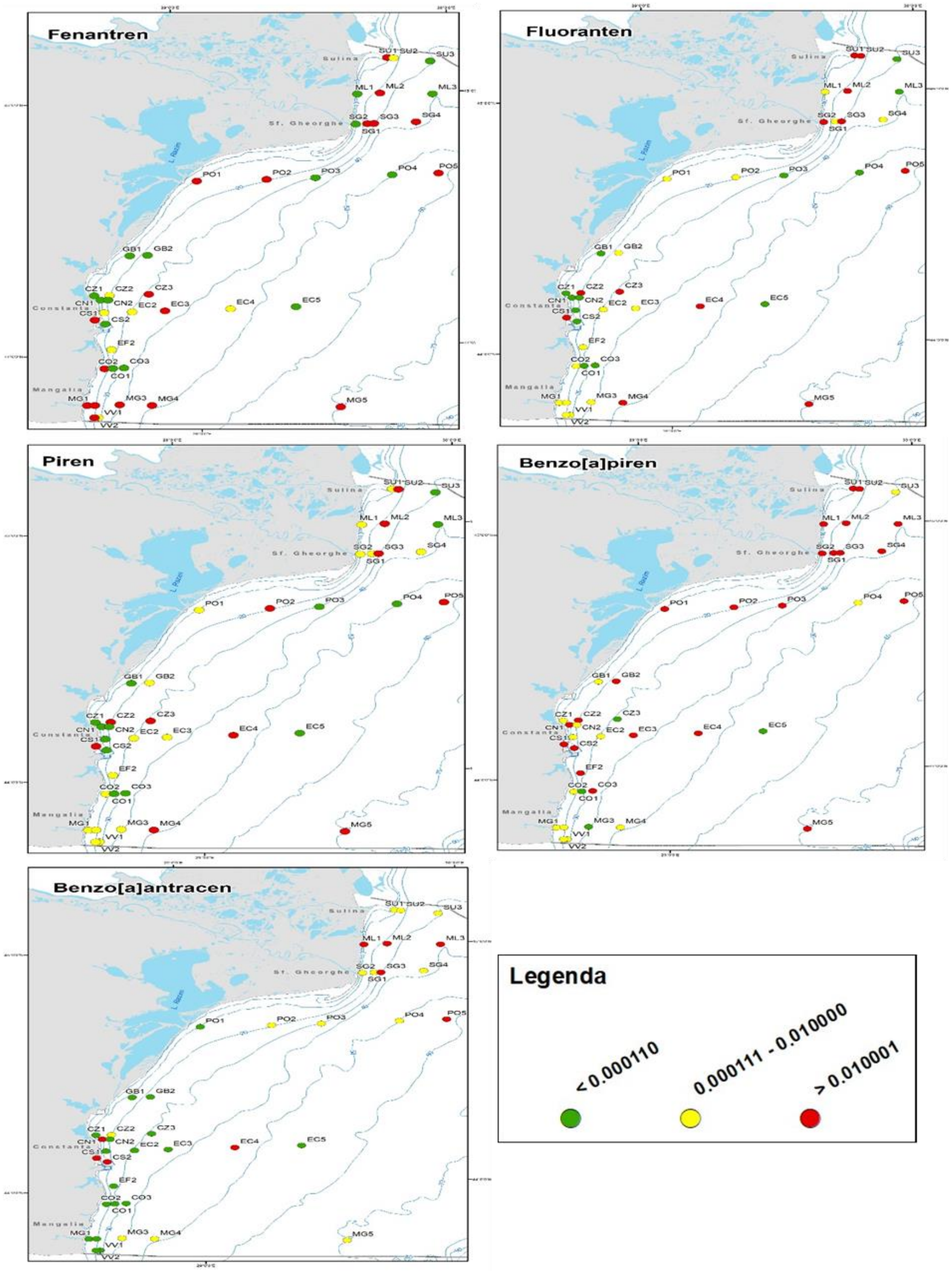
Source: NMRDI

Figure II.128 The concentrations of naphthalene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, and indeno(1,2,3-c,d)pyrene (µg/L) in the waters of the Romanian sector of the Black Sea in 2021



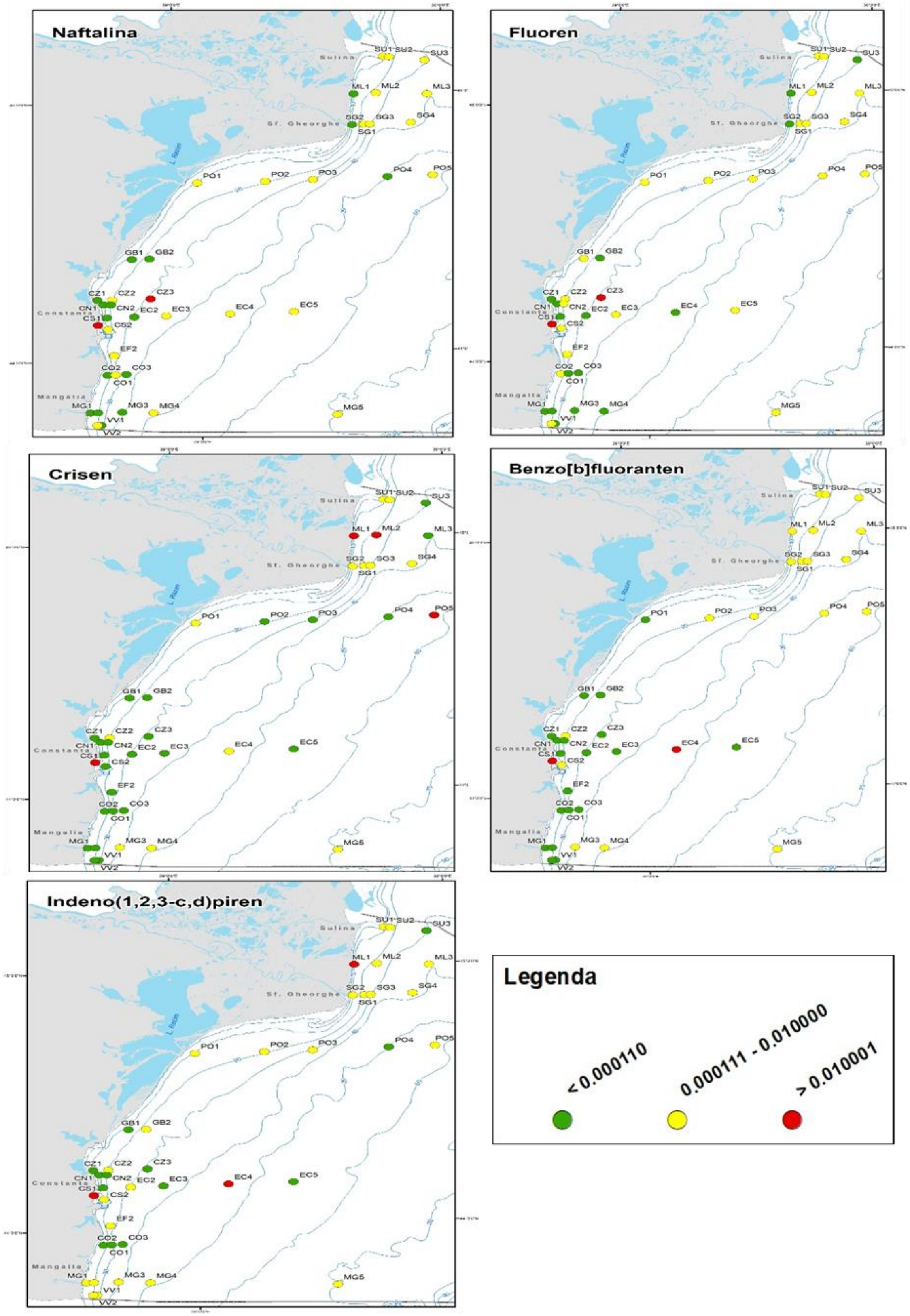
Source: NMRDI

Figure II.129 The concentrations of phenanthrene, fluoranthene, benzo[a]anthracene, pyrene, and benzo[a]pyrene (µg/g dry sediment) in the Romanian sector of the Black Sea in 2021



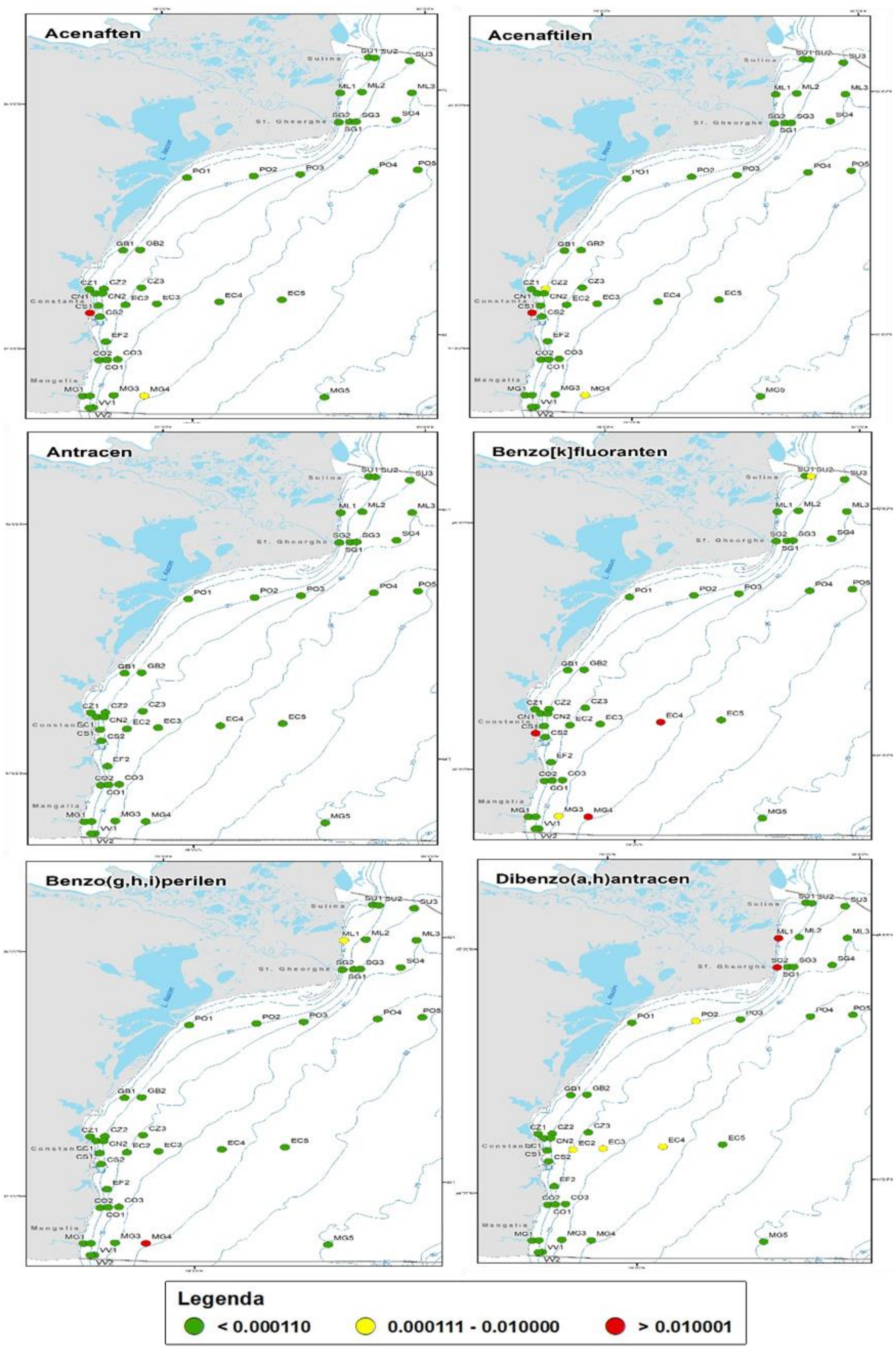
Source: NMRDI

Figure II.130 Concentrations of naphthalene, chrysene, benzo[b]fluoranthene, fluorene and indeno(1,2,3-c,d)pyrene (µg/g dry sediment) in the Romanian sector of the Black Sea, in 2021



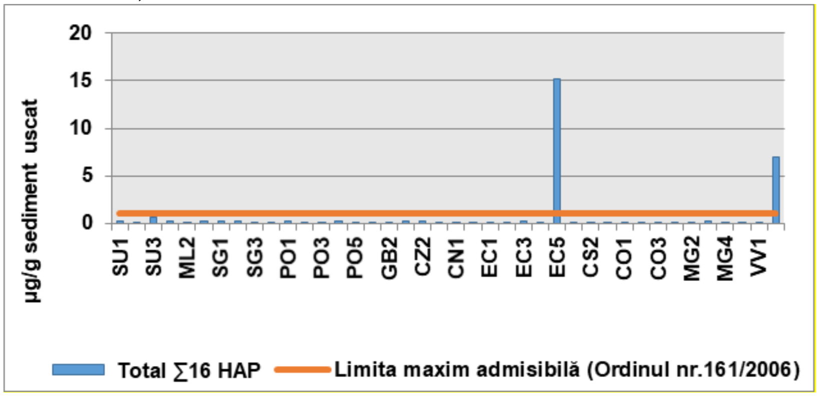
Source: NMRDI

Figure II.131 Concentrations of acenaphthylene, acenaphthenyl, anthracene, benzo(g,h,i)perylene, dibenzo(a,h)anthracene and benzo[k]fluoranthene (µg/g dry sediment) in the Romanian sector of the Black Sea, in 2021



Source: NMRDI

Figure II.131 The concentrations of polycyclic aromatic hydrocarbons (PAHs) - Σ16 PAHs in marine sediments from the Romanian coast of the Black Sea in 2021, in relation to the maximum allowed limit



Source: NMRDI

The concentrations of individual compounds were compared with the sediment quality criteria proposed to define good ecological status in the Romanian zone of the Black Sea in accordance with the OSPAR methodology, specifically the ERL values (Effect Range Low - the 10th percentile of a contaminant concentration at which biological effects are minimal). The threshold values defining good ecological status in sediments were exceeded for acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, benzo[a]pyrene, benzo(g,h,i)perylene, and indeno(1,2,3-c,d)pyrene in 0.6 - 2% of samples (Table II.45).

Table II.45 Exceedances of the threshold values defining good ecological status for individual polycyclic aromatic hydrocarbons (PAHs) in the sediments of the Romanian Black Sea coastal zone in the year 2021

Compound name	ERL* (µg/g)	Exceeded ERL values (%)
Naphthalene	0.1600	0
Acenaphthylene	0.0440	0.6
Acenaphthene	0.0160	1.3
Fluorene	0.0190	1.3
Phenanthrene	0.2400	0.6
Anthracene	0.0850	0.6
Fluoranthene	0.6600	0.6
Pyrene	0.6650	0
Benzo[a]anthracene	0.2610	0
Chrysene	0.3840	0
Benzo[b]fluoranthene	-	-
Benzo[k]fluoranthene	-	-
Benzo[a]pyrene	0.4300	0.6
Benzo(g,h,i)perylene	0.0850	2
Dibenzo[a,h]anthracene	0.0630	0
Indeno(1,2,3-c,d)pyrene	0.2400	0.6

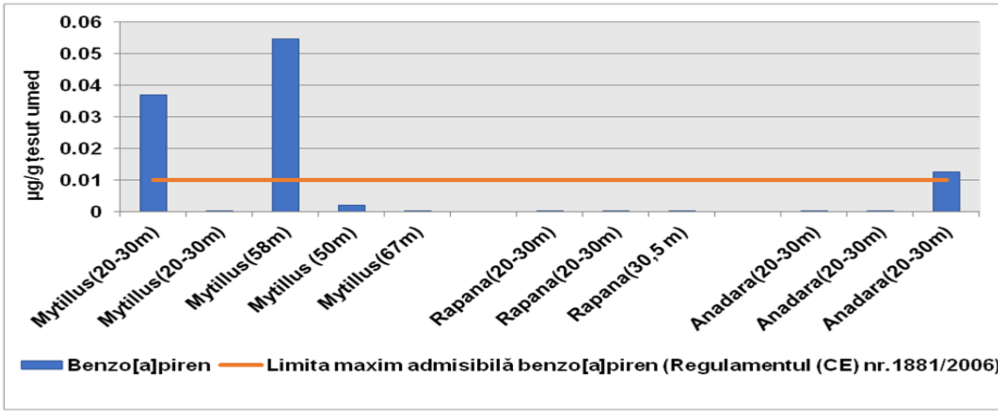
Source: NMRDI

** ERL values (µg/g dry sediment) established by US-EPA (1998) for polycyclic aromatic hydrocarbons in marine sediments (Long et al., 1980) and adopted by the OSPAR methodology (2008)*

In biota, the analysis of polycyclic aromatic hydrocarbons (PAHs) was conducted on samples of *Mytilus galloprovincialis*, *Anadara inequivalvis*, and *Rapana venosa* collected between May and September from the Romanian coastal area within the 20–60 m bathymetric range.
The values of individual compounds ranged from the detection limit to 1.1090 µg/g wet tissue, with the highest concentrations determined for naphthalene, fluorene, phenanthrene, fluoranthene, benzo[a]anthracene, and pyrene.
Among the three analyzed mollusk species, the highest concentrations were measured in *Mytilus galloprovincialis* and *Anadara inequivalvis*, where exceedances of the maximum permissible limit (0.01 µg/g wet tissue) specified by Regulation

(EC) No. 1881/2006 for benzo[a]pyrene, as a representative of this compound class, were observed in 0.4% of the analyzed samples (Figure II.132).

Figure II.132 The concentrations of benzo[a]pyrene in mollusks collected from the Romanian sector of the Black Sea in 2021, in relation to the maximum allowable limit



Source: NMRDI

Conclusions

The concentration of total petroleum hydrocarbons indicates a low level of pollution in the marine waters and a moderate level in sediments collected from the Romanian coast of the Black Sea in 2021.

With the exception of chrysene, benzo[b]fluoranthene, and benzo[k]fluoranthene, polycyclic aromatic hydrocarbons (PAHs) exceeded the detection limit in water, with exceedances of the maximum allowable values specified by current legislation occurring in 2 - 27% of the samples for phenanthrene, anthracene, fluoranthene, benzo[a]anthracene, and benzo(g,h,i)perylene.

In sediment, 1.3% of the total polycyclic aromatic hydrocarbons (PAHs) content exceeded the maximum allowable limit stipulated by current legislation, and concentrations of individual compounds (acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, benzo[a]pyrene, benzo(g,h,i)perylene, indeno(1,2,3-c,d)pyrene) surpassed the threshold defining good ecological status in 0.6 - 2% of the samples.

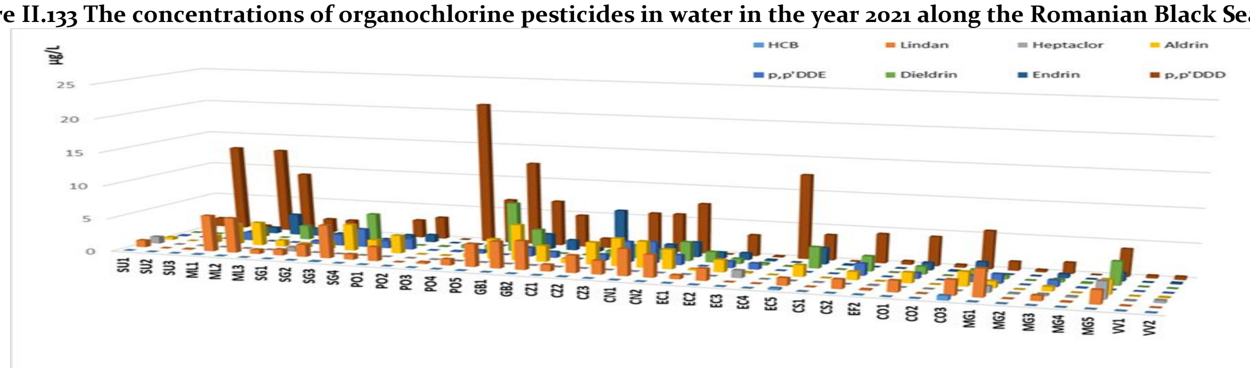
In biota, concentrations of polycyclic aromatic hydrocarbons suggest a low level of pollution, with benzo[a]pyrene exceeding the maximum allowable limit stipulated by current legislation in 0.4% of the analyzed samples.

Organochlorine pesticides and polychlorinated biphenyls

Organochlorine pesticides (HCB, lindane, heptachlor, aldrin, dieldrin, endrin, p,p' DDE, p,p' DDD, p,p' DDT) and Organochlorine pesticides (HCB, lindane, heptachlor, aldrin, dieldrin, endrin, p,p’ DDE, p,p’ DDD, p,p’ DDT) and polychlorinated biphenyls (PCB 28, PCB 52, PCB 101, PCB 118, PCB 138, PCB 153, PCB 180) were investigated in water, sediment, and biota.

In water, most of the values for HCB and heptachlor were below the detection limit (heptachlor – 70%, HCB – 67.5%), while the other organochlorine pesticides had values below the detection limit to a much lesser extent (p,p DDE – 32.5%, endrin – 30%, dieldrin – 27.5%, p,p’ DDT – 25%, aldrin – 20%, p,p’ DDD – 17.5%, lindane – 12.5%). The highest values were measured for p,p’ DDT at Sfântul Gheorghe 20 m (SG2) – 1811.11 µg/L, Mangalia 10 m (MG1) – 1628.30 µg/L, and Sfântul Gheorghe 30m (SG3) – 585.46 µg/L. The remaining compounds had values between 0.0044 and 21.11 µg/L (Figure II.133).

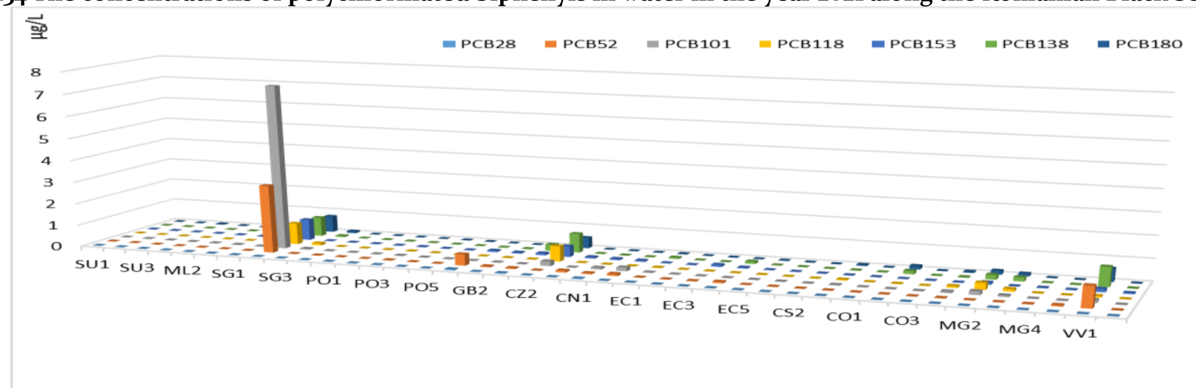
Figure II.133 The concentrations of organochlorine pesticides in water in the year 2021 along the Romanian Black Sea coast



Source: NMRDI

The concentrations of polychlorinated biphenyls were below the detection limit to a proportion of 92.5% – PCB28, 65% – PCB101, 62.5% – PCB52, PCB118, and PCB138, 55% – PCB153 and PCB180, and the detected concentrations ranged from 0.004 to 7.430 µg/L (Figure II.134).
Exceedances of the threshold values established for water, defining the good ecological status in accordance with Directive 2013/39/EU (Table II.46), were most frequently observed for the sum of cyclodienes (95%), lindane (82.5%), sum of DDT (82.5%), and p,p' DDT (75%).

Figure II.134 The concentrations of polychlorinated biphenyls in water in the year 2021 along the Romanian Black Sea coast



Source: NMRDI

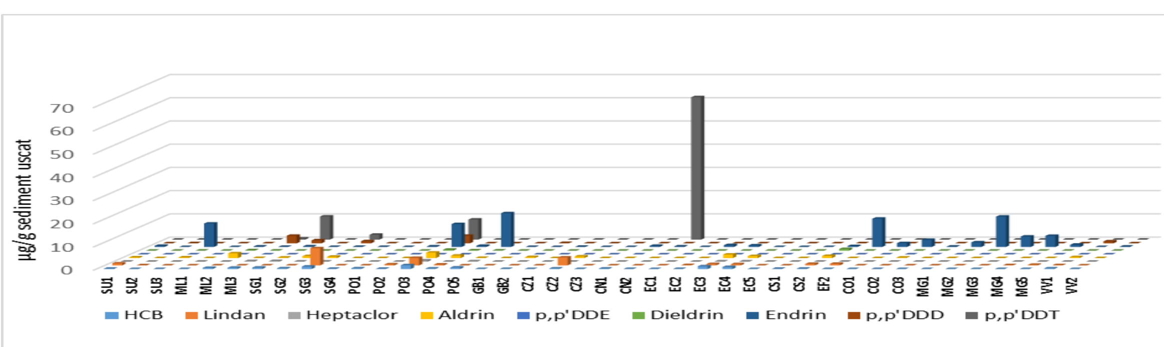
Table II.46 Exceedances of the proposed threshold values for organochlorine pesticides in water for defining good ecological status (in accordance with Directive 2013/39/EU)

Compound	Maximum allowed limit (µg/L)	Exceeding the limit maximum allowed (%)
HCB	0.05	10
Lindane	0.02	82.5
Heptachlor	0.00003	30
Sum of cyclodienes	0.005	95
p,p' DDT	0.010	75
Sum of DDT	0.025	82.5

Source: NMRDI

The highest concentrations of polychlorinated biphenyls (PCBs) were observed in the areas Sfântul Gheorghe 20m (SG2), Gura Buhaz 5m (GB1), Cazino Mamaia 20m (CZ2), Mangalia 20m (MG2), Mangalia 39m (MG3), and Vama Veche 10m (VV1), particularly for PCB52, PCB101, PCB118, and PCB153 (Figure II.114 - II.134). Threshold values defining a good ecological status for PCBs have not been established yet.
In sediment, concentrations of organochlorine pesticides ranged from the detection limit to 61.34 µg/g dry sediment. The highest concentrations were measured in Sulina 30m (SU3), Sfântul Gheorghe 30m (SG3), Sfântul Gheorghe 40m (SG4), Portița 30m (PO3), Portița 57m (PO5), Constanța Nord 20m (CN2), Eforie Sud 20m (EF2), and Mangalia 20m (MG2), especially for lindane, endrin, and p,p' DDT (Figure II.135).

Figure II.135 Concentrations of organochlorine pesticides measured in sediment, in 2021, on the Romanian coast of the Black Sea



Source: NMRDI

Exceedances of the threshold values proposed for defining a good ecological status were observed primarily for HCB and lindane (Table II.47). Threshold values for defining a good ecological status in sediment have not yet been proposed for heptachlor, aldrin, endrin, p,p' DDD, and p,p' DDT.

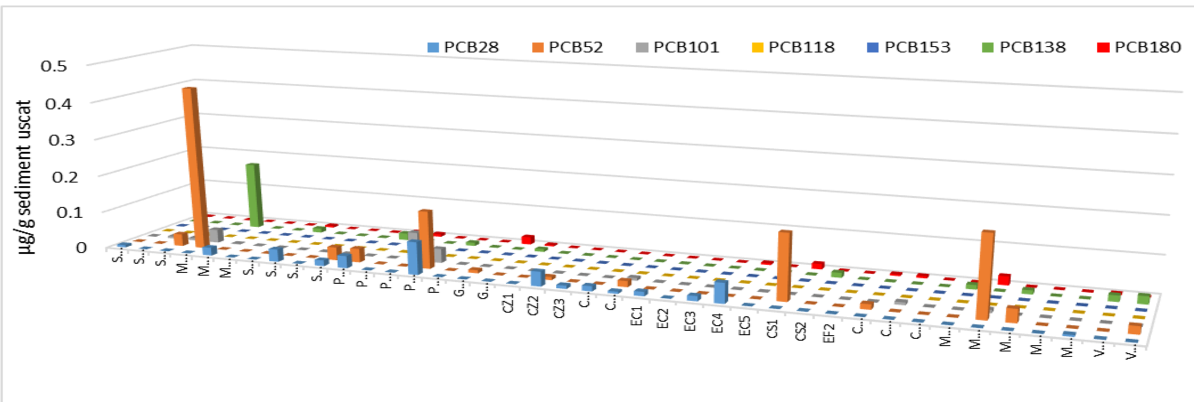
Table II.47 Exceedances of the proposed threshold values for organochlorine pesticides in sediment, for the purpose of defining good ecological status

Compound	Maximum allowed limit (µg/g)	Exceeding the maximum allowed limit (%)
HCB	0.02	57.5
Lindane	0.003	40
Dieldrin	0.022	2.5
p,p' DDE	0.002	17.5

Source: NMRDI

The concentrations of polychlorinated biphenyls varied between the detection limit and 0.44 µg/g dry sediment. Values below the detection limit were observed in a high percentage of samples (between 67.5% and 100%). The concentrations of PCB 28, PCB52, PCB 101, PCB 118, PCB 153, PCB 138 and PCB 180 did not exceed the proposed threshold values for defining good ecological status (figure II.136).

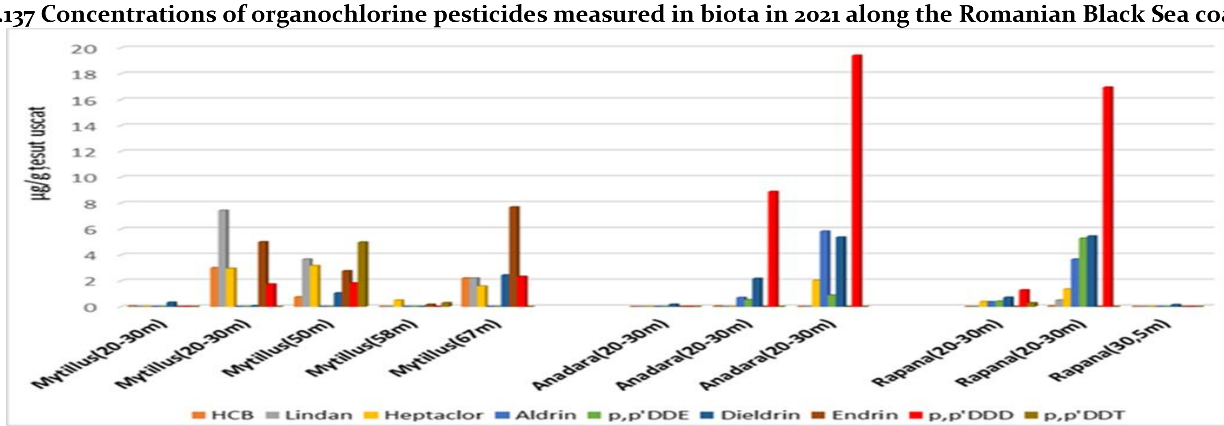
Figure II.1136 Concentrations of polychlorinated biphenyls measured in sediment in the year 2021 along the Romanian Black Sea coast



Source: NMRDI

The bioaccumulation of persistent organic pollutants was studied in samples of *Mytilus galloprovincialis, Anadara inequivalvis and Rapana venosa*, taken from the Romanian coastal area, bathymetric strip 20-70m.
The values of organochlorine pesticides varied between the detection limit and 19.42 µg/g of dry tissue. The highest concentrations were observed for aldrin, dieldrin, p,p' DDD and p,p' DDE (figure II.137).

Figure II.137 Concentrations of organochlorine pesticides measured in biota in 2021 along the Romanian Black Sea coast

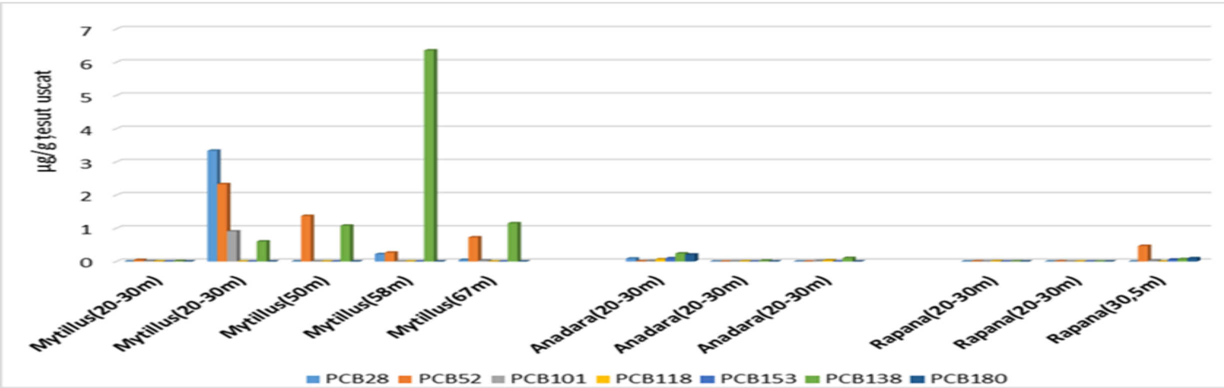


Source: NMRDI

The current legislation (Directive 2013/39/EU) establishes threshold values for good ecological status only for heptachlor and HCB in biota. These values were exceeded by 68.75% for heptachlor and 50% for HCB.

Concentrations of polychlorinated biphenyls (PCBs) varied between the detection limit and 6.36 µg/g dry tissue. In Mytilus samples, higher concentrations were determined for PCB 28 (3.33 µg/g dry tissue), PCB 52 (2.33 µg/g dry tissue), PCB 101 (0.90 µg/g dry tissue), and PCB 138 (6.36 µg/g dry tissue). In Rapana, higher concentrations were detected for PCB 52 (0.468 µg/g dry tissue). Elevated values were observed in Anadara for PCB 138 (0.240 µg/g dry tissue), PCB 180 (0.207 µg/g dry tissue), PCB 153 (0.095 µg/g dry tissue), and PCB 118 (0.066 µg/g dry tissue) (Figure II.138).

Figure II.138 The concentrations of polychlorinated biphenyls measured in biota in the year 2021 along the Romanian coast of the Black Sea



Source: NMRDI

Exceedings of the proposed threshold values for the definition of good ecological status were observed for all compounds, in proportions between 8.33 and 75% (table II.48).

Table II.48 Exceedings of the proposed threshold values for polychlorinated biphenyls (PCBs) in biota, in order to define good ecological status

Compound	Maximum allowed limit (µg/g)	Exceeding the maximum allowed limit (%)
PCB28	0.0032	33,33
PCB52	0.0054	66,66
PCB101	0.006	50
PCB118	0.0012	41.66
PCB153	0.08	8.33
PCB138	0.0158	75
PCB180	0.024	16.66

Source: NMRDI

Conclusions

In 2021, frequent exceedances of the proposed threshold values for water, aiming to define good ecological status, were observed for the sum of cyclodienes (95%), lindane (82.5%), the sum of DDT (82.5%), and p,p' DDT (75%). High concentrations were measured for p,p' DDT in the Sfântul Gheorghe and Mangalia stations.

Higher concentrations of polychlorinated biphenyls were observed in the Sfântul Gheorghe, Gura Buhaz, Cazino Mamaia, Mangalia, and Vama Veche areas, especially for PCB52, PCB101, PCB118, and PCB153.

In sediments, elevated concentrations were measured for lindane, endrin, and p,p' DDT in Sulina, Sfântul Gheorghe, Portița, Gura Buhaz, Constanța Nord, Eforie Sud, and Mangalia areas. Exceedances of the proposed threshold values for defining good ecological status in sediment were recorded for HCB (57.5%) and lindane (40%).

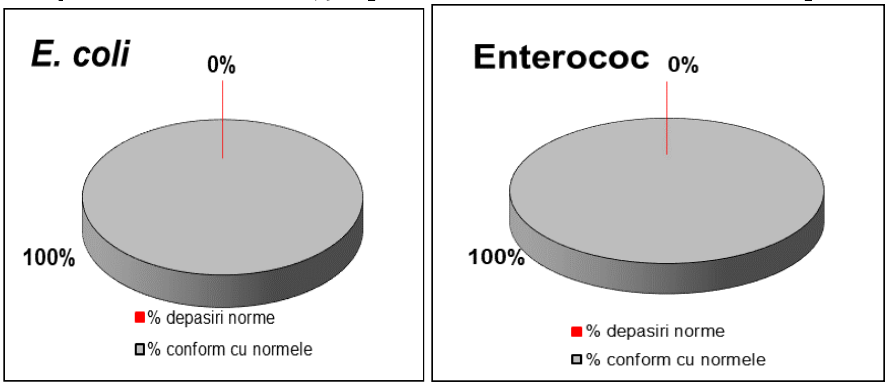
Concentrations of polychlorinated biphenyls did not exceed the proposed values for defining good ecological status, with a high percentage of samples below the detection limit (ranging from 67.5% to 100%).

In biota, the highest concentrations of organochlorine pesticides were observed for aldrin, dieldrin, p,p' DDD, and p,p' DDE in all analyzed species, while polychlorinated biphenyls showed high values in *Rapana and Anadara*. Exceedances of the proposed threshold values for defining good ecological status were observed for all compounds, ranging from 8.33% to 75%.

Microbiological load

The microbiological load, an indicator of environmental contamination in the marine environment, was excellent in the southern area of the Romanian coast (Baia Mamaia) in 2021. The concentrations of enterobacteria recorded (*Escherichia coli*/ E. coli; intestinal enterococci) generally fluctuated below the limits set by National Regulations and European Community Directives (0 – 35.9 intestinal enterococci/100 ml and 0 – 68.2 E. coli/100 ml).
The maximum values of the analyzed bacterial indicators (>10,000 bacteria/100 ml) were identified, as in previous years, in areas influenced by wastewater discharges, potentially having a negative impact on the marine environment and human health.

Figure II.139 The proportion of marine water analyzes from the southern coastal area (Baia Mamaia), which exceeds the recommended and mandatory values (based on the 95th percentile evaluation), in the summer period 2021



Source: NMRDI

Marine waste

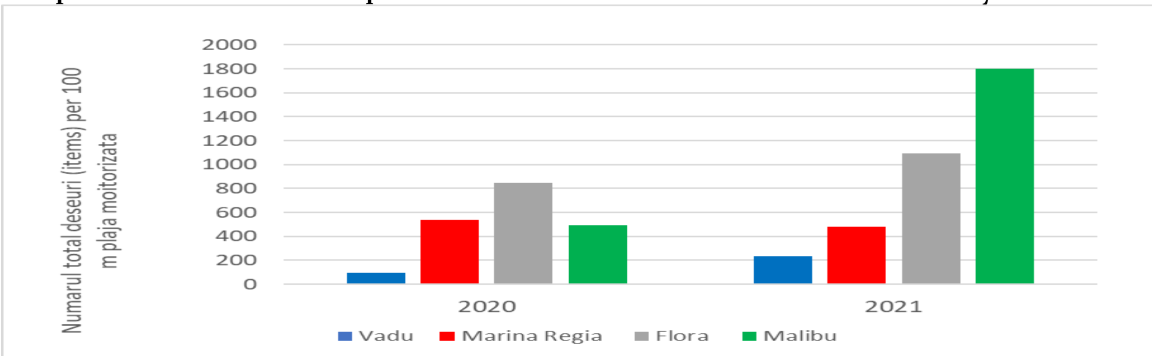
Monitoring of marine litter on the Romanian coast was conducted in 2021 in accordance with the requirements of the Marine Strategy Framework Directive (2008/56/EC) for Descriptor D10 ("*Properties and quantities of marine litter do not cause harm to the coastal and marine environment*"). The assessment focused on two major marine compartments of the Black Sea: the beach and the water column and seafloor. The main evaluation criterion used was *Criterion C10.1 - Characteristics of marine and coastal litter*.
Beach litter was assessed based on the methodology specified in the "Monitoring Guidance for Marine Litter in European Seas" developed by the Technical Group for D10 Marine Litter of the European Commission (JRC, 2013) and the Marine Litter Watch App at stations located on the Vadu, Maria Regia Beach (Mamaia Nord), Flora (Mamaia Sud area), and Malibu (Mamaia Sud area) beaches during the 2021 tourist season (Figure II.140).

Figure II.140 The map of marine litter monitoring stations on Romanian beaches in 2021 (Photo: National Institute for Marine Research and Development 'Grigore Antipa' - Constanța)

Source: NMRDI

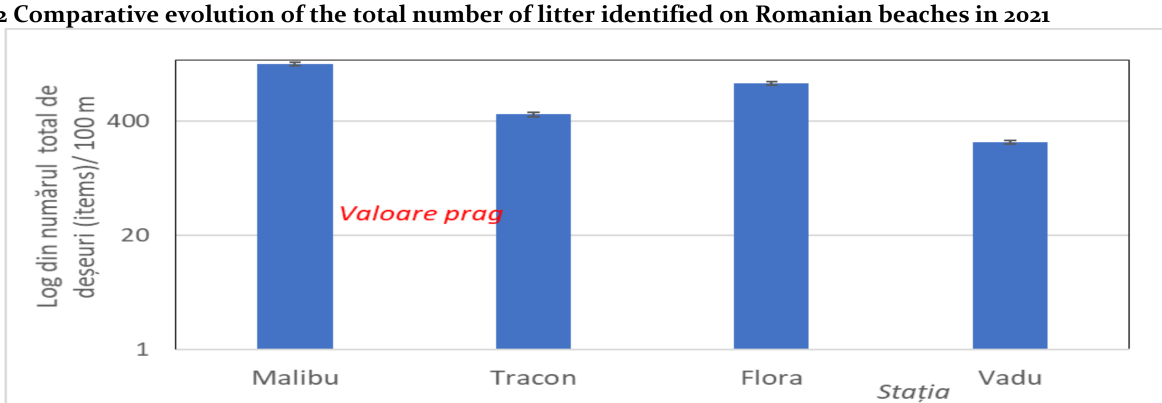
The monitoring results for the year 2021 indicated a continuation of the general trend of increasing total macro-litter on Romanian beaches, exceeding the European threshold value of 20 litter items/100 m (Van Loon et al., 2020). This trend was observed in the beaches in the southern part of the Romanian coast (Malibu and Flora) compared to the northern part (Vadu), which exhibited cleaner beaches (Figure II.141 and Figure II.142). These values reflect the failure to achieve the Good Environmental Status (GES) of the marine environment for the D10 descriptor in 2021.

Figure II.141 Comparative evolution of total quantities of macro-litter on Romanian beaches in the years 2020 and 2021



Source: NMRDI

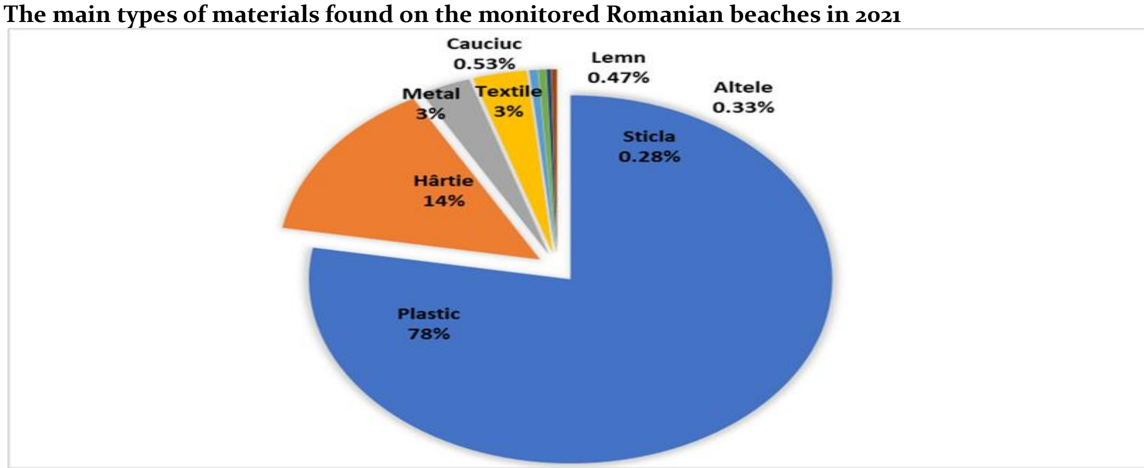
Figure II.142 Comparative evolution of the total number of litter identified on Romanian beaches in 2021



Source: NMRDI

In terms of material types, plastic also constituted the dominant material (78%) on the analyzed beaches, with the remaining 22% being represented by paper/cardboard (14%), metal (3%), textiles (3%), and in an extremely low percentage, glass/ceramic (0.28%), wood materials (0.46%), rubber (0.53%), and others (e.g., chemicals 0.33%) (Figure II.143).

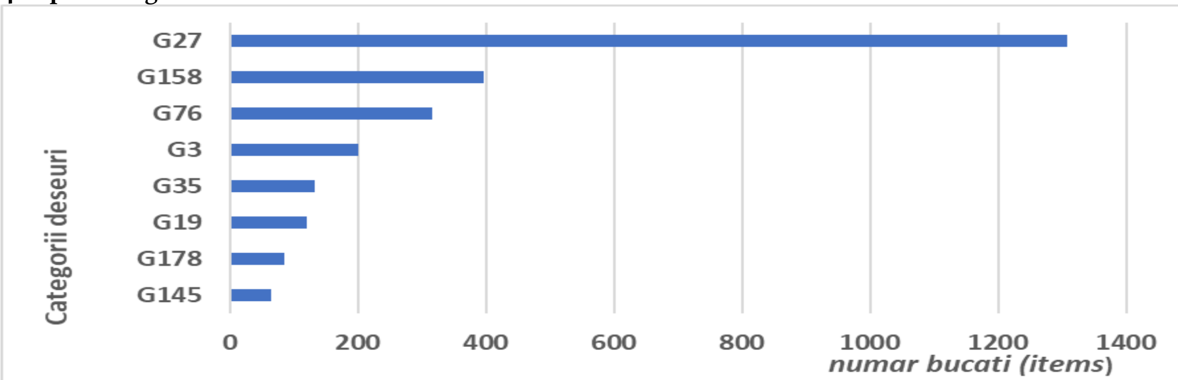
Figure II.143 The main types of materials found on the monitored Romanian beaches in 2021



Source: NMRDI

The main waste category on the beaches in 2021 remained G27 (cigarette butts and filters), followed by G158 (other paper fragments), G76 (pieces of plastic/polystyrene 2.5 cm > - < 50cm), G3 (shopping bags), G35 (cutlery and trays/straws and stirrers), G19 (plastic bottle caps/lids), G178 (caps/metal rings from beverage bottles/cans), G145 (other textiles). Cigarette butts recorded in 2021 amounted to 1,308 pieces or 35% of the total plastic waste collected from beaches in the northern Romanian sector, maintaining their position as the top waste item in the top 10 recorded wastes on Romanian beaches.

Figure II.144 Top 10 categories of waste identified on Romanian beaches monitored in 2021



Source: NMRDI

Waste deposited on the seabed or benthic waste *(bottom litter)*

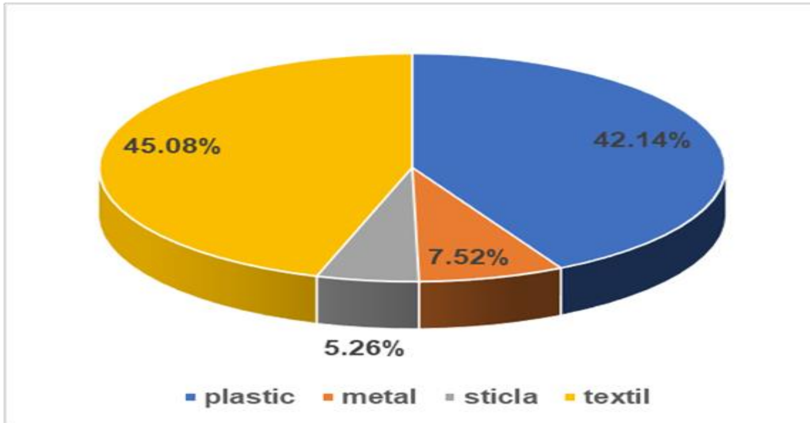
The monitoring of benthic litter was carried out in 2021 in association with demersal fishing activities conducted annually at the National Institute for Marine Research and Development "Grigore Antipa" (NMRDI). The methodology used followed the European marine area guidelines (Galgani et al., 2013), adhering to the MEDITS protocol, 2017. As in previous years, the collection of litter from the seabed was performed using a bottom trawl (22/27-34 m), a fishing tool towed by the research vessel "Steaua de mare 1" at a trawling speed of 1.7 – 2.5 knots and a duration of 50-60 minutes/trawl. The monitoring operations for benthic litter through trawling in 2021 took place in the marine sector between Vama Veche and Sulina, at isobaths of 12 – 65 m, during three trawling expeditions (in the spring and autumn of 2021) with a bottom trawl, each lasting 10 days. Out of a total of 188 trawls conducted in 2021, benthic litter was identified in only 27 trawling operations. The total quantity of litter collected in 2021 from the trawled area (7779.34 m2) was 11.65 kg (Figure II.145).

Figure II.145 Examples of benthic litter types identified during trawls in 2021. From left to right: plastic, glass (top). Debris collected with a beam trawl (metal) (bottom) (Photo: National Institute for Marine Research and Development Constanta)

Source: NMRDI

During the demersal fishing operations with the beam trawl, the area covered by the 108 trawls was 7779.34 m2, and the total amount of waste collected was 11.65 kg. In terms of types, the waste consisted of various materials (textile fabrics, plastic, metal, glass), with textiles and plastic predominating. However, regarding plastic waste, the average quantity was very low relative to the trawled area, specifically 0.0002 items/m2 of waste. The percentage composition of these waste items in the total by category is presented in the figure below (Figure II.146).

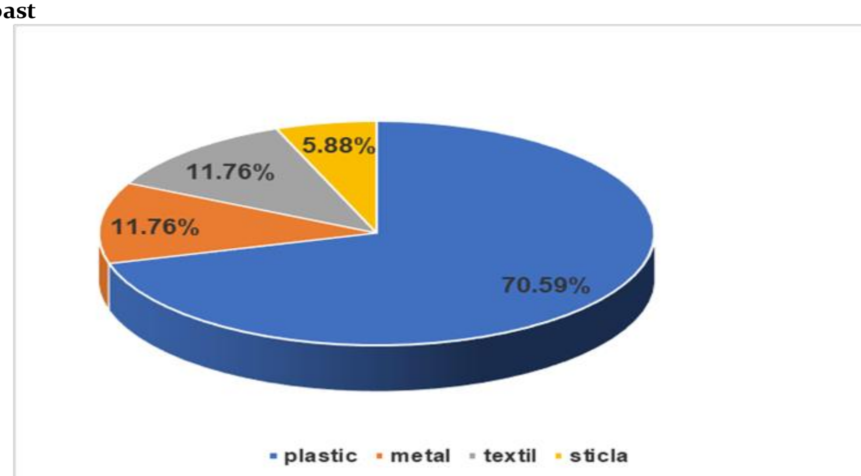
Figure II.146 The overall composition (%) of types (categories) of bottom litter waste identified through demersal trawling in 2021 on the Romanian coast



Source: NMRDI

Also, the following types of marine waste were monitored during the 2021 expedition organized with the beam trawl tool for the species Rapana venosa: plastic, metal, glass, textile materials (figure II.147).

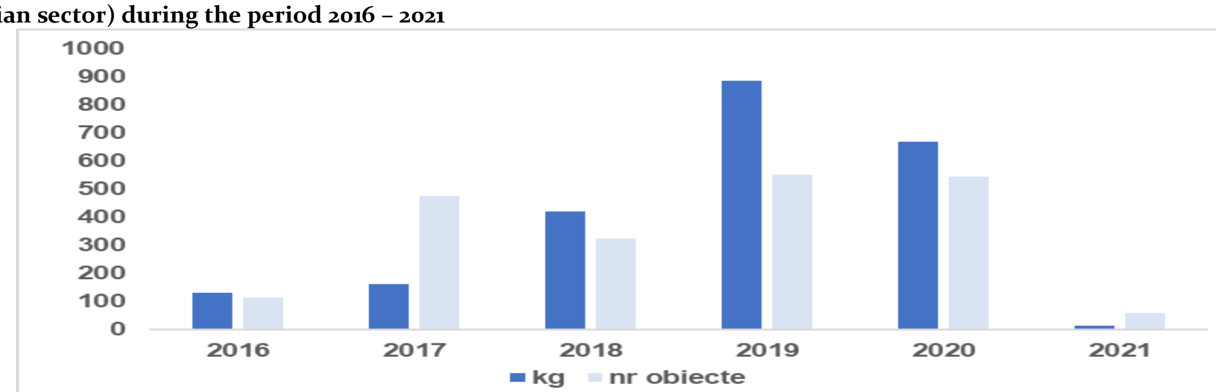
Figure II.147 The overall composition (%) of types (categories) of bottom litter waste identified through beam trawl trawling in 2021 on the Romanian coast



Source: NMRDI

During 2021, the decreasing trend was maintained both in terms of the amount of waste identified and the number of objects (items) identified (figure II.148).

Figure II.148 Comparative evolution of the total annual amount of bottom litter waste collected from the Black Sea bottom (Romanian sector) during the period 2016 – 2021



Source: NMRDI

Sea water temperature and salinity

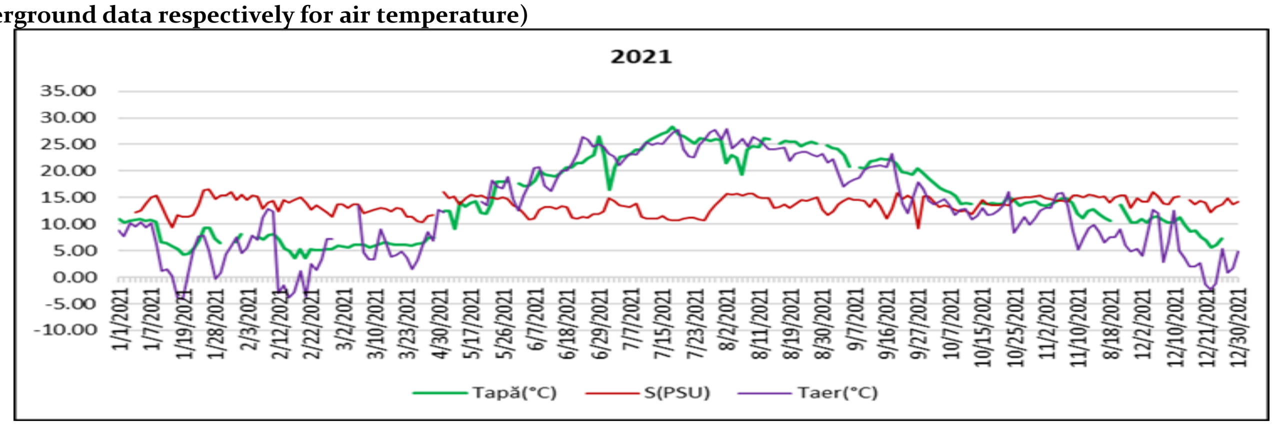
RO 51
Indicator code Romania: RO 51 EEA indicator code: CLIM 13
TITLE: INCREASING SEA WATER TEMPERATURE
DEFINITION: This indicator can be defined by: the annual average of surface sea water temperature anomalies; the trend of the annual average sea water temperature at the surface.

Temperature and salinity variations were analyzed in the coastal area, based on the records made at the Mamaia oceanographic station (figure II.169) and in the offshore area, based on the data collected in the NMRDI expeditions carried out in the months of May-June, August-September and November (figures II.170 – II.174).

The thermal regime in the Romanian coastal area

From the analysis of the data recorded at the Mamaia station (N=198), it can be observed that, in the Romanian coastal area of the Black Sea, most of the average monthly air temperatures were positive, due to the influence of the sea on the moderate continental climate in this coastal area, but also to the particularities climate of 2021, one of the seven warmest years on record according to the World Meteorological Organization (WMO).

Figure II.149 Daily evolution of air temperature, sea water temperature and salinity at Constanța station, in 2021 (NMRDI and Wunderground data respectively for air temperature)

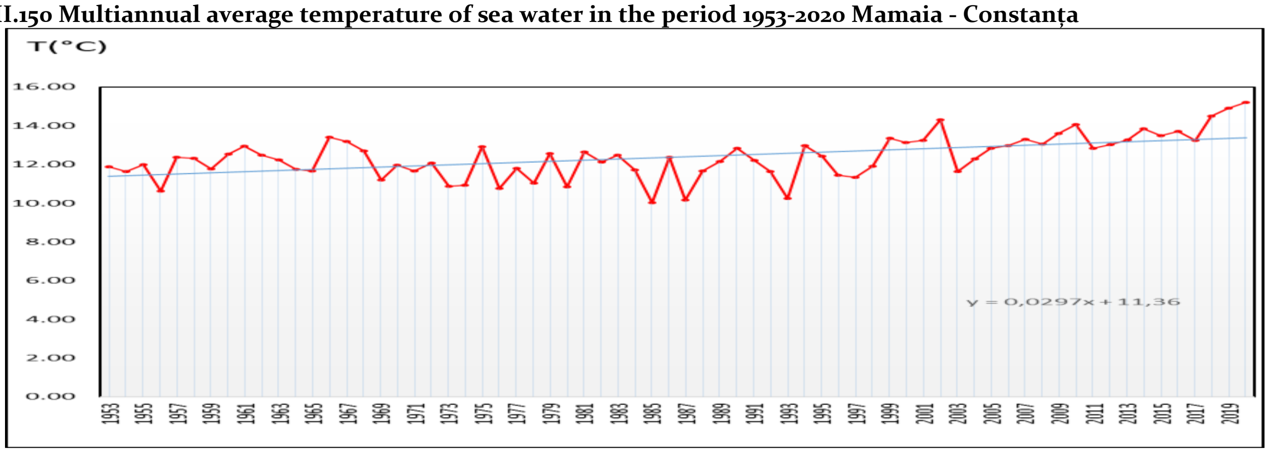


Source: NMRDI

The maximum measured daily temperature of the sea water, of 28.3°C, was recorded in July associated with the air temperature (figure II.169), exceeding the maximum value of the water temperature in July of the previous year, of 26.5°C by 1.8°C.

Compared to the reference period of the last 60 years, the year 2021 is characterized by a significant trend of increasing temperatures compared to the multiannual average, in the active surface layer of sea water (figure II.150).

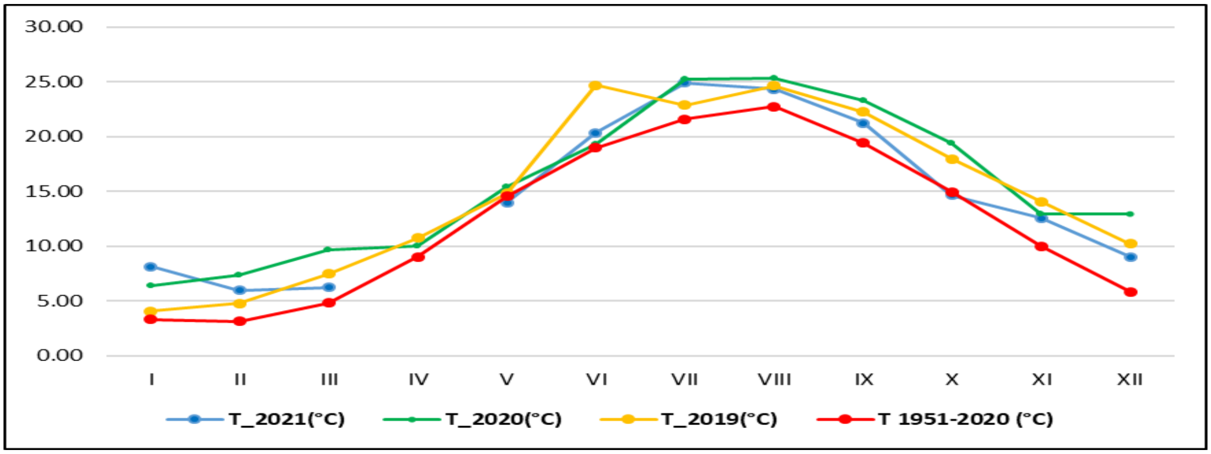
Figure II.150 Multiannual average temperature of sea water in the period 1953-2020 Mamaia - Constanța



Source: NMRDI

The average sea water temperatures recorded in 2021 in Constanța exceeded the multiannual averages almost throughout the year, with only the months of May and October falling within normal limits with temperatures of 14°C. This trend of increasing sea water temperature can be seen comparatively in figure II.151 in the values of the last three years, 2019-2021, and can be considered as an indicator of global climate change.
Thus, the average temperature of the sea water in Constanța in 2021 (average 2021 = 14.30°C), compared to the average of the last 60 years of the analyzed period, was 1.91°C higher (average 1959 – 2020 = 12.39°C).

Figure II.151 Average monthly temperatures (2019, 2020, 2021)/multiannual monthly averages (1953-2020) at the Mamaia – Constanța station

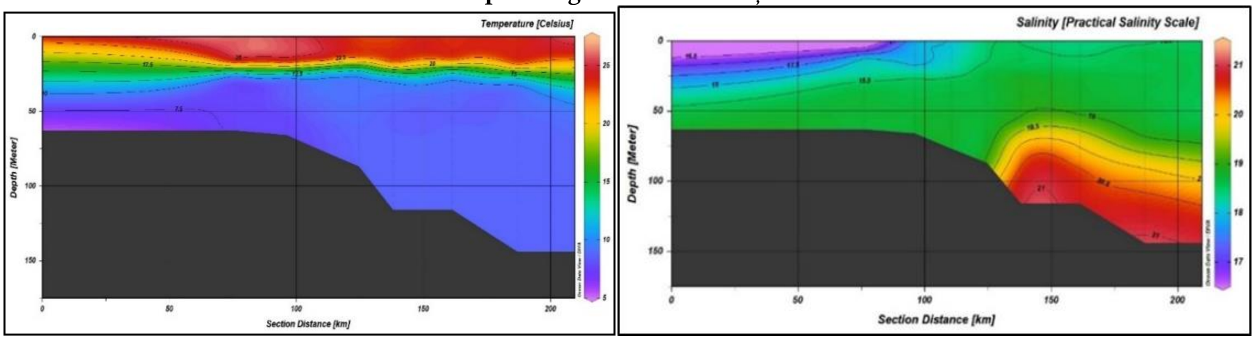


Source: NMRDI

Saline regime at the coast
The salinity in the Romanian coastal zone is strongly influenced by the riverine input from the north-western part of the Black Sea basin and the marine current regime in the coastal area. According to historical data held by INCDM over the course of a year, salinity shows the lowest monthly average in March, after which salinity values start to rise, peaking in December.
In 2021, the coastal zone was affected by both the variations in the rainfall regime in the Danube River basin and the influence of marine currents induced primarily by wind and the Coriolis force, which acts at the level of the western basin of the Black Sea.
At the Constanța station, an average annual salinity of 13.59 PSU was recorded. The minimum salinity recorded in Constanța was 9.26 PSU on September 27 and 9.43 PSU on January 15 (Figure II.149). The maximum salinity values on the coast, of 16.5 PSU, were recorded in the cold season on January 31.
A significant variation in the salinity gradient of 7.07 PSU was observed in January due to an upwelling phenomenon, in the context of persistent winds from the western and south-western sectors in the second half of January. The upwelling phenomenon, as a coastal process of movement of coastal water masses under the influence of the Coriolis force and winds from the southeast, south, southwest, and west, leads to an offshore inclination of the sea surface. Subsequently, to balance the mass budget, it results in the uplifting of cold, deep water masses with high density (high salinity values) close to the coast.

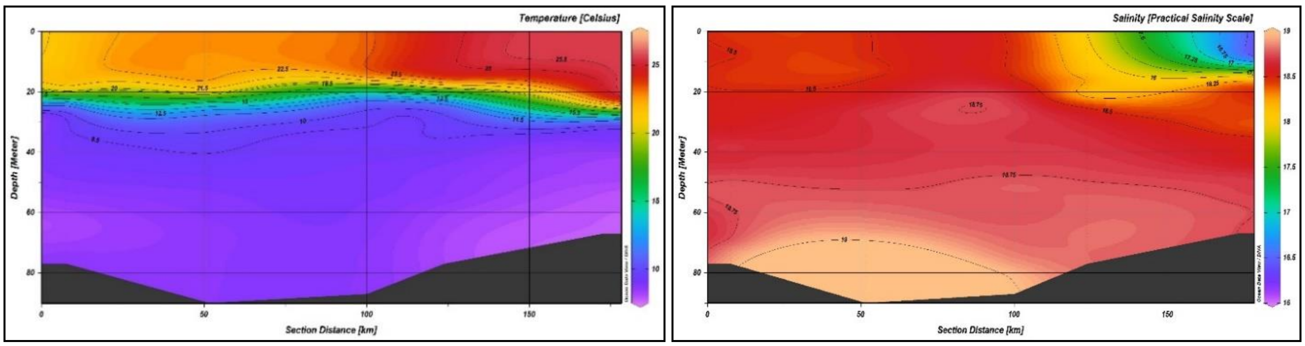
Offshore area
In oceanographic practice, water masses are identified through two essential characteristics, temperature and salinity, considered conservative (they are not generated and do not disappear through internal processes, changes occur only through interactions at interfaces with other environments). Variations in these parameters can occur due to the action of external sources: mixing with fresh waters from the continental area, heating processes due to solar radiation, phenomena that can significantly affect the dynamics of water masses. In the offshore areas related to the Romanian continental shelf, hydrophysical parameters measured in the period of August - September allowed for visualizing data on water mass dynamics in the western basin of the Black Sea, including thermal stratification and salinity concentration with depth (Figure II.152 and Figure II.153).
Thus, interpolation throughout the water column of the water temperature recorded on profiles at oceanographic stations showed values ranging from 7.45°C on August 29, recorded at a depth of 47m in the Vama Veche area, to 26.34°C recorded on August 30 at a depth of 5m in the northern part of the Romanian shelf.

Figure II.152 The distribution in a cross-section perpendicular to the shore of temperature and salinity during August-September 2021 in the continental shelf area corresponding to the Constanța zone



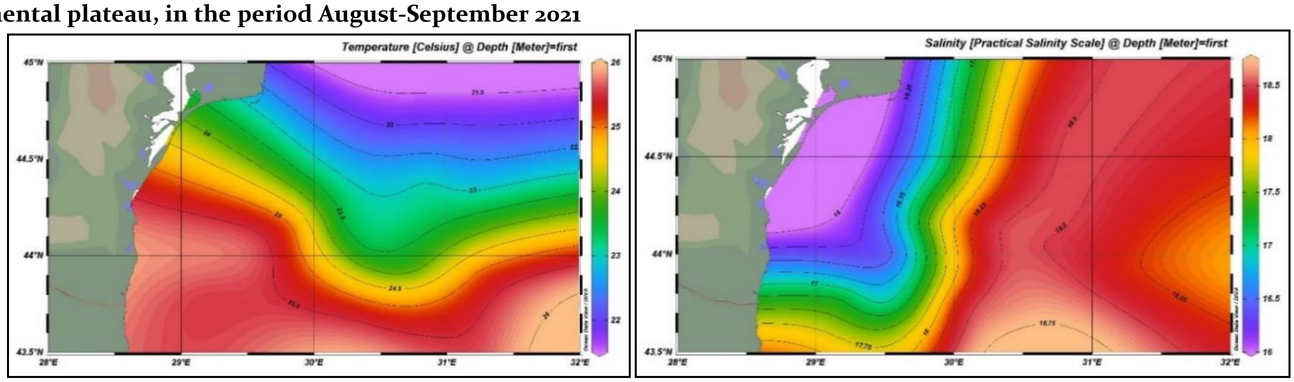
Source: NMRDI

Figure II.153 Distribution in north-south section of temperature and salinity during August September 2021 in the area of the continental shelf



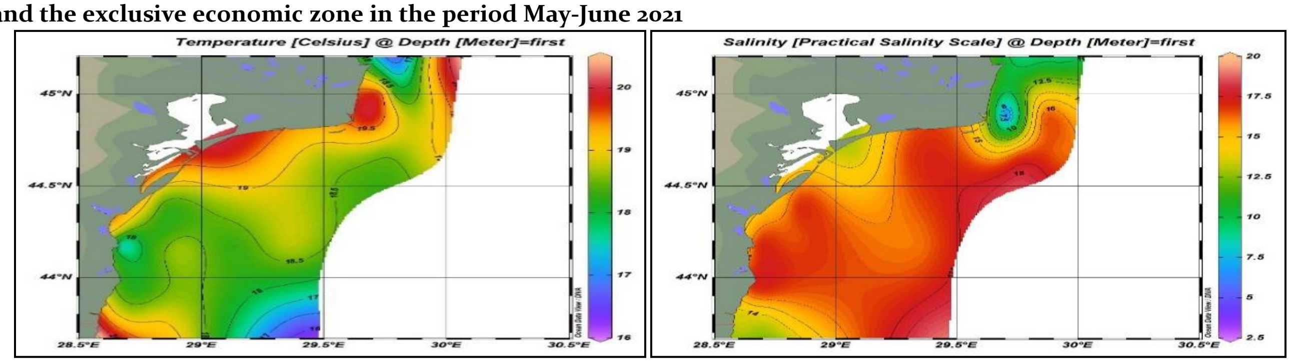
Source: NMRDI

Figure II.154 Horizontal distribution on the surface (0.00 - 1m), of temperature and respectively salinity, along the Romanian continental plateau, in the period August-September 2021



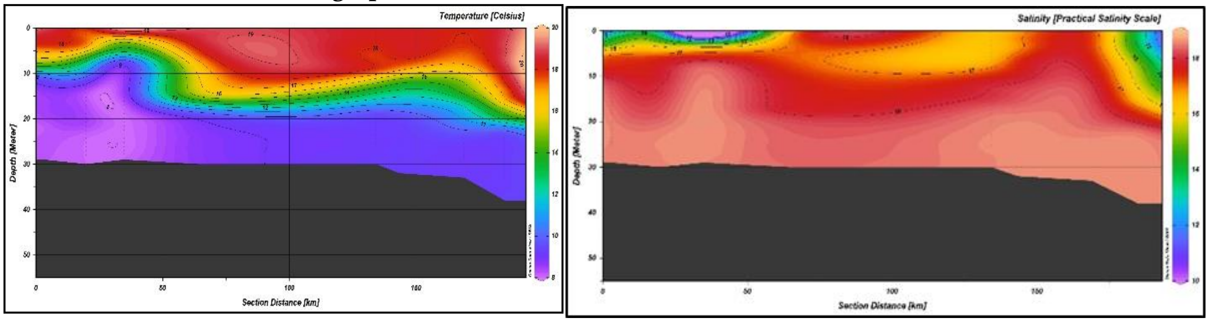
Source: NMRDI

Figure II.155 Horizontal distribution in the surface layer (0.00 -1m) of temperature and, respectively, salinity in the coastal zone and the exclusive economic zone in the period May-June 2021



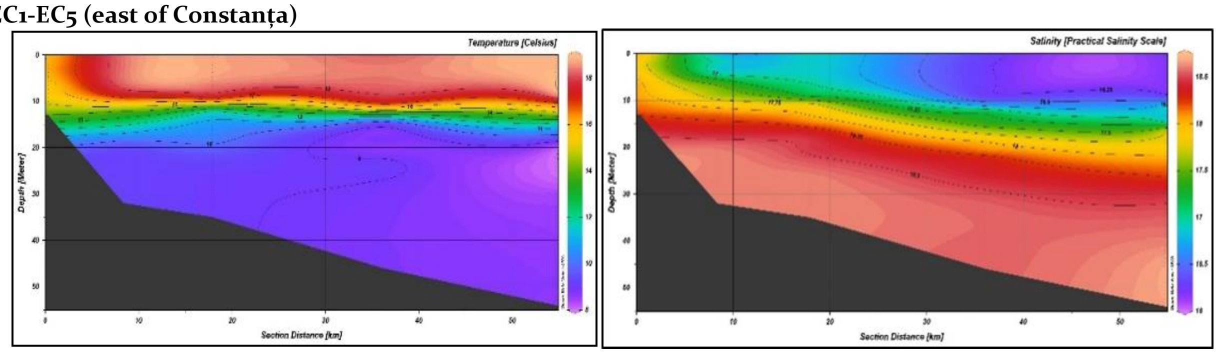
Source: NMRDI

Figure II.156 The distribution in the north-south section of temperature and salinity respectively, in the period May-June 2021, data collected in the network of oceanographic stations



Source: NMRDI

Figure II.157 The distribution in a cross-section perpendicular to the shore of temperature and salinity, during May-June 2021, stations EC1-EC5 (east of Constanța)

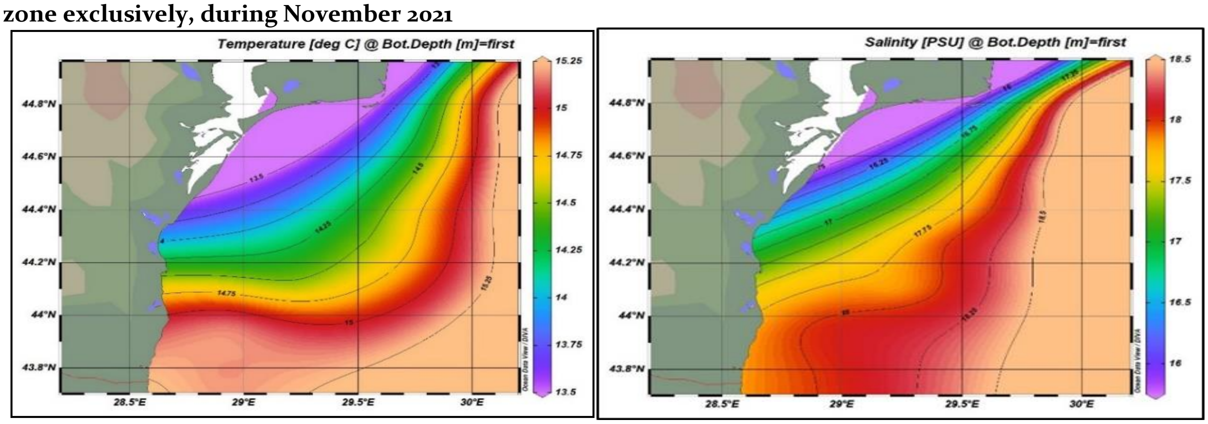


Source: NMRDI

The minimum values belong to the Cold Intermediate Layer (CIL ≤ 8°C) corresponding to the Est-Constanța transect, starting from the shore/station East Constanța 1 (ECTA1) at a depth of 15m, to station East Constanța 5 (EC5), at a depth of approximately 60m, towards the Viteaz Canyon area. The vertical distribution of water temperature depends on the atmospheric thermal regime and dynamic factors of the sea (currents and waves) that cause the mixing of water masses. The minimum temperature during May-June of 7.3°C was recorded on May 28th at a depth of 37m in the Gura Portiței area, at the isobath of 55m, and a salinity of 18.59 PSU. The maximum temperature of 20.44°C was recorded on May 27th in the surface layer, in the Sfântu Gheorghe area, at the isobath of 20m, with a salinity of 7.3 PSU.

In November, the minimum temperature of 9.83°C was recorded in the northern area of the Romanian shelf at a depth of 55m, corresponding to a salinity of 18.5 PSU. The maximum temperature of 15.4°C was recorded in the depth interval of 14-19m, in the area of the southern Romanian coast (Mangalia station, at the isobath of 50m), with a salinity of 18.3 PSU. In the surface layer, temperatures remained in the range of 13.4°C in the Sf. Gheorghe area (isobath of 40m) to 15.2°C in the Costinești area (isobath of 50m). Associated with these temperatures, salinity values in the surface layer varied between 15.14 PSU in the Sf.Gheorghe area and 18.11 PSU in the Tuzla-Costinești area (Figure II.158).

Figure II.158 Horizontal surface distribution (0.00 -1m) of temperature and salinity, respectively, in the coastal zone and the economic zone exclusively, during November 2021



Source: NMRDI

Conclusions

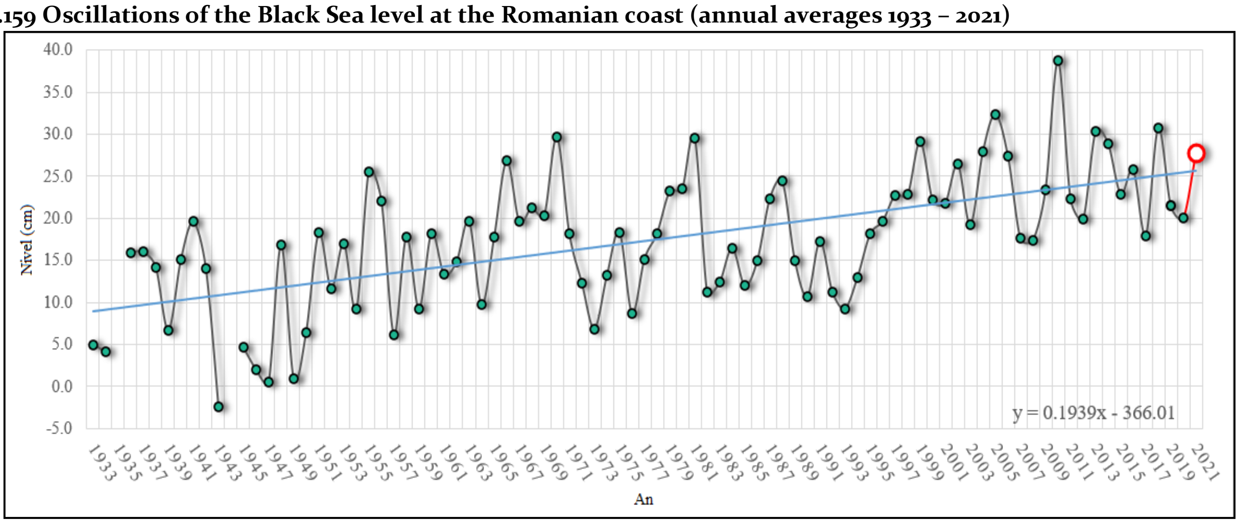
In 2021, the average sea water temperatures at Constanța exceeded the multi-year averages for almost the entire year, except for the months of May and October, which fell within the 14°C range of multi-year averages. The maximum temperature of 28.3°C, recorded at the Mamaia oceanographic station in July, was above the multi-year average of 21.6°C over the past 67 years.
During May-June, on the Romanian shelf, minimum temperature values of 7.3°C were recorded at a depth of 37m in the Gura Portiței area. The maximum temperature of 20.44°C was recorded in the surface layer in the Sfântu Gheorghe area.
The salinity of seawater in the Romanian coastal zone is strongly influenced by the riverine input from the northwest of the Black Sea basin. On the shelf area, the lowest salinity value of 4.17 PSU during May-June was recorded in the surface layer at the mouth of the Sf. Gheorghe arm, station SG3, during the oceanographic expedition conducted by INCDM. The highest salinity value of 19.53 PSU was recorded in the Mangalia area, station MG5, at a depth of 60m, during the same expedition.
In the nearshore zone, according to data collected at the Mamaia station, salinity recorded the lowest monthly averages in March, June, and July at 12.42 PSU, 12.16 PSU, and 12.17 PSU, respectively. The maximum values of monthly salinity averages were recorded in November, December, and May, at 14.97 PSU, 14.26 PSU, and 14.92 PSU, respectively.
Marine agitation parameters for the year 2021 in the Constanța area highlight a predominance of waves with average heights of less than 1m, with a maximum wave frequency in March at 84.06% and in May at 85.00%. A peak in sea agitation of 5 – 6, with maximum wave heights of 2.5m from the N direction and a period of 5.1s, was determined in January. Waves from the E-SE sector also had a high frequency, indicating the exposure of the Romanian coast to marine factors.

Sea level

RO 50
Indicator code Romania: RO 50 EEA indicator code: CLIM 12
TITLE: SEA LEVEL RISE AT GLOBAL, EUROPEAN AND NATIONAL LEVEL
DEFINITION: The indicator reflects the change in mean sea level, the absolute evolution of sea level using satellite data.

In the case of variations in sea level along the Romanian coast, the predominant factors are meteorological and hydrological, with tides governed by astronomical factors being small. In figure II.159, records of the OTT tide gauge from the Port of Constanța can be observed.

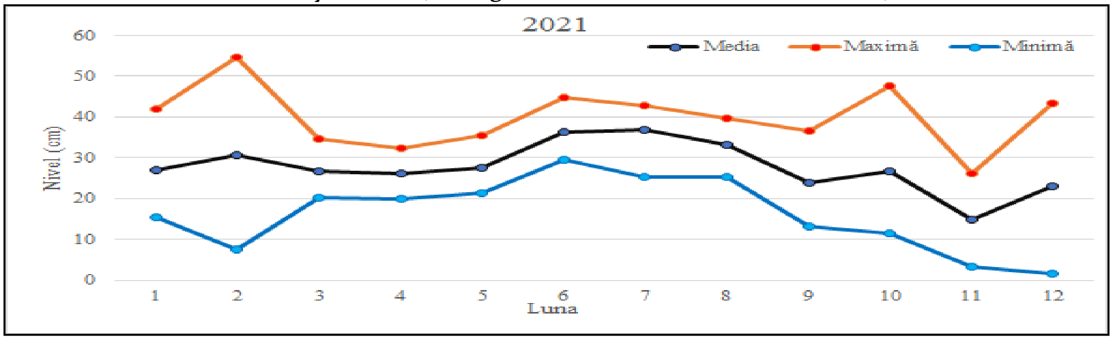
Figure II.159 Oscillations of the Black Sea level at the Romanian coast (annual averages 1933 – 2021)



Source: NMRDI

Regarding the sea level for the year 2021 (figure II.160), it had an average value of 27.71 cm, which denotes an increase in the level compared to the multi-year average of 17.47 cm (1933-2021). The maximum value recorded was 54.50 cm on February 8 and the minimum value was 1.60 cm on December 1.

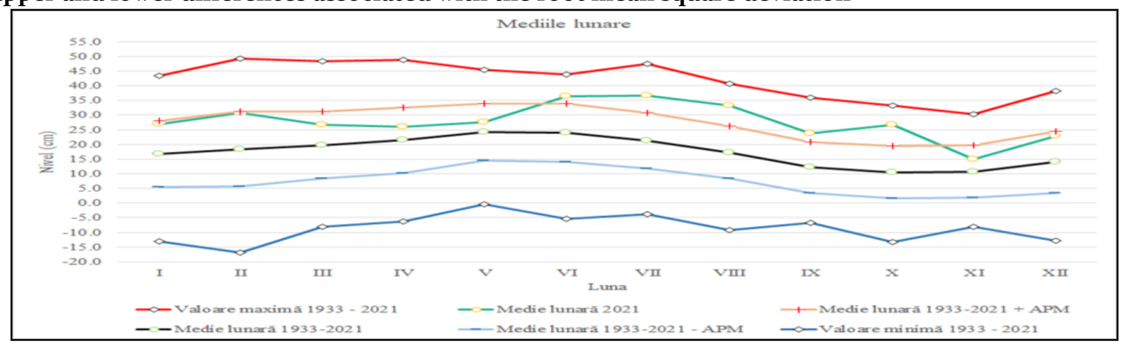
Figure II.160 Sea level fluctuations for the year 2021 (average maximum and minimum values)



Source: NMRDI

The sea level variation in Constanța in the long term is similar to the global variation, having the same growth rate of 1.9 mm/year.

Figure II.161 Monthly means, maximums, and minimums for the period 1933 – 2021, alongside the monthly average for the year 2021 and the upper and lower differences associated with the root mean square deviation



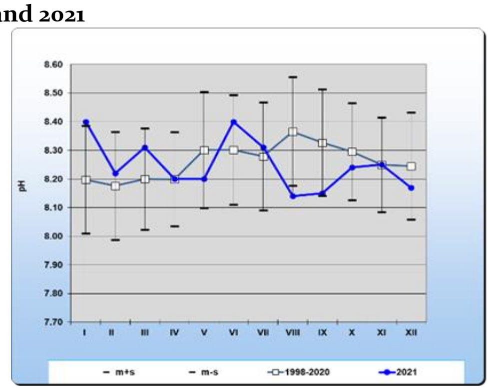
Source: NMRDI

Analyzing the monthly average for the year 2021 and comparing it with the upper root mean square deviation, it can be observed that from June to October, the average value exceeds this mean. Overall, the average sea level values for the year 2021 fall within the upper range of the multi-year average (1933 – 2021), with no monthly average falling below this multi-year average. Since the 2021 annual average values are not close to the multi-year average, they contribute to a greater variation in the multi-year average for these months.

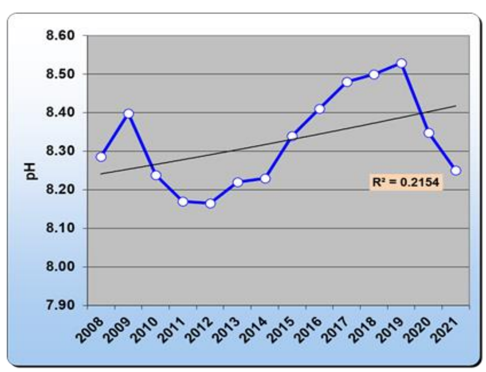
pH Level

The pH of coastal waters in the Constanța area recorded absolute values ranging from 6.67 to 8.77 in the year 2021. The monthly pH averages from the 1998-2020 interval and the year 2021 are comparable (t-test, 95% confidence interval, p=0.6709, t=0.7307, df=21, difference standard deviation=0.031) (Figure II.162a). The 2021 annual average, 8.25, continues the decreasing trend of the past two years but falls within the variability range of the last decade (Figure II.162b).

Figure II.162 The comparative situation of the multiannual (a) and annual (b) monthly averages of sea water pH in Constanta between 1959-2020 and 2021



(a)



(b)

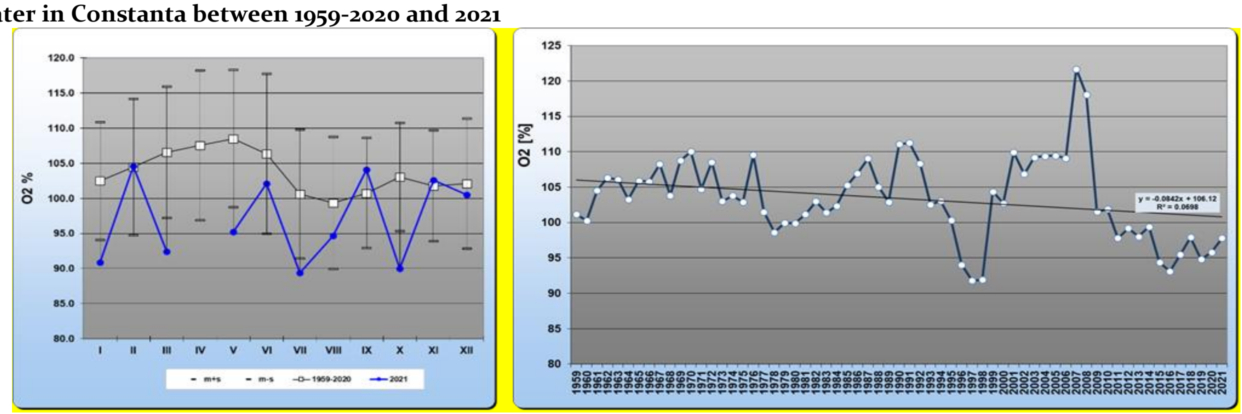
Source: NMRDI

Dissolved oxygen

Dissolved oxygen saturation ranged between 62.7% and 163.2%, (mean 96.8%, median 95.8%, standard deviation 13.8%).

In the long term, the multiyear averages from 1959-2020 are significantly higher than in 2021 (t-test, 95% confidence interval, $p=0.0098$, $t=2.8284$, $df=21$, Dev. St. of the difference =2.049) (figure II.163 a).

Figure II.163 The comparative situation of the multiannual (a) and annual (b) monthly averages of dissolved oxygen saturation in seawater in Constanta between 1959-2020 and 2021



(a) *(b)*

Source: NMRDI

The 1959-2020 annual averages range from 91.8% (1997) - 121.7% (2007), with dissolved oxygen saturation in 2021 being 97.8% and falling within sub-unit values (<100%) constantly recorded since 2011 (figure II.183 b).

Coastal processes

Field measurements consisted of:

- The position of the shoreline and beach profiles, the equipment used being GIS class GPS (Leica Zeno 20);
- Aerial images - DJI Phantom 4 Professional quadcopter, equipped with an integrated 20 MP CMOS camera, vertical accuracy is: +/- 0.1 m (when Vision positioning is active) or +/- 0.5 m and horizontal +/ - 1.5 m, with the help of GPS/GLONASS and GPS Leica Zeno 20 (positioning landmarks).

The flights and measurements were carried out between April and November 2021, with the main object being the mapping of sectors with high vulnerability, in which the geomorphological changes were rapid and in the sectors where coastal protection works were carried out:

- GPS measurement campaigns of the coastline – April-May, 2021, in the sectors Năvodari-Mamaia-Constanța-Agigea-Eforie-Costinești-Tatlageac-Neptun-Saturn-Mangalia- 2 Mai and Vamă Veche May-October in the northern sector of the coast (Cap Midia-Sulina)
- topographical profiles of the emerged beach, using the network of ridges (IRCM/NMRDI 2014), in the sectors Năvodari-Mamaia, Constanța, Agigea-Eforie, Costinești, Tatlageac-Neptun-Saturn-Mangalia, 2 Mai -Vama Veche;
- orthophotoplans made on the basis of aerial images for the Nordic sector (in sectors vulnerable to erosion): Sulina - Sfantul Gheorghe, Perisor, Portita - Periboina-Edighiol.

The identification of vulnerable sectors to erosion was carried out using the Coastal Vulnerability Index (CVI), one of the most commonly used methods to assess the vulnerability of coastal areas to natural hazards (erosion/sealevel rise/flooding).

The data used for evaluating coastal vulnerability to erosion were processed and quantified into model variables: geology and geomorphology, shore slope (both emerged and submerged), sea level, changes in the shoreline position from 2008 to present, average and maximum wave height, and sea level variation.

Aerial image processing was done using Agisoft PhotoScan Pro software. The Digital Surface Model (DSM) and orthomosaic were generated using known z-values and positions of Ground Control Points (GCPs) and exported in specific formats (GeoTIFF) with Stereo 70 projection system. Spatial analysis was conducted using ArcGIS 10.8, involving a comparison of the results obtained with previous spatial data, including DEMs, orthophotos from satellite imagery, GPS data, and topographic measurements.

Northern sector (Sulina – Cap Midia)

The northern unit, bounded to the north by the Musura stream and to the south by Cape Midia, features a lagoon and deltaic coast characterized by sandbars, spits, and coastal coordinates with pronounced dynamics, with erosion processes predominantly at play.

The methodological steps for calculating the Coastal Vulnerability Index involved:

- Identification and quantification of key variables such as geomorphology, elevation/altitude, substrate, submerged shore slope, changes in the shoreline, wave regime/exposure to waves, and sea level. Quantification was done on a scale from 1 (indicating low contribution to coastal vulnerability) to 5 (indicating high contribution).
- Integration of these key variables into a single index using a specific formula.
- Classification into five categories ("5") using ArcGIS software, ranging from "very low" to "very high" vulnerability.
- From the analysis of the results (Figure II.164), sectors with the following vulnerability levels were identified:

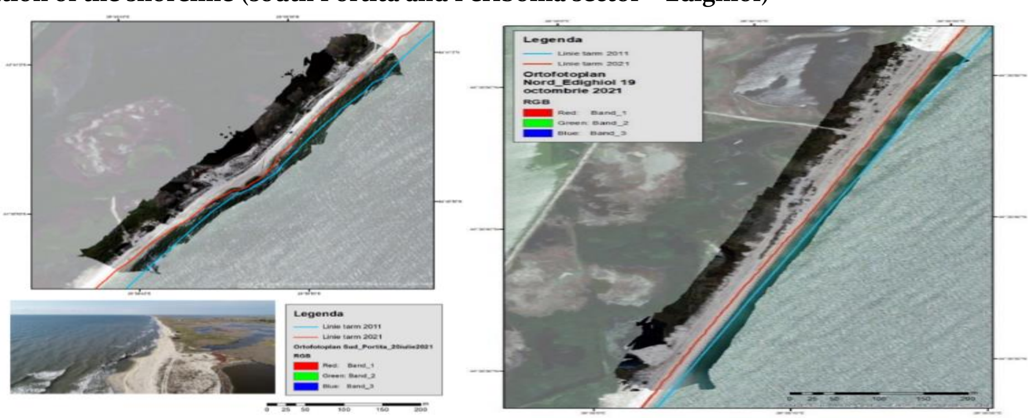
Very high vulnerability (Sud Sulina – Câșla Vădanei, Sahalin, Nord Gura Portitei-Periboina-Edighiol-Vadu)
High vulnerability (Zăton -Perisor, Grindul Sărăturile, Periteasca)
Low vulnerability (Sulina beach, Periteasca, south of Chituc sandbar).
The model's results are confirmed by a multi-decadal and annual analysis of shoreline evolution.

Figure II.164 Results of applying the Coastal Vulnerability Index

Source: NMRDI

The south Sulina - Sfântul Gheorghe sector (Figure II.166) consists of a deltaic coast with accelerated dynamics, where erosion processes predominate.
In the **Gârla Împuțită – Câșla Vădanei sector**, the shore is characterized by narrow coastal ridges, with widths of 10-30 m and heights below 1 m, with portions where traces of reed vegetation are frequently present at the waterline. The highest annual shoreline retreat rates are recorded in this area, with an average of ~ 5-15 m/year.
The **Sacalin Peninsula** currently has an arcuate shape, with a general tendency of merging with the mainland through successive westward withdrawal (translation), infilling the area between the mainland and the peninsula (Meleaua Sahalin), and elongating southwestward, with uneven rhythms depending on the hydrological conditions of the Danube and the sea. Erosion processes predominate across the entire sector, as evidenced by the absence of a beach, with the sea directly meeting the reed.
In the south **Periteșca – Gura Portiței - Periboina sector**, the lagoon barrier is significantly narrowed, and the beach has a short profile with a steep slope and erosion zones of 2-5 m/year (calculated over a 10-year period from 2011 to 2021), highlighted by the destruction of fishing shelters.

Figure II.165 Evolution of the shoreline (south Portita and Periboina sector – Edighiol)



Source: NMRDI

The measurements in the **Periboina - south Edighiol sector** (figure II.165 and figure II.166) showed a narrowing of the lagoon barrier by 2-5m in 2021 compared to 2020. The erosion rates calculated for the period 2011-2021 exceeded 4-5m/

year south of the Edighiol fishing point. The longitudinal profile with a concave shape, the width of the beach not exceeding 10 m wide and the presence of the beach scarp ~ 0.5 m high are specific to erosion processes.

Figure II.166 The evolution of the coastline (southern Edighiol sector)

Source: NMRDI

The southern sector (Cape Midia - Vama Veche)

In the short term (2013-2015), within the project "Protection and Rehabilitation of the Southern Part of the Romanian Black Sea Coast in the area of Constanța and Eforie Nord, Constanța County," five priority projects were planned and implemented to reduce the risk of erosion and coastal rehabilitation along a 7.1 km stretch of the shore in the following locations: Mamaia Sud, Tomis Nord, Tomis Centru, Tomis Sud, and Eforie Nord. The resulting beach area after sand placement is approximately 33.7 hectares. The works included measures to reduce wave energy, protect the beach with groynes for sand stability, and artificial sand placement**.**

Mamaia Sud Sector

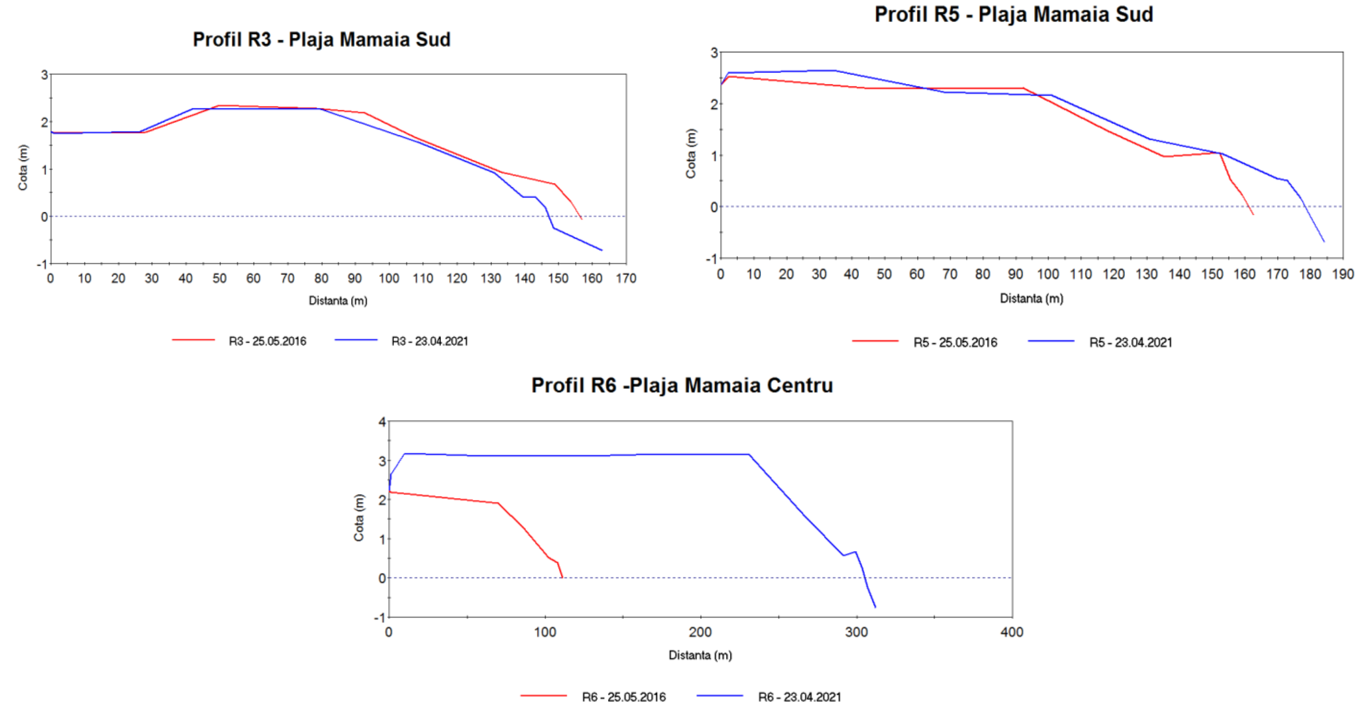
Based on the comparative analysis of profiles conducted previously in the project and in the current phase, the average change in beach width in the Mamaia Sud sector was determined to be 3.8 meters, with an exception being profile R6, where an increase of 195.6 meters in beach width was determined compared to May 2016 (due to the artificial sand placement works completed in April 2021, under the coastal protection and rehabilitation program phase II). The maximum erosion value of -8.4 meters was determined on profile R3, and the maximum accretion value of 17 meters was determined on profile R5 (Table II.49, Figure II.167, and Figure II.168).

Table II.49 Determining the range of variation in beach width in the Mamaia Sud sector (2016-2021)

SECTOR	Profile	Date	Dist. R-LRV(m)	Date	Dist. R-LRV(m)	Variation(m)
MAMAIA SUD	R1	13.05.2016	128.0	23.04.2021	140.4	12.4
	R2	13.05.2016	155.0	23.04.2021	159.6	4.6
	R3	13.05.2016	157.0	23.04.2021	148.6	**-8.4**
	4	13.05.2016	123.6	23.04.2021	116.9	-6.7
	5	13.05.2016	162.7	23.04.2021	179.7	**17.0**
	6	3.05.2016	111.4	23.04.2021	307.0	**195.6**

Source: NMRDI

Figure II.167 Geomorphological profiles – Mamaia Sud sector



Source: NMRDI

Figure II.168 Evolution of the shoreline in the Mamaia beach area 2014 – 2016 - 2021

Source: NMRDI

In the Constanța area, a total of 17 geomorphological profiles were conducted along a 4 km stretch of the coast, along with GPS measurements to determine the shoreline.

Tomis Sector

For the analysis of geomorphological changes to the beach, 6 geomorphological profiles (CT12-CT17) were conducted over a length of 1.6 km (Figure 1.4.7 4, Figure 1.4.7 7).

During the period from June 2016 to April 2021, based on a comparative analysis of the profiles, the average value of geomorphological changes regarding the beach width in the Tomis Nord sector, between profiles CT12 and CT16, was 6.5 m.

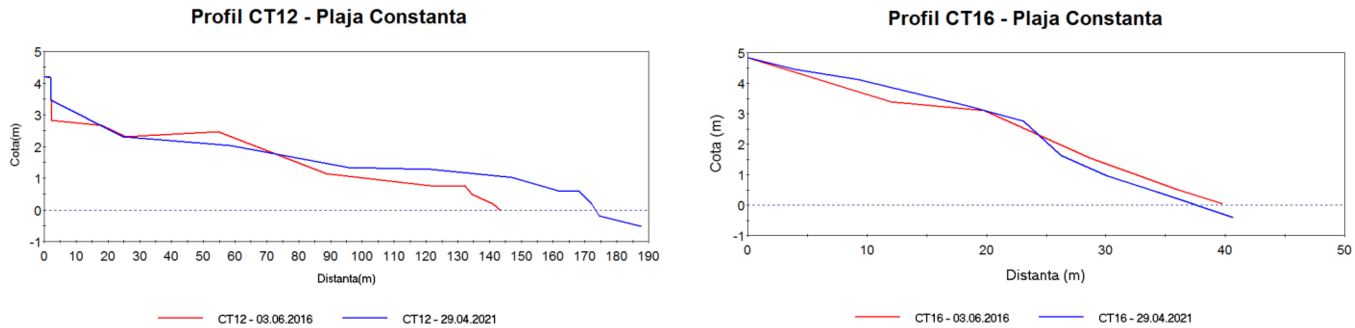
In this beach sector, only accretion was determined with values ranging from a maximum of 30.9 m at profile CT12 to a minimum of 1.5 m at profile CT16. In the case of profile CT17 in the Pescărie area, the increase in beach width by 51 m is largely attributed to leveling works by pushing the accumulated shell waves towards the sea during this period (Table II.50, Figure II.169).

Table II.50 Determining the range of variation in beach width in the Tomis Nord sector (2016-2021)

SECTOR	Profile	Date	Dist. R-LRV(m)	Date	Dist.R-LRV(m)	Variation(m)
TOMIS NORD	CT12	06/03/2016	143.6	29.04.2021	174.5	30.9
	CT13	06/03/2016	139.0	29.04.2021	152.7	13.7
	CT14	06/03/2016	133.9	29.04.2021	148.4	14.5
	CT15	06/03/2016	150.3	29.04.2021	154.9	4.6
	CT16	06/03/2016	39.2	29.04.2021	40.7	**1.5**
	CT17	06/03/2016	56.30	29.04.2021	107.3	**51.0**

Source: NMRDI

Figure II.169 Geomorphological profiles – Tomis Nord sector



Source: NMRDI

Tomis Central sector

To analyze the geomorphological changes of the beach, a number of 5 geomorphological profiles (CT7-CT11) were made over a length of 0.9 km.

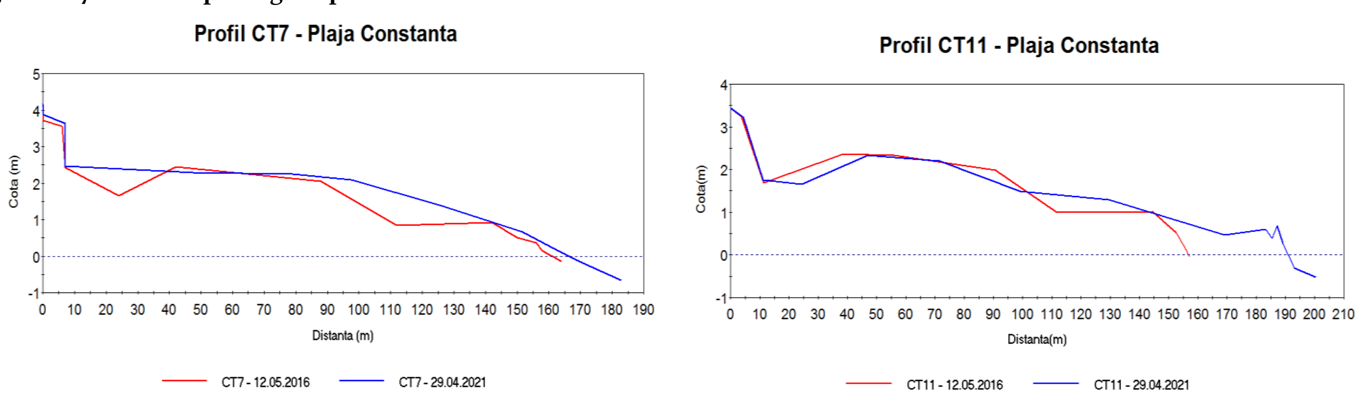
In the period May 2016 - April 2021, based on the comparative analysis of the geomorphological profiles made, the average value of the geomorphological changes, regarding the width of the beach in the Tomis Centru sector, was 17.92 m. In this sector of the beach, only accretion was determined with values between 5.8 m, profile CT7 and 36.0 m, profile CT11 (table II.51, figure II.170).

Table II.51 Determining the range of variation in beach width in the Central Tomis sector (2016-2021)

SECTOR	Profile	Date	Dist. R-LRV(m)	Date	Dist. R-LRV(m)	Variation(m)
TOMIS CENTRAL	CT7	12.05.2016	164.0	29.04.2021	169.8	**5.8**
	CT8	12.05.2016	131.8	29.04.2021	146.7	14.9
	CT9	12.05.2016	143.5	29.04.2021	157.7	14.2
	CT10	12.05.2016	162.9	29.04.2021	181.6	18.7
	CT11	12.05.2016	157.1	29.04.2021	193.1	**36.0**

Source: NMRDI

Figure II.170 Geomorphological profiles – Central Tomis sector



Source: NMRDI

Tomis Sud sector

For the analysis of geomorphological changes to the beach, a total of 6 geomorphological profiles (CT1-CT6) were conducted over a length of 1.5 km.

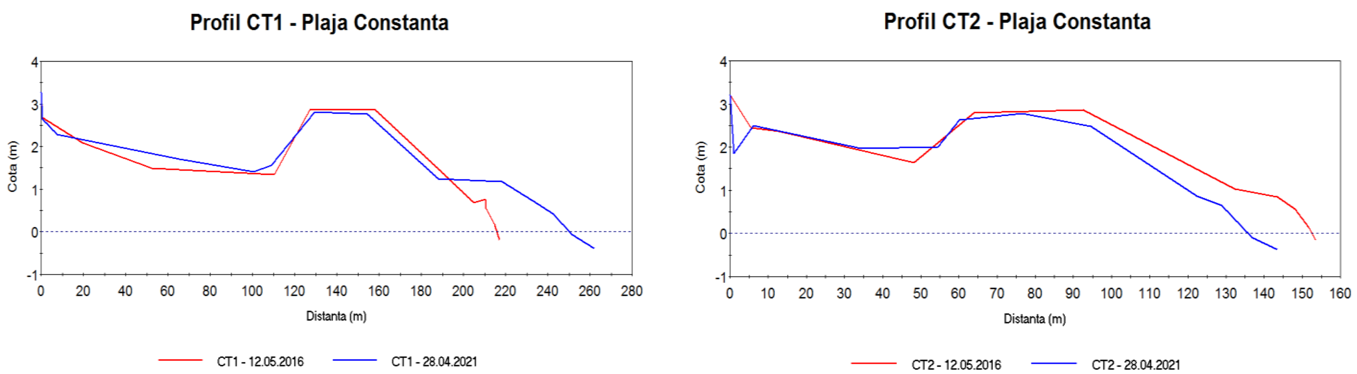
During the period from May 2016 to April 2021, based on a comparative analysis of the profiles, the average value of geomorphological changes regarding the beach width in the Tomis Sud sector was 4.0 m. The maximum erosion value of -16.8 m was determined on profile CT2, and the maximum accretion value of 34.2 m was determined on profile CT1. It is also observed that in the area of profiles CT5 and CT6, there is a relatively balanced state in terms of geomorphological changes, with very small variations (Table II.52, Figure II.171, Figure II.172).

Table II.52 Determining the range of variation in beach width in the Tomis Sud sector (2016-2021)

SECTOR	Profile	Date	Dist. R-LRV(m)	Date	Dist. R-LRV(m)	Variation(m)
TOMIS SUD	CT1	12.05.2016	217.2	28.04.2021	251.4	**34.2**
	CT2	12.05.2016	153.6	28.04.2021	136.8	**-16.8**
	CT3	12.05.2016	130.2	29.04.2021	134.1	3.9
	CT4	12.05.2016	135.4	29.04.2021	139.7	4.3
	CT5	12.05.2016	174.1	28.04.2021	173.4	-0.7
	CT6	12.05.2016	181.4	29.04.2021	180.5	-0.9

Source: NMRDI

Figure II.171 Geomorphological profiles - Tomis Sud sector



Source: NMRDI

Figure II.192 Evolution of the shoreline in the Constanța beach area 2014 - 2016 - 2021

Source: NMRDI

Eforie Nord sector

For the analysis of geomorphological changes to the beach, a total of 6 geomorphological profiles (EF17-EF22) were conducted over a length of 1.2 km, along with GPS measurements to determine the shoreline.

During the period from May 2016 to May 2020, based on a comparative analysis of the profiles, the average value of geomorphological changes regarding the beach width in the Eforie Nord sector was 7.95 m. In this beach sector, the maximum erosion value of -3.4 m was determined on profile EF19, and the maximum accretion value of 23.4 m was determined on profile EF22 (Table II.53, Figure II.173, Figure II.174).

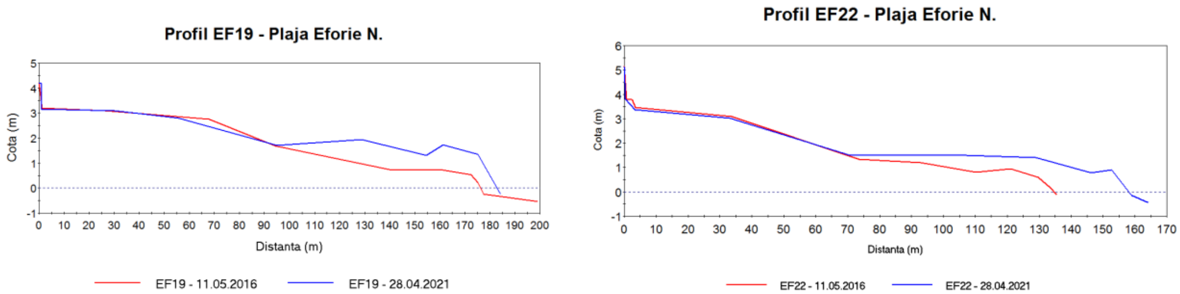
Table II.53 Detemining the range of variation in beach width in the Eforie Nord sector (2016-2021)

SECTOR	Profil	Data	Dist R-LRV(m)	Data	Dist. R-LRV(m)	Variația(m)
	EF17	11.05.2016	169.00	28.04.2021	168.9	-0.1

EFORIE NORD	EF18	11.05.2016	160.40		28.04.2021	168.7		8.3
	EF19	11.05.2016	178.6		28.04.2021	175.2		**-3.4**
	EF20	11.05.2016	140.70		28.04.2021	148.2		7.5
	EF21	11.05.2016	134.10		28.04.2021	146.1		12.0
	EF22	11.05.2016	135.50		28.04.2021	158.9		**23.4**

Source: NMRDI

Figure II.173 Geomorphological profiles – Eforie Nord sector



Source: NMRDI

Figure II.174 Evolution of the shoreline in the Eforie beach area 2014 – 2016 - 2021

Source: NMRDI

Conclusions

For the northern unit, the evolution of the shoreline is determined by the intensity of coastal processes, delineating different sectors:

- Sectors with pronounced erosion: the South sector Sulina-Sf. Gheorghe beach (Câsla Vădanei), the North sector Portița-Periboina-Edighiol, with annual rates calculated for the period 2011-2021 ranging between 2-10 m/year, except for the Canal Sonda, Gârla Împuțită, Zaton-Perisor sectors where the values are higher.
- Sectors dominated by accumulation processes, interspersed with sectors in relative equilibrium: Sulina beach (5-13 m/year), South sector Perişor-sud Periteşca (2-5 m/year), Chituc sandbar (Vadu area) (3-7 m/year);
- Narrow coastal strips with specific, pronounced dynamics, conditioned by hydrological (Danube level and discharge) and oceanographic factors (frequency and intensity of storms, wind and wave regime, etc.).

In the southern unit (Cape Midia - Vama Veche), the shoreline mobility shows a different evolution compared to the northern unit, with small, uneven rhythms, given the presence, for the most part, of the Sarmatian submarine limestone platform and coastal protection works.

Based on the studies conducted, during the period 2015/2016-2021, the modifications of the touristic beaches at the land-sea interface were determined for the 5 sectors (Mamaia Sud, Tomis Nord, Tomis Centru, Tomis Sud, and Eforie Nord), where short-term coastal protection measures were implemented, as follows:

- Geomorphological changes were determined, on average, between 3.8 m (Mamaia sector) and 17.92 m (Tomis Centru sector);
- The maximum erosion values were -16.8m (reference point CT2, Tomis Sud sector) and the maximum accretion was 36 m (reference point CT11, Tomis Centru sector);
- The Tomis Centru beach sector recorded values ranging from 5.8 m (profile CT7) to 36 m (profile CT11).

The situation regarding the marine fishery resources

RO 32

Indicator code Romania: RO32
EEA indicator code: CSI 32

TITLE: THE STATE OF MARINE FISH STOCKS AND SPECIES DIVERSITY

DEFINITION: The indicator covers the estimated amount of fish for the main fish species in the Romanian sector of the Black Sea. The indicator monitors the proportion of overfished fish stocks out of the total number of commercial stocks, by fishing areas in the Romanian sector of the Black Sea.

Status of marine fish stocks

The Romanian fishing zone is between Sulina and Vama Veche; the coastline stretches for a distance of 243 km and can be divided into two geographical and geomorphological sectors:

- ***northern sector***(approx. 158 km in length) stretches between the secondary delta of the Chilia branch and Constanța, mainly composed of alluvial sediments;
- ***the southern sector***(approx. 85 km in length) stretches between Constanța and Vama Veche, characterized by promontories with high, active cliffs, separated by wide areas with accumulation beaches, often harboring coastal lakes.

The industrial fishing activity in 2021 was carried out in two ways:

- ***fishing with active gear***, carried out with coastal trawlers, at depths greater than 20 m;
- ***fixed gear fishing,*** practiced along the coastline, in 12 fishing spots located between Sulina-Vama Veche, at shallow depths of 2-11 m/nets, as well as at depths of 20-60 m/trawls and seines.

Evolution of status indicators:

Stock biomass for the main fish species (figure II.195) indicates:

- the biomass of the sprat population was estimated at around 93,677 tons, higher than the value obtained in the previous year, but in general it shows a natural fluctuation, for a species with a short life cycle;
- the biomass of the cod population was estimated at about 8123 tons, a value about 20% lower than last year;
- the biomass of the turbot population was estimated at around 3441 tons, the highest biomass value recorded in recent years;
- the biomass of the shark population was estimated at about 4150 tons, a value about 50% higher than in 2020;
- the biomass of the rapana population was assessed at around 8007 tons, a minimum value compared to previous years.

Table II.54 Stock value (tons) for the main fish species in the Romanian sector of the Black Sea

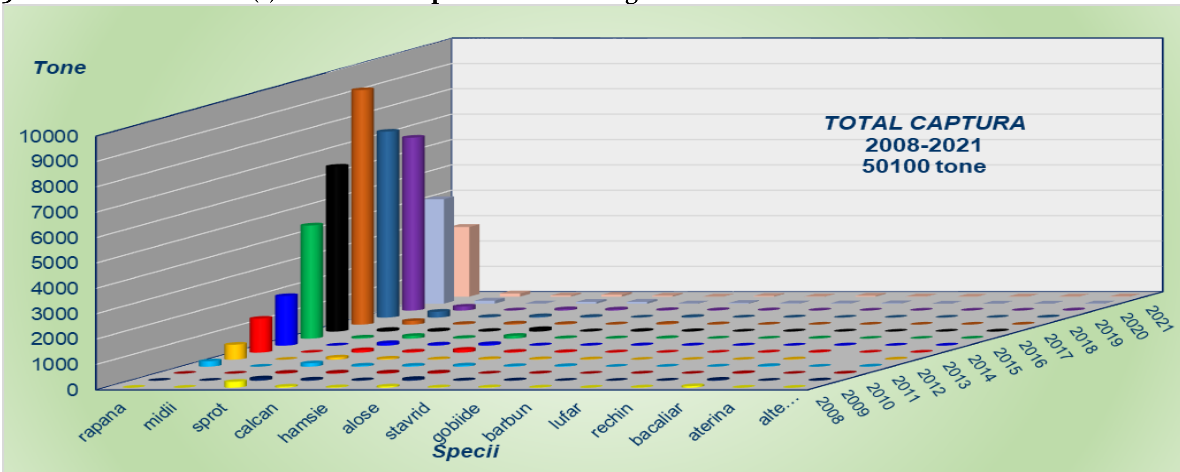
Species	2016	2017	2018	2019	2020	2021
Sprat	114653	23269	42599	124000	92398	93677
Cod	6928	20911	23171	20000	10714	8123
Mullet	300	300	300	300	300	300
Sole	2117	1523	2065	2700	2400	3441
Shark	1550	1223	5556	2000	2150	4135
Rapa whelk	14000	17500	17500	15000	15000	8007

Source: NMRDI

Starting from the year 2020, the catches of cuttlefish showed a decreasing trend by nearly 40% compared to the catches in 2019. This decreasing trend continued in 2021, with a 45% reduction in catches compared to 2020. This was attributed to the Sars-Cov 19 pandemic, which reduced the demand for this species due to the closure of the Horeca industry and limited exports to major cuttlefish processing factories in Bulgaria. This resulted in a significant decrease in fishing effort.

The main species in the catches of the year 2021 were: cuttlefish (2746 t); mussels (125 t); anchovy (39 t); sprat (48 t); horse mackerel (28 t); mullet (9 t); flounder (75 t) and red mullet (34 t) (Figure II.175). In addition to these species, the catches also included: smelt (2 t); gobies (7 t); and shads (4 t).

Figure II.175 Structure of catches (t) of the main species of fish caught in the Romanian marine sector



Source: NMRDI

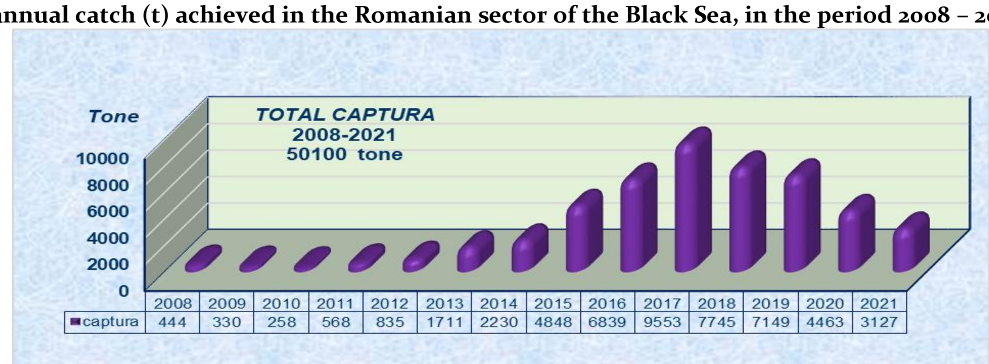
The evolution of pressure indicators

The fishing effort continues the decreasing trend noted since the year 2000. Thus, in 2021, the active fishing fleet consisted of 1 vessel (24-40 m) equipped with 2 beam trawls and 1 hydraulic dredge, **3 vessels (18-24 m)** equipped with 6 beam trawls, 3 pelagic trawls, 230 horse mackerel nets, and 1 hydraulic dredge, and **18 vessels (12-18 m)** equipped with 30 beam trawls, 1,859 horse mackerel nets, 100 herring nets, 2 trawls, and 6 pelagic trawls. In stationary fishing with fixed gear, practiced along the Romanian coast, a total of **108 vessels** were active, including **9 boats (under 6 m) and 99 boats (6-12 m)**, using 6 pelagic trawls, 32 setlines, 16 beam trawls, 1,115 goby traps, 35 cuttlefish traps, 2,307 horse mackerel nets, 412 herring nets, 1 beach seine, 8 shark seines, 25 traps, and 22 pound nets.

The total level of catches and fishing efficiency, which fluctuated from year to year, was mainly due to both a reduction in fishing effort (reduction in the number of coastal trawlers and consequently the personnel engaged in fishing activity) and the influence of hydroclimatic conditions on fish populations, rising production costs, as well as the Covid-19 pandemic that reduced demand through the closure of the Horeca industry and limited exports.

During the period 2005 - 2013, the total level of catches fluctuated, ranging from 1,940 tons in 2005 to 258 tons in 2010. Specifically, in 2006: 1,390 tons; 2007: 435 tons; 2008: 177 tons; 2009: 331 tons; and 2010: 258 tons. There was a slight increase in catches in 2011 (568 tons), 2012 (835 tons), and 2013 (1,712 tons). In the last six years, catches showed an increasing trend, specifically: 2,231 tons in 2014, 4,847 tons in 2015, 6,839 tons in 2016, and 9,553 tons in 2017. Starting from 2018, recorded catches from commercial fishing began to decline, with 7,745 tons in 2018, 7,149 tons in 2019, and 4,463 tons in 2020. In 2021, the decline in catches continues, with a value 25% lower than in 2020. Out of the 3,127 tons captured in 2021, over 85% was represented by the species Rapana venosa (Figure II.176).

Figure II.176 Total annual catch (t) achieved in the Romanian sector of the Black Sea, in the period 2008 – 2020



Source: NMRDI

The evolution of impact indicators

Percentage of species whose stocks are outside safe limits was close to that of previous years, being approximately 90%. Exceeding the safety limits is not only due to exploitation in the Romanian marine sector, most fish species having a cross-border distribution, a fact that requires regional management.

The percentage of complementary species in Romanian catches continues to maintain a level similar to that of recent years, being over 20%.
Changes in the structure by size classes (length, weight, age), compared to the previous years, in 2021, for the species identified in the catches, the biological parameters remained almost at the same values with small fluctuations.

Anthropogenic pressures on the marine and coastal environment

RO 33
Indicator code Romania: RO33 EEA indicator code: CSI 33
TITLE: AQUACULTURE PRODUCTION
DEFINITION: The indicator monitors aquaculture production as well as nutrient discharges, thus measuring the pressures exerted by aquaculture on the marine environment. It is a simple and easily accessible indicator, but when used alone, it has limited importance and relevance due to varied production practices and local conditions.

The leasing of Black Sea waters for aquaculture activities became possible through Government Decision no. 1.283/2021 amending and supplementing Government Decision no. 183/2020 on the approval of the lease of certain state-owned real estate properties under the administration of the National Administration "Romanian Waters", published in the Official Gazette no. 42 of January 14, 2022, opening up development opportunities.
In this context, the efforts and consultancy provided by the National Institute for Marine Research and Development "Grigore Antipa" (NMRDI) through the Aquaculture Demonstrative Center materialized in the summer of 2021 with the installation of the only mussel farm on the Romanian coast in the Agigea - Eforie Nord area (Figure II.177 left). The first seed collection lines from the natural environment were installed (Figure II.177 right), with the first harvest expected in the summer of 2022. The partnership between research and the business environment was formalized through the signing of a collaboration protocol between the company managing the farm and INCDM.
It should be emphasized that the microbiological survey of the proposed classification areas was completed in the fall of 2020, and the competent authority (National Sanitary Veterinary and Food Safety Authority - ANSVSA) classified all 3 production and relocation zones for live bivalve mollusks in the Romanian sector of the Black Sea (Chituc - Perișor, Baia Mamaia, and Agigea - Mangalia) in class A. This opens up opportunities for bivalve aquaculture on our coastline.

Figure II.177 The location of the long-line mussel cultivation farm in Agigea (Google Earth map, original photos M. Nenciu & V. Niță)

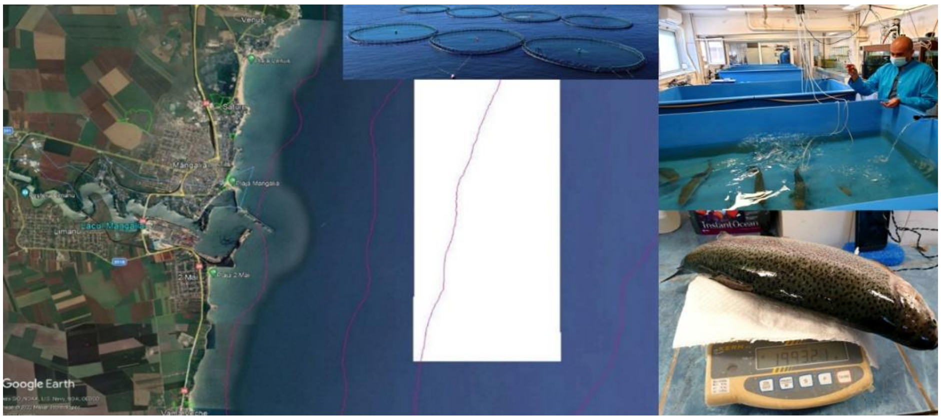
Source: NMRDI

The resolution of the legislative framework for the concession of marine waters (through Government Decision no. 1283/2021) has also unlocked the mariculture activity of fish in floating cages along the Romanian coast, considering that several domestic operators have shown interest in the alternative growth of rainbow trout - Oncorhynchus mykiss (Walbaum, 1792) - in marine water during the cold period of the year (in floating cages, located in open sea), aiming to improve meat quality and enhance economic efficiency.

NMRDI conducted a growth rate and optimal stocking density study in marine water. The experiment began in October 2020. Two lots of trout of different sizes (average biomass 150 g and 300 g) were introduced into two tanks supplied with seawater. In order to obtain the most relevant results, similar conditions to the natural environment were ensured in the laboratory tanks, and the administered food was rich in carotenoids. Throughout the experiment, the overall adaptability of the fish to the saline environment was monitored, as well as their growth compared to the freshwater environment. Both lots quickly adapted to the experimental conditions, with an observed increased appetite, resulting in a spectacular growth of biomass in both tanks: after approximately 6 months of the experiment, the trout reached an average biomass of about 2 kg (Figure II.178 right). The results of the experiment confirmed that transferring rainbow trout to the Black Sea during the winter months is a feasible and beneficial alternative to stimulate the diversification of Romanian aquaculture.

In contrast to long-line installations for bivalve aquaculture, which are preferably located in sheltered areas like the Agigea zone, it is desirable for floating cages to be in currents, ensuring constant water renewal, which is essential for many fish species. Therefore, the area offshore the Mangalia port (Figure II.178 left) is targeted for the installation of the floating cages. Additional data, such as bathymetry, currents, waves, temperature, salinity, etc., are required for the proper sizing of the cages etc.)

Figure II.178 The proposed location for placing the floating cages for the growth of rainbow trout in marine water is the offshore area across Mangalia (Google Earth map, original photos M. Nenciu & V. Niță)



Source: NMRDI

In this context, INCDM has initiated a collaboration protocol with interested investors and will provide scientific consultancy to the business operator who will install the first floating cages for the marine growth of rainbow trout in Romania.

Fishing fleet capacity

RO 34

Indicator code Romania: RO 34
EEA indicator code: CSI 34

TITLE: FISHING FLEET CAPACITY

DEFINIȚIE: Fishing capacity, defined in terms of tonnage and engine power and sometimes the number of vessels, is one of the key factors determining fleet-caused fish mortality. The average size of the vessels is an important parameter for assessing the pressure exerted by the fishing activity. Larger vessels generally result in greater fishing pressure than small vessels, mainly due to the fishing equipment used, the level of activity and the geographical coverage that these vessels can achieve.

Fishing capacity management aims to achieve a sustainable balance over time between the fishing capacity of the fleets and fishing opportunities. Thus, the **CPUE** (catch per unit of fishing effort) resulting from fishing in the Romanian coastal area was achieved by:

Boats smaller than 6 meters:

- ***Beam trawl***: 355.5 kg/trawl; 142.2 kg/month; 33.85 kg/day; 22.21 kg/hour, with a fishing effort carried out by 2 trawls, for 5 months, 21 days, 32 hours, resulting in a catch of **711** kg;
- ***Hake net***: 203 kg/boat; 4.06 kg/net; 101.5 kg/month; 50.75 kg/day; 10.15 kg/hour, with a fishing effort conducted by one boat, 50 nets, for 2 months, 4 days, 20 hours, resulting in a catch of **203** kg;
- ***Mackerel net***: 211.75 kg/boat; 11.44 kg/net; 141.16 kg/month; 105.87 kg/day; 27.32 kg/hour; with an effort by 4 boats, 74 nets, for 6 months, 8 days, 31 hours, resulting in a catch of **847** kg;
- ***Fish traps***: 18 kg/boat; 9 kg/trap; 18 kg/month; 6 kg/day; 1.5 kg/hour, with an effort by 1 boat, 2 traps, for 1 month, 3 days, 12 hours, resulting in a catch of **18** kg;
- ***Hand collection of rapana***: 16,976.3 kg/boat; 12,732.25 kg/diver; 2,546.45 kg/month; 185.19 kg/day; 67.81 kg/hour, with an effort by 3 boats, 4 divers, for 20 months, 275 days, 751 hours, resulting in a catch of **50,929** kg;

Goby cages: 126 kg/boat; 5.04 kg/cage; 31.5 kg/month; 9.69 kg/day; 2.1 kg/hour, with an effort conducted by one boat, 25 cages, for 4 months, 13 days, 60 hours, resulting in a catch of **126** kg.

Boats from 6 - 12 m:

- ***Beam trawl***: 2,514.53 kg/boat; 902.65 kg/trawl; 320.55 kg/month; 115.8 kg/day; 94.5 kg/hour, with an effort carried out by 28 boats, 28 trawls, for 78 months, 608 days, 745 hours, resulting in a catch of **70,407** kg;
- ***Hake net***: 1,126.52 kg/boat; 17.46 kg/net; 320.55 kg/month; 146.57 kg/day; 31.16 kg/hour, with an effort by 35 boats, 2,257 nets, for 123 months, 269 days, 1,265 hours, resulting in a catch of **39,428.5** kg;
- ***Mackerel net***: 185.45 kg/boat; 16.46 kg/net; 123.63 kg/month; 43.12 kg/day; 12.17 kg/hour, with an effort by 30 boats, 338 nets, for 45 months, 129 days, 457 hours, resulting in a catch of **5,563.5** kg;
- ***Beach seine***: 252 kg/boat; 252 kg/seine; 126 kg/month; 50.4 kg/day; 31.5 kg/hour, with an effort by one boat, one seine, for 2 months, 5 days, 8 hours, resulting in a catch of **252** kg;
- ***Beam trawl***: 55,059.5 kg/boat; 27,529.75 kg/beam trawl; 10,743.31 kg/month; 2,127.9 kg/day; 239.38 kg/trawling, 231.82 kg/hour; with an effort by 8 boats, 16 beam trawls, for 41 months, 207 days, 1,840 trawlings, 1,900 hours, resulting in a catch of **440,476** kg;
- ***Hand collection of rapana***: 21,425.6 kg/boat; 8,480.97 kg/diver; 6,360.73 kg/month; 1,005.15 kg/day; 277.87 kg/hour; with an effort by 19 boats, 48 individuals, for 64 months, 405 days, 1,465 hours, resulting in a catch of **407,087** kg;
- ***Rapana collection cages***: 617 kg/boat; 35.25 kg/cage; 246.8 kg/month; 53.65 kg/day; 44.07 kg/hour; with an effort by 2 boats, 35 cages, for 5 months, 23 days, 28 hours, resulting in a catch of **1,234** kg;
- ***Goby cages***: 139 kg/boat; 3.95 kg/cage; 43.12 kg/month; 16.65 kg/day; 3.59 kg/hour; with an effort by 31 boats, 1,090 cages, for 100 months, 259 days, 1,199 hours, resulting in a catch of **4,312** kg;
- ***Eelpout pots***: 25.84 kg/boat; 15.27 kg/pot; 13.44 kg/month; 10.5 kg/day; 2.89 kg/hour; with an effort by 13 boats, 22 pots, for 32 months, 116 days, 270 hours, resulting in a catch of **336** kg;
- ***Fish traps***: 43.46 kg/boat; 28.34 kg/trap; 20.37 kg/month; 9.05 kg/day; 2.41 kg/hour; with an effort by 15 boats, 23 traps, for 32 months, 72 days, 270 hours, resulting in a catch of **652** kg;
- ***Pelagic trawl***: 1,237.66 kg/vessel; 1,237.66 kg/pelagic trawl; 742.6 kg/month; 176.8 kg/day; 25.25 kg/trawling, 24.75 kg/hour; with an effort by 6 vessels, 6 pelagic trawls, for 10 months, 42 days, 294 trawlings, 300 hours, resulting in a catch of **7,426** kg;
- ***Shark longline***: 130.66 kg/boat; 49 kg/longline; 78.4 kg/month; 43.55 kg/day; 9.56 kg/hour; with an effort by 3 boats, 8 shark longlines, for 5 months, 9 days, 41 hours, resulting in a catch of **392** kg.

Boats from 12 - 18 m:

- ***Beam trawl***: 106,675.5 kg/vessel; 53,337.75 kg/beam trawl; 19,912.76 kg/month; 3,066.64 kg/day; 321.1 kg/trawling, 312.83 kg/hour, with an effort by 14 vessels, 28 beam trawls, for 75 months, 487 days, 4,651 trawlings, 4,774 hours, resulting in a catch of **1,493,457** kg;
- ***Pelagic trawl***: 13,825.66 kg/vessel; 13,825.66 kg/pelagic trawl; 2,765.13 kg/month; 505.81 kg/day; 76.88 kg/trawling, 69.71 kg/hour, with an effort by 6 vessels, 6 pelagic trawls, for 30 months, 164 days, 1,079 trawlings, 1,190 hours, resulting in a catch of **82,954** kg;
- ***Hake net***: 2,374 kg/vessel; 17.87 kg/net; 573.03 kg/month; 259.65 kg/day; 43.73 kg/hour, with an effort by 14 vessels, 1,859 nets, for 58 months, 128 days, 760 hours, resulting in a catch of **33,236** kg;

- ***Mackerel net***: 600 kg/boat; 6 kg/net; 600 kg/month; 300 kg/day; 100 kg/hour; with an effort by one boat, 100 nets, for 1 month, 2 days, 6 hours, resulting in a catch of **600** kg;
- ***Shark longline***: 206 kg/boat; 103 kg/longline; 206 kg/month; 103 kg/day; 20.6 kg/hour; with an effort by one boat, 2 shark longlines, for 1 month, 2 days, 10 hours, resulting in a catch of **206** kg.

Boats from 18 - 24 m:

- ***Beam trawl*:** 120,295 kg/vessel; 120,295 kg/beam trawl; 24,059 kg/month; 2,358.72 kg/day; 260.94 kg/trawling, 240.59 kg/hour, with an effort by one vessel, 2 beam trawls, for 5 months, 51 days, 461 trawlings, 500 hours, resulting in a catch of **120,295** kg;
- ***Hake net***: 3,558 kg/vessel; 15.46 kg/net; 593 kg/month; 296.5 kg/day; 48.08 kg/hour, with an effort by one vessel, 230 nets, for 6 months, 12 days, 74 hours, resulting in a catch of 3,558 kg;
- ***Pelagic trawl***: 1,555.86 kg/vessel; 1,555.86 kg/pelagic trawl; 933.52 kg/month; 179.52 kg/day; 39.89 kg/trawling, 34.32 kg/hour, with an effort by 3 vessels, 3 pelagic trawls, for 5 months, 26 days, 117 trawlings, 136 hours, resulting in a catch of **4,667.6** kg;
- ***Hydraulic dredge for mussels***: 2,966 kg/vessel; 2,966 kg/hydraulic dredge; 988.66 kg/month; 423.71 kg/day; 57.03 kg/trawling, 55.96 kg/hour, with an effort by one vessel, one hydraulic dredge, for 3 months, 7 days, 52 trawlings, 53 hours, resulting in a catch of **2,966** kg.

Boats 24 - 40 m:

- ***Hydraulic dredge for collecting mussels***: 24,469 kg/vessel; 24,469 kg/hydraulic dredge; 3,058.62 kg/month; 661.32 kg/day; 176.03 kg/trawling, 203.9 kg/hour, with an effort by one vessel, one hydraulic dredge, for 8 months, 37 days, 139 trawlings, 120 hours, resulting in a catch of **24,469** kg;
- ***Beam trawl***: 106,941.5 kg/vessel; 53,470.75 kg/beam trawl; 15,277.35 kg/month; 2,890.31 kg/day; 471.1 kg/trawling, 380.57 kg/hour, with an effort by one vessel, 2 beam trawls, for 7 months, 37 days, 227 trawlings, 281 hours, resulting in a catch of **106,941.5** kg.

Thus, in 2021, the number of active boats decreased (Table II.61), with a recorded 130 vessels compared to 138 vessels in 2020.

Table II.55 Total number of active boats/vessels in 2021

Length Classes of Boats/Ships	Total active Boats/Ships	Fishing Technique	Average length (m)	Average age (years)	Total GT	Total kW	No. individuals
< 6 m	9	PG	5,03	18,67	8,33	145,95	17
6-12 m	69	PG	7,84	22,29	135,63	748,43	165
6-12 m	30	PMP	8,74	15,83	176,41	877,84	95
12 - 18 m	18	PMP	14,85	12,56	596,31	2.493,57	72
18-24 m	3	PMP	22,13	31	318	846,25	12
> 24 m	1	PMP	25,5	39	117	220	4
TOTAL	130				1.351,68	5.332,04	365

Source: NMRDI

PG* - Vessels/boats using only stationary gear (nets, longlines, traps, trotlines, etc.)
PMP* - Vessels/boats that fish with both stationary and towed gear (trawl, seine, dredge, etc.)

Regarding inactive vessels, in 2021, there was also a decrease in their numbers (Table II.56).

Table II.56 Total number of inactive boats/vessels in 2021

Length Classes of Boats/Ships	Total active Boats/Ships	Average length (m)	Average age (years)	Total GT	Total kW
< 6 m	4	5,3	28	3,78	10
6-12 m	26	7,61	19,88	43,01	118,25

12 - 18 m	2	14,9	3,5	65,79	403
> 24 m	1	26,7	18	111	335
TOTAL	33			223,58	866,25

Source: NMRDI

The conservation of biological diversity in marine ecosystems and the protection of threatened fish species from extinction can also be achieved through the use of selective and non-destructive fishing tools and techniques that are cost-effective and preserve living marine resources.

III. SOIL

LANDS AFFECTED BY VARIOUS LIMITING FACTORS

RO 55
Indicator code Romania: RO 55 EEA indicator code: CLIM 27
TITLE: **ORGANIC CARBON IN SOIL**
DEFINITION: Variation of organic carbon content in fertile soil.

From the inventory carried out by ICPA in collaboration with 37 OSPA in the years 1994-1998 for 41 counties and with other research units, on about 12 million ha of agricultural land, of which on about 7.5 million ha of arable land (about 80% of the arable surface), soil quality is affected to a lesser or greater extent by one or more restrictions.
These restrictions are determined either by natural factors (climate, relief form, edaphic characteristics, etc.), or by anthropic agricultural and industrial actions ; in many cases the mentioned factors can act together in a negative sense and have the effect of decreasing the quality of soils and even canceling their functions. The main restrictions on the quality of agricultural soils are presented in table III.1.
Drought can be manifested on about 7.1 million ha, of which most of the 3.2 million ha were previously arranged with irrigation works.
The periodic excess of humidity in the soil affects approximately 3.8 million hectares, of which a large part of the areas have undergone drainage reclamation works that do not function as expected. Periodically, a series of areas within zones protected by old or inefficient dikes are flooded, which are not properly maintained, resulting in significant damage through the destruction of households, agricultural crops, livestock, transportation routes, and human lives lost.
Water erosion is present in varying degrees on 6.3 million ha, of which about 2.3 million ha are equipped with anti-erosion works, currently heavily degraded in most parts : this together with ***landslides*** (about 0.7 million ha) causes soil losses of up to 41.5 t/ha.year.
Wind erosion affects nearly 0.4 million hectares, with the risk of expansion, given that in recent years, some forests and protective barriers have been cleared in sandy soil areas susceptible to this degradation process. These soils have a low edaphic volume, reduced water retention capacity, and suffer from drought, leading to low fertility**.**
The excessive presence of coarse fragments in the upper layer of the soil affects approximately 0.3 million hectares.

Table III.1 The surface of agricultural land affected by various limiting factors (restrictions) of productive capacity

Factor's name	Affected area[1] thousand ha	
	Total	**Arable**
Drought	7100	
Periodic excess of humidity in soil	3781	
Water erosion of soil	6300	2100
Landslides	702	
Wind erosion	378	273
Excessive presence of coarse fragments on soil surface	300	52
Soil salinity :	614	
of which, with high alkalinity	223	135
Secondary soil compaction due to improper work ("plough sole")	6500	6500
Primary soil compaction	2060	2060
Crust formation	2300	2300
Small-extremely small reserve of humus in soil	7485	4525
Strong and moderate acidity	3424	1867
Weak and very weak provision of mobile phosphorus	6330	3401
Weak and very weak provision of mobile potassium	787	312
Poor nitrogen provision	5110	3061
Microelement deficiencies (zinc)	1500	1500

Physico-chemical and chemical soil pollution, of which:	900	
- pollution with particles carried by the wind	363	
- soil destruction through various excavations	24	
Covering soil with waste and solid residues	18	

1) Source : ICPA The same surface can be affected by one or more restrictive factors

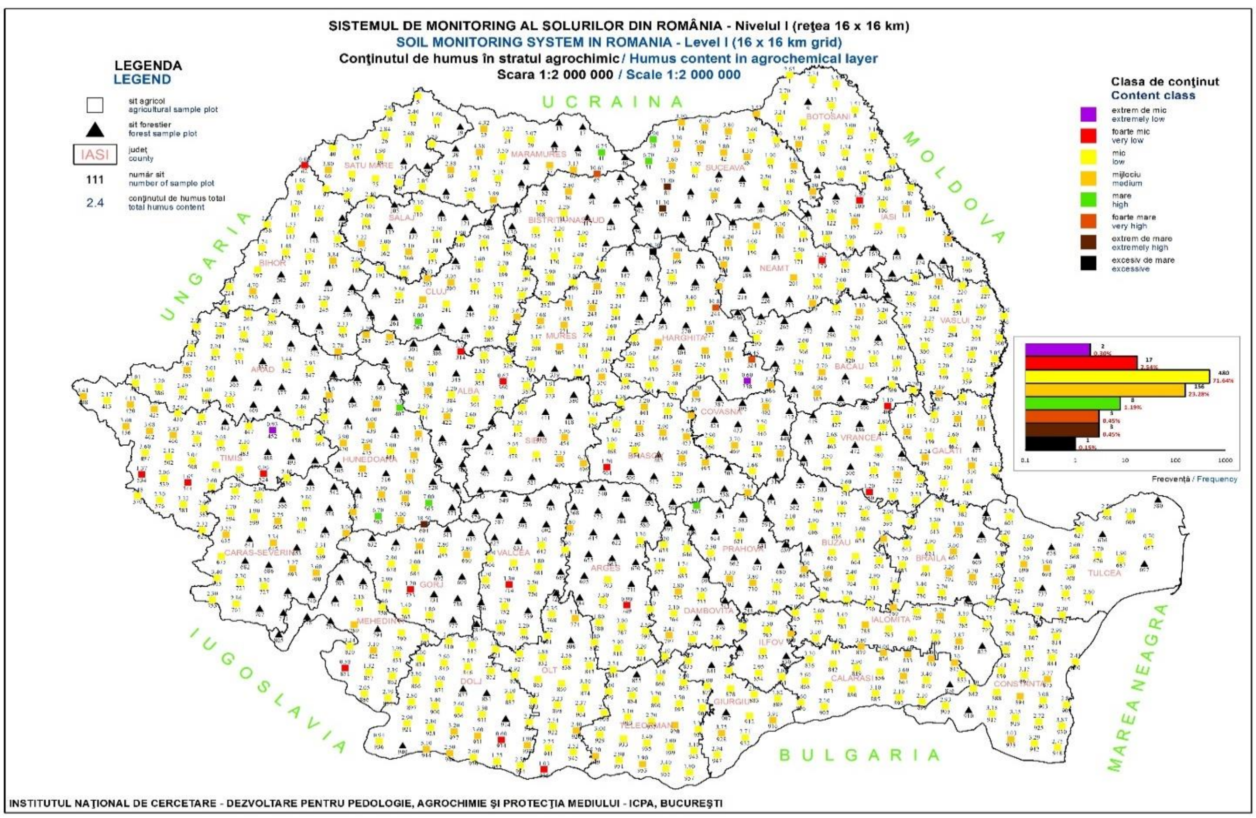
Agrochemical status, analyzed on 66% of the agricultural fund, presents the following unfavorable characteristics :

- Strong and moderate acidity of soil on about 3.4 million ha of agricultural land and moderate-strong alkalinity on about 0.2 million ha of agricultural land.
- poor to very poor provision of the soil with mobile phosphorus, on about 6.3 million ha of agricultural land;
- poor provision of soil with mobile potassium, on about 0.8 million ha of agricultural land;
- poor provision of soil with nitrogen, on approximately 5.1 million ha of agricultural land;
- Extremely low to low provision of soil with humus on almost 7.5 million ha of agricultural land ;
- Microelements deficiencies on large areas, especially zinc deficiencies, strongly felt in the corn culture on about 1.5 million ha.

The humus content (H, %) determined in the agrochemical layer of agricultural monitoring sites in the nationwide 16x16 km grid (2002-2011) showed values ranging from extremely low to excessively high, with the highest proportion belonging to soils with low humus content (71.6%), followed by soils with medium content (23%) (Figure III.1).

Pollution from petroleum and salty water from oil drilling, refining, and transportation is present on approximately 50,000 hectares.

Figure III.1 Spatial distribution of humus content values in the agrochemical layer of agricultural monitoring sites, 16x16 km network



Source:ICPA

Soil damage through various excavation works affects about 24,000 ha, this being the most serious form of soil damage, found in the case of daily mining operations, as for example, in the mining basin of Oltenia.

The quality of soils affected by this type of pollution decreased by 1-3 classes, so that some of these surfaces became practically unproductive.

Covering soil with waste and solid residues determined the removal from the agricultural circuit of about 18,000 ha of agricultural land. The mentioned data are also highlighted by the results of the re-inventory of the lands affected by different processes (2002-2008) presented in summary in table III.2.

Table III.2 The general situation of soils in Romania affected by different processes

General name of processes	Code	Area (ha) and degree of damage					
		weak	**moderate**	**strong**	**very**	**excessi ve**	**Total**
I. Diverse soil pollution processes caused by industrial and agricultural activities.	1. Pollution through open-pit excavation activities (surface mining, quarries, gravel pits, etc.)	2	16	255	519	23640	**24432**
	2. Landfills, heaps, settling ponds, flotation tailings deposits, waste disposal sites, etc..	247	63	236	320	5773	**6639**
	3. Inorganic waste and residues (minerals, inorganic materials, including metals, salts, acids, bases) from industry (including extractive industries)	10	217	207	50	360	**844**
	5. Radioactive materials	-	500	-	-	66	**566**
	6.Waste and organic residues from light, food industry and other industries	13	19	12	17	287	**348**
	7. Waste, agricultural and forestry residues	37	65	90	642	306	**1140**
	8. Animal droppings	2883	993	363	265	469	**4973**
	9. Human waste		689	11		33	**733**
	17. Pesticides	1058	650	224	77	67	**2076**
	18. Contaminating pathogens	-	505	-	-	117	**617**
	19. Salt water (from oil extraction)	952	497	408	205	592	**2654**
	20. Petroleum products	-	473	248	5	25	**751**
	TOTAL I	**5.202**	**4,687**	**2,054**	**2,100**	**31,735**	**45,773**
II. Soils affected by slope processes and other processes	**10.** Surface erosion, landslides	944,763	1,013,854	749420	454150	210729	**3372916**
	15. Primary and/or secondary compaction	543371	544556	251268	125555	88526	**1553276**
	16. Contamination by sediments deposited as a result of the erosion process (clogging)	4088	2389	4808	1178	836	**13299**
	TOTAL II	**1492222**	**1560799**	**1005496**	**580883**	**300091**	**4939491**
III. Soils affected by natural processes and/or anthropic	**11.** Saline soils (saline and/or alkaline)	264163	80639	52488	36867	50678	**484835**
	12. Acid soils	1766295	1926886	716794	186023	18132	**4614130**
	13. Excess water	640738	1075063	420208	199479	185785	**2521273**
	14. Excess or deficiency of nutrients and organic matter	8358147	11604450	7549319	3306533	1373196	**32191645**
	TOTAL III	**11029343**	**14687038**	**8738809**	**3728902**	**1627791**	**39811883**

Source: The National Institute for Pedology, Agrochemistry, and Environmental Protection Research (I.C.P.A.) and the County Offices for Pedological and Agrochemical Studies (O.J.S.P.A)

SITES CONTAMINATED BY ANTHROPICAL PROCESSES

RO 15
Indicator code Romania: RO 15 EEA indicator code: CSI 15
TITLE: **PROGRESS IN THE MANAGEMENT OF CONTAMINATED SITES**
DEFINITION: Contaminated site management shows the progress achieved in five main stages: preliminary study, preliminary investigation, main site investigation, implementation of risk reduction measures, costs of decontamination

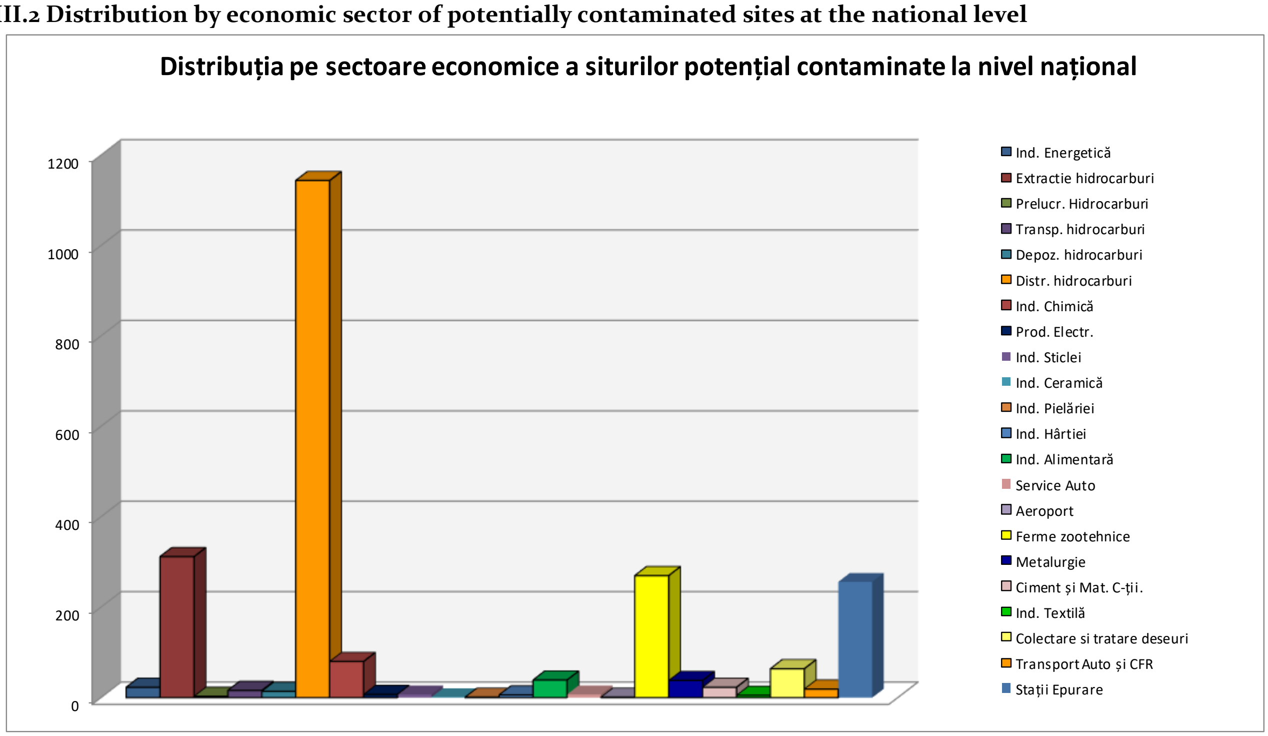
The management of potentially contaminated and contaminated sites aims to minimize any adverse effects of pollutants on human health and the environment.

Currently, the inventory of potentially contaminated sites, contaminated sites and remedied sites is in progress, complying with the provisions of Law no. 74/2019 on the management of potentially contaminated and contaminated sites.
This inventory is continuously dynamic and excludes waste deposits and mining industry sites, in accordance with the provisions of Law no. 74/2019 on the management of potentially contaminated and contaminated sites.

During the period following the publication of Law no. 74/2019 regarding the management of potentially contaminated and contaminated sites, until the update made on April 15, 2022 (update carried out by environmental protection agencies based on data transmission, where applicable, by local public administrations, until March 31, 2022), a total of 2,336 potentially contaminated sites were recorded, categorized by economic sectors as follows (see Figure III.2):

- 1489 potentially contaminated sites from the oil industry;
- 38 potentially contaminated sites from the metallurgical industry;
- 80 potentially contaminated sites from the chemical industry;
- 729 potentially contaminated sites from other activities (activities specific to the industries: energy, textile, paper, glass, cement and construction material, food, car transport and CFR, zootechnical activities, sewage treatment plants, etc.).

Figure III.2 Distribution by economic sector of potentially contaminated sites at the national level



Source: NEPA

In 2021, for the locations where preliminary investigation and/or detailed investigation and risk assessment were conducted, twelve decisions were issued categorizing potentially contaminated sites as suitable for less sensitive use, in accordance with Law no. 74/2019 on the management of potentially contaminated and contaminated sites, in the following sectors: petroleum industry, food industry, and chemical industry.

Following the procedural steps provided in Law no. 74/2019, nine contaminated sites (locations where detailed investigation and risk assessment were conducted) were identified in 2021, primarily from the petroleum industry. The funding for environmental remediation works of contaminated sites is borne by the polluter, adhering to the "polluter pays" principle. The implementation of Law no. 74/2019 will continue in the future, involving a significant volume of data and, for the first time, actively involving local authorities in the creation of the national inventory mentioned above.

Accidental pollution

In 2021, 168 environmental incidents were reported (table III.3 and figure III.3).
For the period 2017-2021, the distribution of environmental incidents by main environmental factors is shown in table III.3.

Table III.3 Breakdown of environmental incidents by main environmental factors

Environmental factors/Years	2017	2018	2019	2020	2021
Air	38	44	47	43	62
Water	73	56	53	65	46
Water/Soil	5	11	8	2	10
Air/Soil	4	3	4	12	3
Air/Water	0	0	2	0	0
Soil	73	52	44	52	45

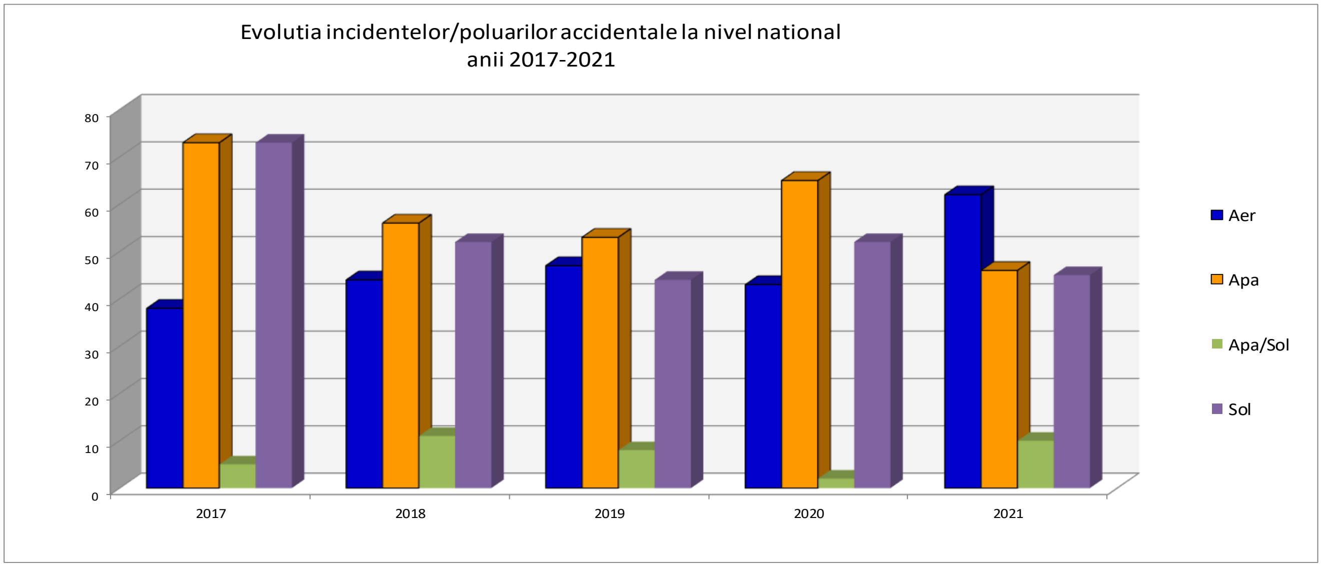
Source: NEPA

CONCLUSIONS:

- In 2021, 168 events were registered, 4.55% less than in 2020 (176 events), 6.33% more than in 2019 (158 events), 1.20% more than in 2018 (166 events) and 14.73% less than in 2017 (197 events).
- Over 90% of the environmental events recorded at national level in 2021 were caused by:
    - the activities of extraction/exploitation of hydrocarbon deposits and the transportation of petroleum products, the causes being: age, degradation, cracking of pipelines;
    - discharges/leaks of domestic waste water/technological and industrial water not purified or insufficiently purified with or without fish mortality;
    - fires/spontaneous ignitions at landfills or other industrial platforms.
- No major impact on environmental factors or human health was reported for environmental events recorded in 2021.

The evolution of environmental incidents at national level for the year 2021 and the 2017-2021 interval, as well as the evolution of pollution according to the environmental factors affected, is graphically presented below.

Figure III.3 Evolution of incidents/accidental pollution at national level, years 2017-2021



Source: NEPA

USE AND CONSUMPTION OF FERTILIZERS

RO 25

Indicator code Romania: RO 25
EEA indicator code: CSI 25

TITLE: GROSS **BALANCE OF NUTRIENT SUBSTANCES**

DEFINITION: The indicator estimates the nitrogen surplus on agricultural land. This is done by calculating the balance between the total amount of nitrogen entering the agricultural system and the total amount of nitrogen leaving the system, per hectare of agricultural land.

The situation of chemical fertilizer application on agricultural soils during the period 1999-2021 is presented in Table III.4 and Figure III.4. It is notable that the trend of chemical fertilizer application has been maintained, and in 2021, a peak was reached with 92.5% of the country's arable land being fertilized. The fertilized area in 2021 increased by 1,171,158 hectares compared to 2020.

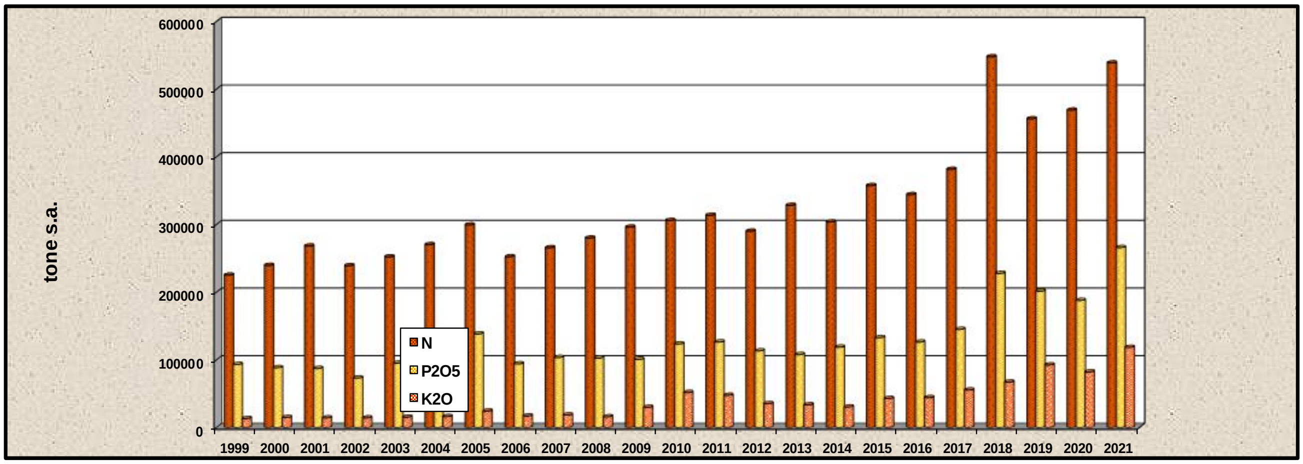
Table III.4 Use of chemical fertilizers in Romanian agriculture in the period 1999-2021

Year	Chemical fertilizers used (tons of active substance)				N+P2O5+K2O (kg.ha-1)		Fertilized area ha
	N	**P2O5**	**K2O**	**Total**	**Arable**	**Agricultural**	
1999	225000	93000	13000	331000	35.4	22.5	3640900
2000	239300	88300	14600	342200	36.5	23.0	3724578
2005	299135	138137	24060	461392	49.0	31.3	5737529
2006	252201	93946	16837	363000	38.5	24.7	5388348
2007	265487	103324	18405	387000	41.1	26.3	6422910
2008	279886	102430	15661	397977	42.3	27.1	6762707
2009	296055	100546	29606	426207	45.3	29	5889264
2010	305756	123330	51500	480586	51.0	32.7	7092256
2011	313333	126249	47362	486944	51.8	33.3	6893863
2012	289983	113045	34974	438002	46.8	30.0	6340780
2013	328088	107543	33324	468955	49.9	32.1	5965817
2014	303562	118574	30103	452239	48.2	30.9	6676089
2015	357352	132657	42693	532702	56.7	36.41	6574741
2016	344000	126000	44000	514000	54.7	35.13	6491498
2017	381342	144869	44259	581470	61.89	39.74	7272565
2018	547694	227605	66894	842193	89.8	57.7	6740184

2019	455964	201329	92258	749551	79.78	51.23	7373689
2020	468891	187577	81985	738453	78.60	50.48	7522224
2021	538610	265678	118199	922487	98.21	63.05	8693382

Source: NIS

Figure III.4 Use of chemical fertilizers in Romanian agriculture in the period 1999-2021



Source: NIS

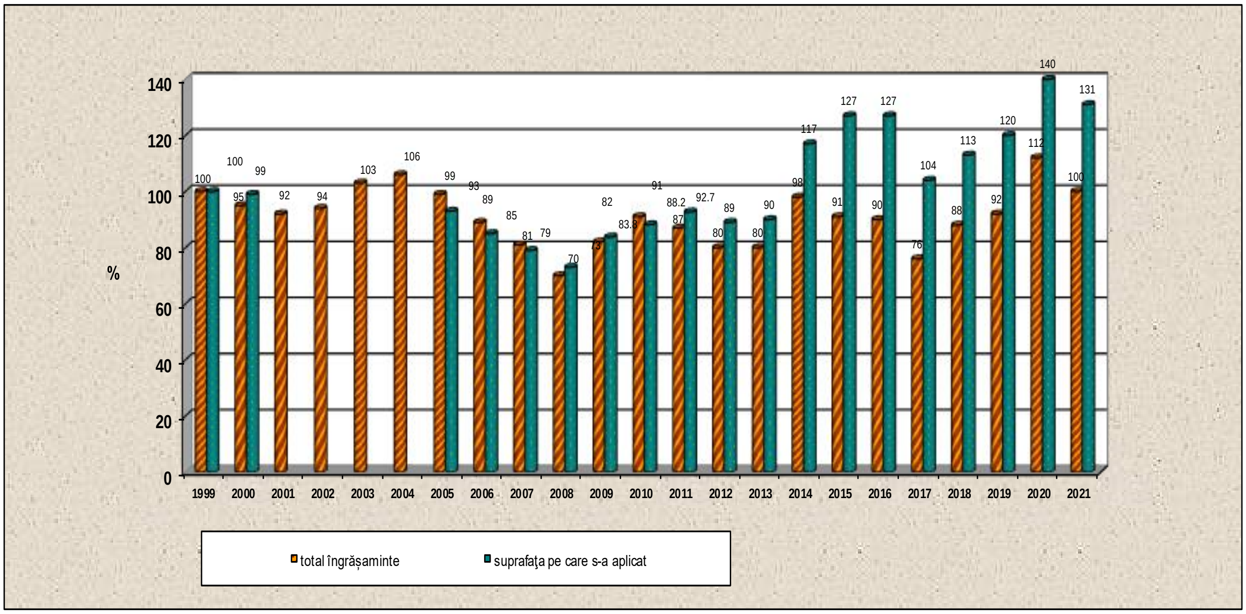
The quantity of natural fertilizers applied in 2021 (Table III.5, Figure III.5), compared to the amount used in 1999, increased by approximately 42,928 tons, and the area where natural fertilizers were applied recorded a 31% increase compared to 1999.

Table III.5 Amount of natural fertilizers applied in the period 1999-20211

Year	Total fertilizers		Area where applied		The proportion of the applied area compared to the cultivable area.	Average quantity per ha			
						on the area applied		**on the agricultural area**	
	t	**%**	**ha**	**%**	**%**	**t/ha**	**%**	**t/ha**	**%**
1999	16,685,312	100	680,016	100	6.90	24,537	100	1,129	100
2000	15,812,625	95	674,200	99	6.80	23,454	96	1,068	95
2005	16,570,000	99	632,947	93	6.78	26,179	107	1,124	100
2006	14,900,000	89	575,790	85	6.10	25,877	105	1,011	90
2007	13,498,000	81	536929	79	5.69	25,139	102	0.916	81
2008	11,725,220	70	494,412	73	5.25	23,715	97	0.797	71
2009	13,748,307	82	569,531	83.8	6.05	24,140	98	0.935	83
2010	15,231,715	91	600,052	88.2	6.37	25,38	103	1.04	92
2011	14,510,194	87	630293	92.7	6.70	23.02	94	0.99	88
2012	13.292.61713.2	80	605694	89	6.48	21.95	89.5	0.91	81
2013	82,877	80	613563	90	6.53	21.65	88.2	0.91	81
2014	16,261,702	98	795031	117	8.47	20.45	83.3	1.11	98
2015	15,212,325	91	864218	127	9.20	17.60	71.7	1.04	92
2016	14,927,000	90	862330	127	9.18	17.31	70.5	1.02	90
2017	12,625,073	76	708,364	104	7.54	17.8	72.5	0.86	76
2018	14,617,549	88	771,814	113	8.52	18.9	77.02	1.05	88
2019	15,323,344	92	816,713	120	8.69	18.8	76.6	1.05	93
2020	18,680,226	112	952,337	140	10.14	19.6	79.88	1.28	113
2021	16,728,240	100		131	9.45	18.8	76.62	1.14	101

Source: NIS

Figure III.5 Amount of natural fertilizers applied in the period 1999-2021



Source: NIS

EVOLUTION OF LAND IMPROVEMENT AREA

Climate change recorded in recent years in Romania, reflected by modifications in temperature and precipitation patterns, affects a significant portion of the country's agricultural land, especially in the southern, southeastern, and eastern regions. Agriculture is highly vulnerable to the impact of climate change as the associated risks are not evenly distributed.

There are regional variations in the likelihood of extreme events such as droughts and episodes of heavy precipitation, as well as in the vulnerability, resilience, and adaptive capacity of rural communities to climate change.

Land improvement works play a crucial role in ensuring an adequate level of soil moisture, which allows or stimulates plant growth, and in providing protection against floods, landslides, and erosion.

Land improvement arrangements are mostly administered by the National Land Improvement Agency (ANIF/NLIA) and include the following categories :

- Irrigation facilities ;
- Drying-drainage facilities ;
- Soil erosion combat facilities.

The proportion of areas developed for each category of works out of the total developments as well as the one reported to the value in 1999, present the following values:

- the area arranged for irrigation has a share of 36.82% of the total arrangements, which decreased by 9450 ha compared to 1999;
- the area arranged with drainage works comprises 36.58% of the total arrangements and decreased by 51,600 ha compared to 1999;
- the area arranged with anti-erosion works represents 26.61% of the total arrangements and increased by 14,198 ha compared to 1999.

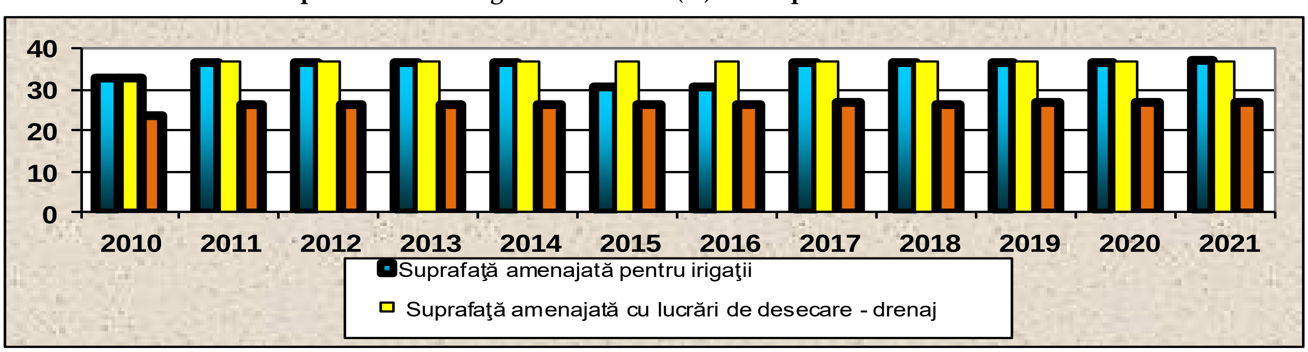
In 2021, compared to 2020, the area developed for irrigation increased by 4,380 hectares (Table III.6 and Figure III.6). There has been a trend of increasing the area developed for irrigation from 2016 to 2021. However, during the period from 2017 to 2021, there were no notable increases in the areas developed for drainage reclamation works or soil erosion control works.

Table III.6 Evolution of land improvements on agricultural land in the period 1999-2021

Year	Arranged area for irrigation[2]		Arranged area			
			with drainage works		with works to combat soil erosion	
	ha	%	ha	%	ha	%
1999	3179796	36.72	3201553	36.98	2276909	26.3
2000	3177512	35.25	3201628	36.12	2485374	28.03
2001	3177207	36.7	3201628	36.98	2278490	26,32
2002	3176283	36.69	3201748	36.98	2279904	26.33
2003	3176252	36.69	3201885	36.98	2280336	26.34
2004	6176632	36,67	3202431	36.97	2281335	26,36
2005	3001091	37.86	2851181	35.97	2074913	26,17
2006	3097309	36.88	3085295	36.73	2216577	26.39
2007	3057047	37.73	2911441	35.93	2134250	26.34
2008	3095633	36.83	3085295	36.72	2222287	26.45
2009	3095721	36.83	3085895	36.71	2224469	26.46
2010	3094839	36.82	3085895	36.71	2225383	26,47
2011	3091268	36.78	3086161	36.72	2226470	26.50
2012	3091268	36.78	3085895	36.72	2226469	26.5
2013	3091268	36.78	3085895	36.72	2226469	26.50
2014	3091268	36.77	3086140	36.71	2229018	26.52
2015	3091268	30.76	3086234	36.7	2231356	26.54
2016	3091268	30.76	3086234	36.7	2231356	26.54
2017	3149111	36.66	3149953	36,67	2291107	26.67
2018	3149111	36.66	3149953	36,67	2291107	26.67
2019	3152446	36.68	3149953	36.66	2291107	26.66
2020	3165966	36.78	3149953	36.60	2291107	26.62
2021*	3170346	36.82	3149953	36.58	2291107	26.61

*1)Source: NIS, *) last update on 16.05. 2022*

Figure III.6 Evolution of land improvements on agricultural land (%) in the period 2010-2021



*Source: NIS, *) last update on 16.05. 2022*

THE AREA INTENDED FOR ORGANIC FARMING

RO 26

Indicator code Romania: RO 26
EEA indicator code: CSI 26

TITLE: **AREA FOR ORGANIC FARMING**

DEFINITION: The indicator quantifies the share of the area dedicated to organic agriculture (the sum of the current areas with organic agriculture and the areas undergoing transformation), as a proportion of the total agricultural area.

Ecological agriculture represents a sector with significant development potential for Romania, being an essential instrument in the journey towards improving the environment through soil conservation, water quality enhancement, biodiversity, and nature protection.

The European and national legal framework regulating the organic production sector must aim to achieve the objective of ensuring fair competition and proper functioning of the internal market for organic products, as well as maintaining and justifying consumers' trust in products labeled as ecological.

The Ministry of Agriculture and Rural Development (MADR) is the competent authority for the organic agriculture sector in Romania, in accordance with the provisions of Article 27 of Regulation (EC) No. 834/2007..

Ecological agriculture is a production system that places great importance on the protection of the environment and animals, by reducing or eliminating genetically modified organisms and synthetic chemical products such as fertilizers, pesticides and growth regulator promoters (table III.7, figure III.7).

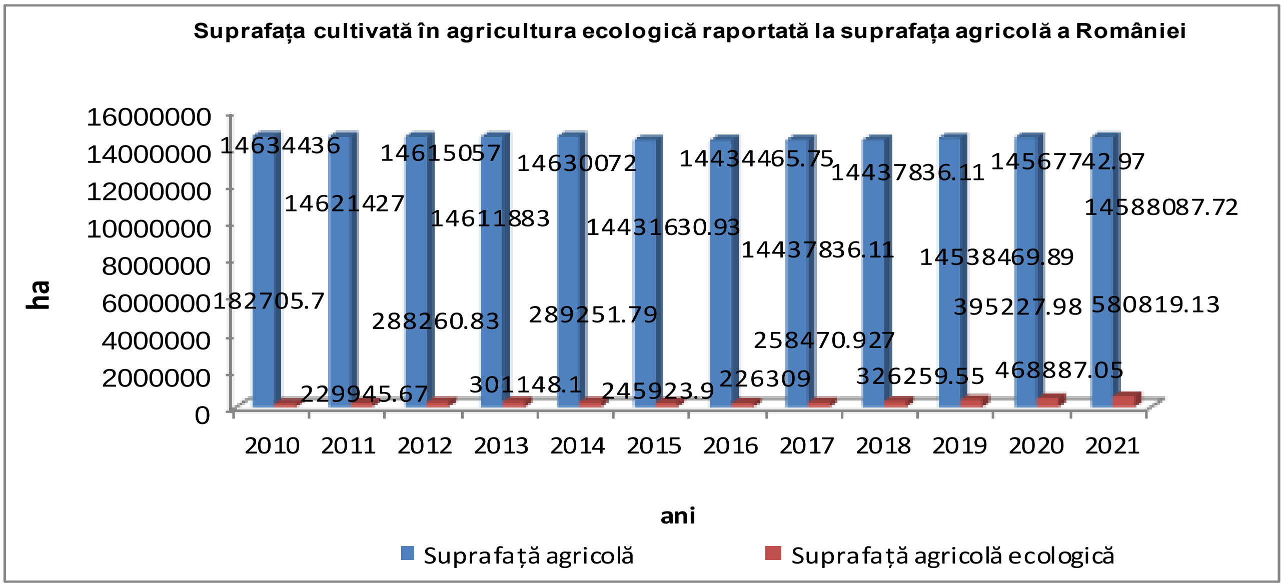
Table III.7 Dynamics of operators and areas in organic farming (2016-2021)

Indicator	2016	2017	2018	2019	2020	2021
Number of operators certified in organic farming	10562	8434	9008	9821	10210	12231
Total area in organic farming (ha)	226,309	258,470.92	326,259.55	395,227.97	468,887.05	578,718.45
Cereals (ha)	75,198.31	84,925.51	114,427.49	126,842.95	134,170.21	139,378.17
Dry and protein vegetabes for grain production (including seeds and mixtures of cereals and vegetables) (ha)	2,203.78	4,994.66	8,751.13	7,411.05	5,709.97	5,852.99
Tuberculiferous and root crops total (ha)	707.02	665.54	505.66	515.63	387.30	269.17
Industrial crops (ha)	53,396.86	72,388.33	80,193.08	78,350.29	91,638.97	114,407.78
Green harvested plants (ha)	14,280.55	20,350.75	28,253.75	37,660.85	53,718.20	74,703.17
Other crops on arable land (ha)	258.47	88.25	112.79	2.07	0	190.17
Vegetables (ha)	1,175.33	1,458.78	983.10	804.29	847.79	1,227.27
Permanent crops (ha) vine orchards, cultivated fruit bushes	12,019.81	13,165.41	18,569.27	22,143.43	22,219.42	21,233.35
Permanent crops (ha) pastures and hayfields	57,611.65	50,685.74	66,890.44	115,420.14	155,038.18	214,657,219

Uncultivated land (ha)	9,457.20	9,747.94	7,572.80	6,077.27	5,157.18	6,799.16

Source: Data communicated by the control bodies approved by MARD

Figure III.7 The area cultivated in ecological agriculture compared to the agricultural area of Romania



Source: ICPA, MARD

IV. LAND USE

IMPACT OF LAND USE CHANGE ON AGRICULTURAL LAND

Changes on the use of agricultural land in the period 2010 – 2014 are illustrated in table IV.1.
No other information is published by the NIS for this chapter, so the following shows the situation from 2010 to 2014.

Table IV.1 Distribution of the land fund by categories of use in the interval 2010 – 2014

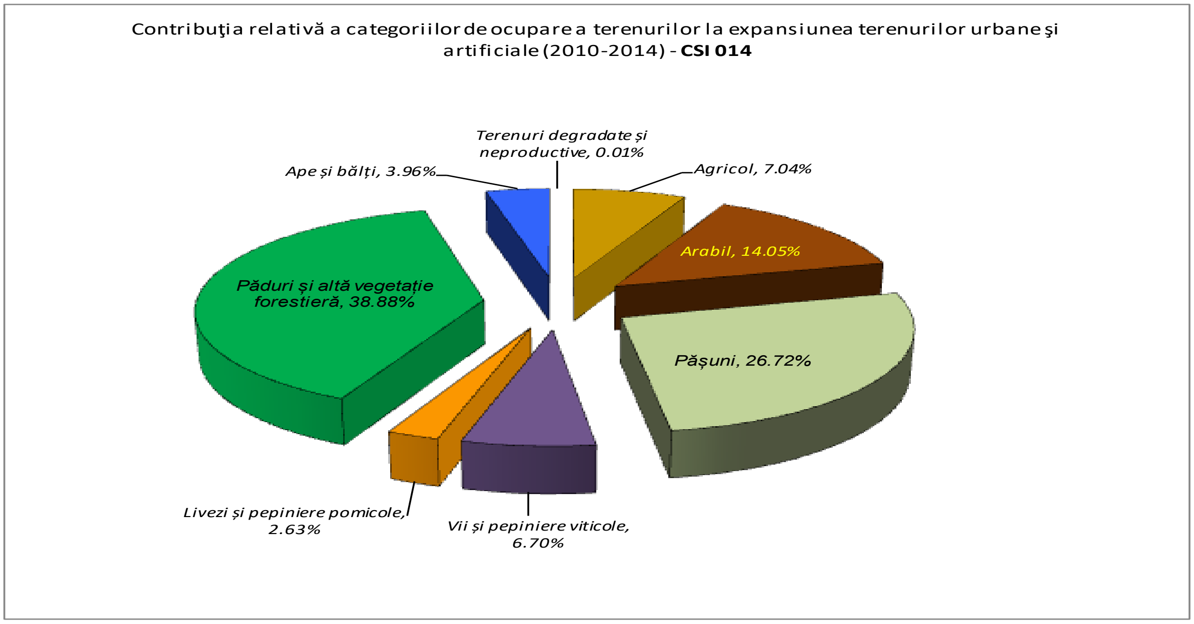
The manner of use of the land fund	Hectares per years				
	2010	**2011**	**2012**	**2013**	**2014**
Agricultural	14634436	14621427	14615057	14611883	14630072
Arable	9404008	9379489	9392262	9389254	9395303
Pastures	3288725	3279251	3270610	3273961	3272165
Meadows	1529561	1554680	1544957	1541854	1556246
Vineyards and vine nurseries	213571	211347	210475	210270	209417
Orchards and fruit tree nurseries	198571	196660	196753	196544	196941
Non-agricultural land, total	9204635	9217644	9224014	9227188	9208999
Forests and other wooded land	6758097	6759140	6746906	6742056	6734003
Occupied by water, ponds	833949	822202	836856	835997	831495
Occupied by buildings	728261	749386	752361	758303	758285
Communication and railway routes	388903	388194	388262	389895	389795
Degraded and unproductive lands	495425	498722	499629	500937	495421

Source: NIS, TEMPO-Online database

From data analysis, the representation in Figures IV.1 and IV.2 reveals an increase in pressure on forest and pasture areas due to urban expansion at the expense of rural areas, which has led to deforestation and reduction of meadow areas adjacent to expanding settlements. Additionally, the forest areas have decreased due to massive deforestation beyond the capacity of forest regeneration.

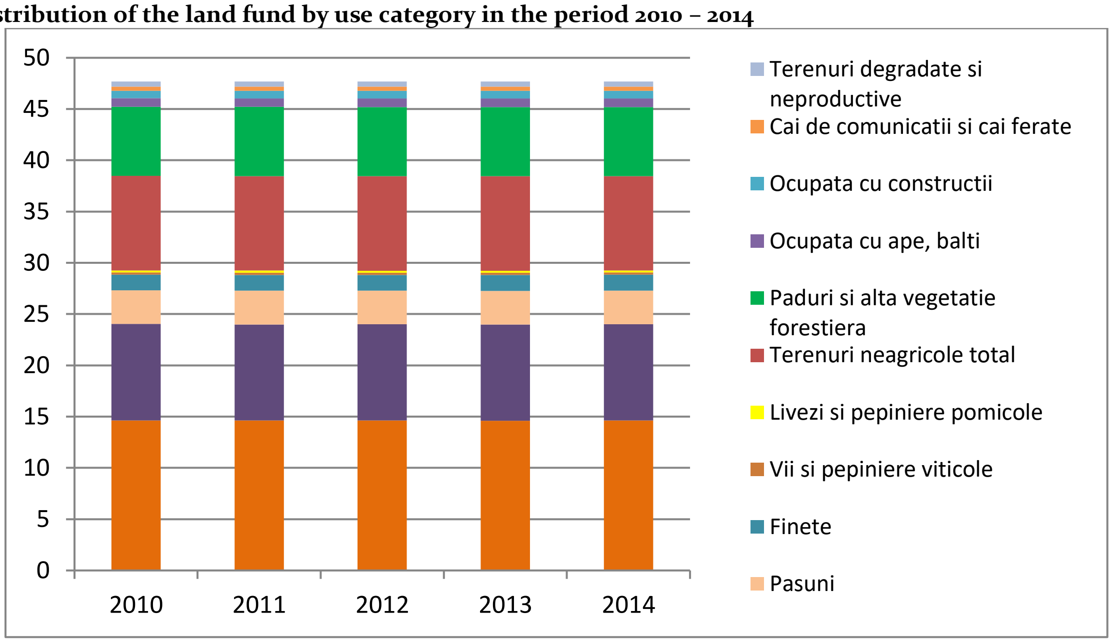
As for the arable land, the pressure on it has increased due to labor migration from the agricultural sector to other EU countries and the degradation and lack of investments in the irrigation system. In the vineyards and vine nurseries sector, the pressure exerted was caused by the aging of vine crops and the failure to replace them with young crops.

Figure IV.1 Relative contribution of land occupation categories to the expansion of urban and artificial land (2010-2014) - CSI 014



Source: NIS, TEMPO-Online database

Figure IV.2 Distribution of the land fund by use category in the period 2010 – 2014



Source: NIS, TEMPO-Online database

THE IMPACT OF LAND USE CHANGE ON HABITATS

RO 44
Indicator code Romania: RO 44 EEA indicator code: SEBI 13
TITLE: **FRAGMENTATION OF NATURAL AND SEMI-NATURAL AREAS**
DEFINITION: The indicator shows differences in the average of natural and semi-natural areas, based on land cover maps made by interpreting satellite images. The indicator is intended to address the issue of ecosystem integrity by providing a "measure" of land fragmentation over the entire surface of Romania.

The change in land use can lead to the fragmentation of habitats and implicitly affect the distribution of species that occupy a certain area.
The conversion of land for the purpose of urban expansion, the development of transport infrastructure, industrial, agricultural, touristic development is the main cause of the fragmentation of natural and semi-natural habitats. Currently, it is considered that approximately 6.5% of the country's surface is intended for housing construction. Chaotic construction, without respecting a coherent and consistent urban planning strategy, leads to the injudicious use of areas intended for construction and their expansion to the detriment of natural ones.
Uncontrolled urban development and the transfer of population from the countryside, accompanied by the destruction of ecosystems in urban areas (decreasing green spaces, constructions on green spaces, cutting down trees, destroying nests, etc.) and insufficient measures for the collection and proper treatment of waste and wastewater have considerable negative effects on biodiversity.

DETERMINANT FACTORS OF LAND USE CHANGE

CHANGE IN POPULATION DENSITY

The change in population at national level by development region, according to the available statistical data, is presented below in table IV.2 and figure IV.3.

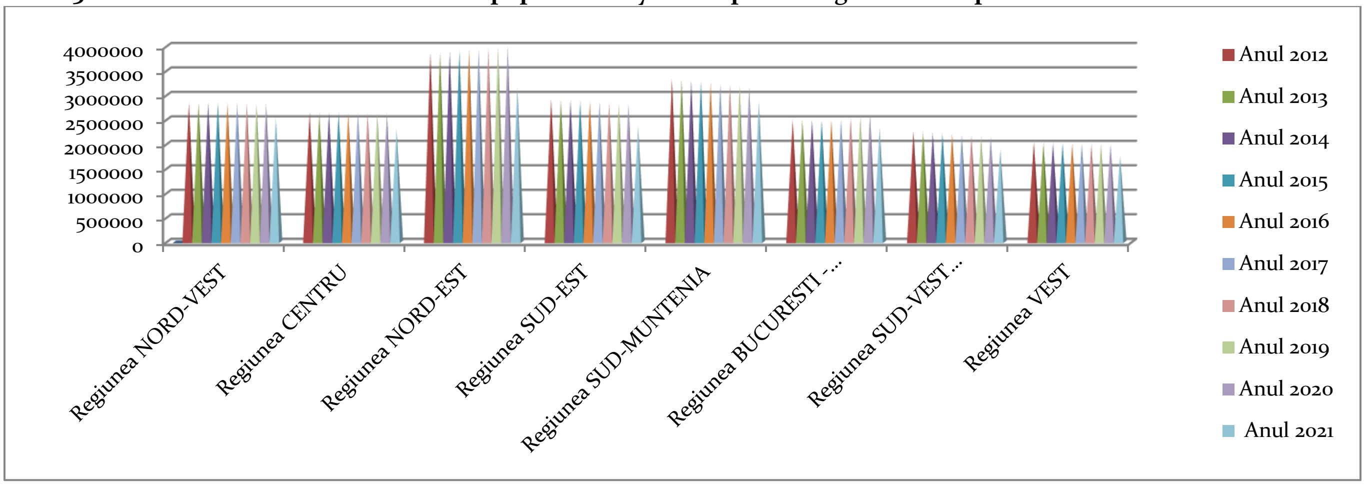
Table IV.2 Numerical distribution of the total population by development regions in the period 2012 – 2021

National population by development regions	2012	2013	2014	2015	2016	2017	2018	2019 2020		2021*
NORTH-WEST region	2847763	2844387	2841110	2838651	2836241	2836219	2835510	2833789	2832940	2537017
CENTER region	2646270	2643673	2641067	2638707	2636047	2634748	2633402	2631033	2628881	2302833
NORTH-EAST region	3879911	3885934	3899889	3918985	3929282	3939938	3958248	3979271	3999777	3163465
SOUTH-EAST region	2921160	2912373	2900677	2887747	2873851	2859897	2844235	2828048	2812450	2351636
SUD-MUNTENIA region	3337516	3320102	3300634	3282123	3262847	3242876	3219020	3194237	3167385	2868994
BUCHAREST - ILFOV region	2498698	2500564	2498984	2487485	2498318	2510877	2536859	2571442	2605519	2327057

SOUTH-WEST OLTENIA region	2264978	2251542	2237651	2223112	2207918	2194235	2179006	2163319	2146177	1892078
WEST region	2037445	2032403	2026166	2021443	2016294	2012053	2007273	2003368	1998689	1758582

**) Resident population on January 1 by development regions*
Source: NIS, TEMPO-Online database

Figure IV.3 Numerical distribution of the total population by development regions in the period 2012 - 2021



Source: NIS, TEMPO-Online database

URBAN EXPANSION

Continuous and rapid urban expansion threatens Europe's ecological, social and economic balance, says a new report by the European Environment Agency (EEA). This occurs when the rate of land use conversion exceeds the population growth rate. Over a quarter of the territory of the European Union has already been urbanized, the report states. Europeans are living longer and more and more people are living alone, creating a greater demand for housing space.

Land occupancy

RO 14
Indicator code Romania: RO 14 EEA indicator code: CSI 14
TITLE: **LAND OCCUPANCY**
DEFINITION: The indicator presents the quantitative change in the occupancy of agricultural, forested, semi-natural and natural lands through the expansion of urban and artificial lands. It includes waterproofed construction areas and urban infrastructure, as well as urban green spaces, sports and human recreation complexes.

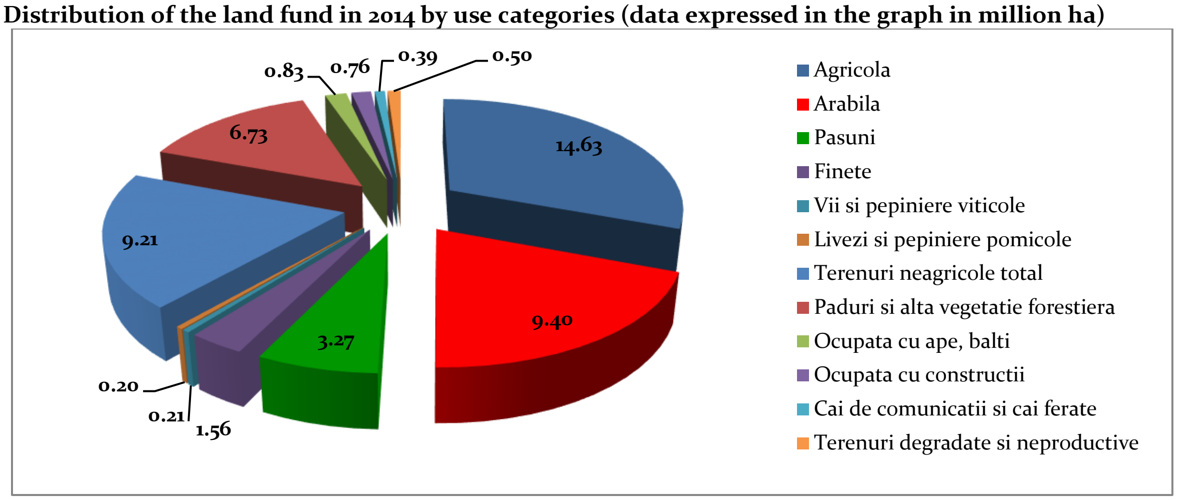
As of the year 2014, the land area was covered with the following land use categories according to Table IV.3 and Figure IV.4.

Table IV.3 Distribution of the land fund in 2014 by use categories

The land area according to land use pattern	HECTARES
Agricultural	14630072
Arable	9395303
Pastures	3272165
Meadows	1556246
Vineyards and vine nurseries	209417
Orchards and fruit tree nurseries	196941
Non-agricultural land, total	9208999
Forests and other wooded land	6734003
Occupied by water, ponds	831495
Occupied by buildings	758285
Communication and railway routes	389795
Degraded and unproductive lands	495421

Source: NIS, TEMPO-Online database http://statistici.insse.ro/shop/index.jsp?page=tempo3&lang=ro&ind=AGR101A

Figure IV.4 Distribution of the land fund in 2014 by use categories (data expressed in the graph in million ha)



Source: NIS

Land occupancy by transport infrastructure

RO 68
Indicator code Romania: RO 68 EEA indicator code: TERM 08
TITLE: **LAND OCCUPANCY BY TRANSPORT INFRASTRUCTURE**
DEFINITION: The indicator shows the land occupied by the transport infrastructure.

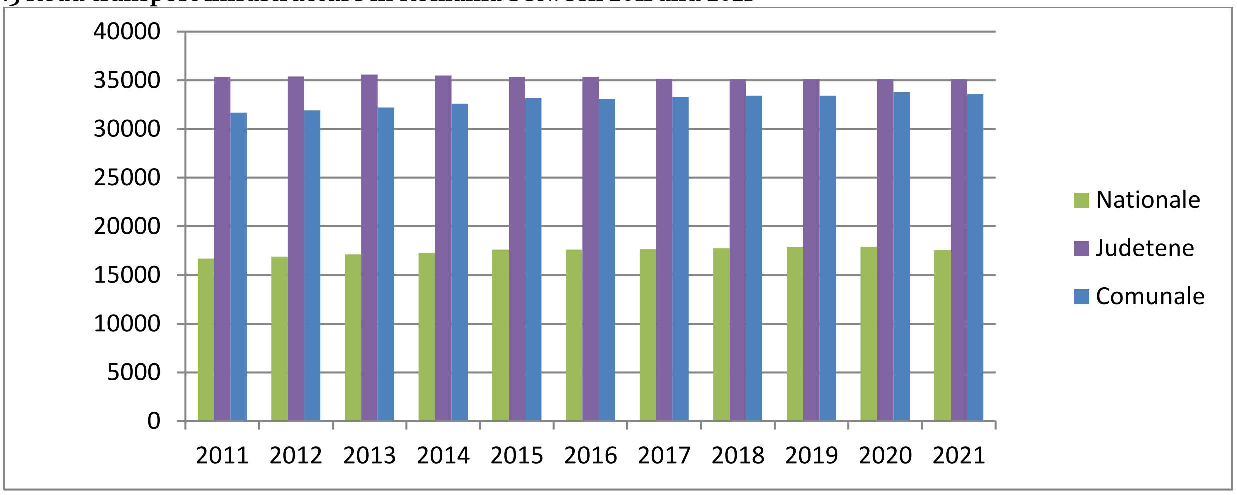
The transport infrastructure in Romania, in the period 2011 - 2021, according to the available national statistical data, shows an insignificant increase (tables IV.4, IV.5 and figures IV.5 and IV.6).

Table IV.4 Road transport infrastructure in Romania between 2011 and 2021

Categories of roads	Length kilometers per years										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
National	16690	16887	17110	17272	17606	17612	17654	17740	17873	17913	17530
County	35374	35380	35587	35505	35316	35361	35149	35085	35083	35085	35096
Communal	31674	31918	32190	32585	33158	33107	33296	33409	33435	33793	33573

Source: NIS, TEMPO-Online database

Figure IV.5 Road transport infrastructure in Romania between 2011 and 2021



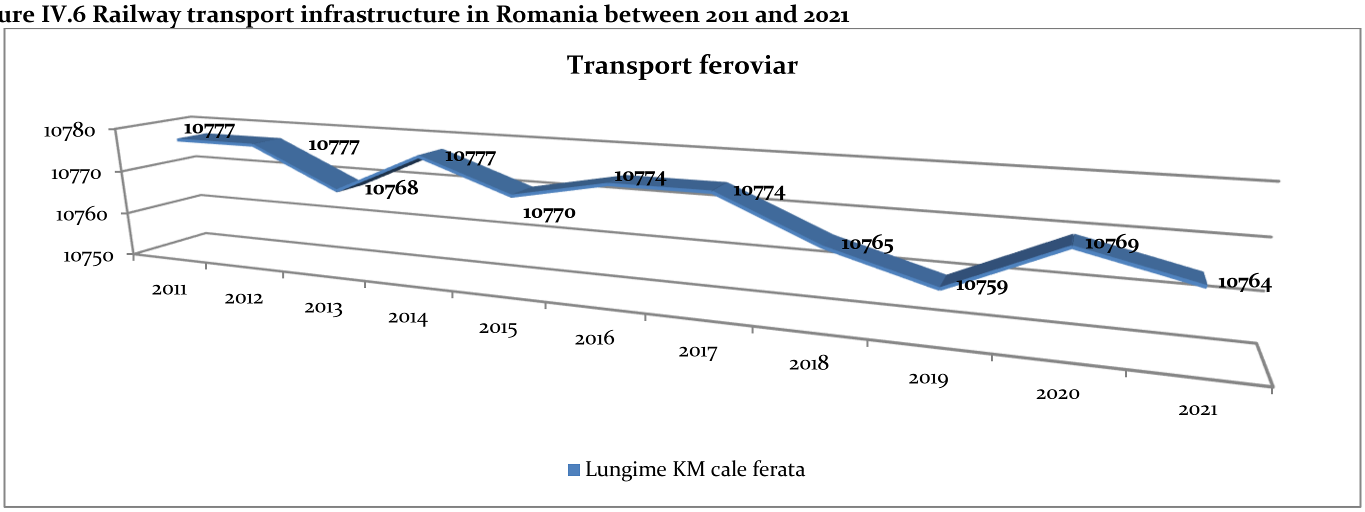
Source: NIS, TEMPO-Online database

Table IV.5 Railway transport infrastructure in Romania between 2011 and 2021

Rail transport	Year										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Length Km CF	10777	10777	10768	10777	10770	10774	10774	10765	10759	10769	10764

Source: NIS, TEMPO-Online database

Figure IV.6 Railway transport infrastructure in Romania between 2011 and 2021



Source: NIS, TEMPO-Online database

V.NATURE PROTECTION AND BIODIVERSITY

Biodiversity in Romania is one of the richest in Europe, and it holds significant importance at local, national, regional, and global level. Romania has brought into the European Union a valuable natural capital, with numerous species and animals, some of which are endemic and extinct or rare in other parts of Europe. In Romania, pressures on biodiversity include changes in land use, infrastructure development, inadequate exploitation of natural resources, invasive species, climate change, and pollution. According to the updated information from the Natura 2000 standard forms, the most important threats are related to grazing and forestry activities (affecting 247 Natura 2000 sites), hunting (189 sites), and urbanization (151 sites).

Biodiversity indicators selected and treated in this chapter are those for which there are relevant data for the year 2021, respectively:

Indicator name	RO code	EEA code	Type
Species of European interest	RO 07	CSI 007	S
Habitats of European interest	RO 40	SEBI 005	S
Nationally designated protected areas	RO 41	SEBI 007	R
Protected areas of community interest, designated according to the Habitats Directive and the Birds Directive	RO 42	SEBI 008	R

CONSERVATION STATUS AND TRENDS OF BIODIVERSITY COMPONENTS

The geographical position of Romania, at the junction of the floral and faunal sub-zones - Mediterranean, Pontic, and Eurasian palearctic, as well as the radial and symmetrical distribution of landforms, has resulted in a great diversity and richness of flora and fauna. Romania's territory overlaps with 5 out of the 11 biogeographical regions of Europe: alpine, continental, Pannonian, Pontic, and steppe, with the following proportions of the country's surface: continental (53%); alpine (23%); steppe (17%); Pannonian (6%); Pontic (1%). In Romania, natural and semi-natural ecosystems account for approximately half of the country's surface, while the other half is occupied by agricultural ecosystems, constructions, and infrastructure. The types of ecosystems fall into the following major categories: forest ecosystems, grassland ecosystems, freshwater and brackish ecosystems, marine and coastal ecosystems, and underground ecosystems.

n order to fulfill the reporting obligations, the European Union member states are required to monitor and periodically transmit data to the European Commission regarding the conservation status of species and habitats of European interest, in accordance with the provisions of Article 17 of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive).

The conservation status is the result of monitoring and evaluating the following characteristics of habitats::

- ✓ *natural distribution area;*
- ✓ *area covered by the habitat;*
- ✓ *structure and specific functionality of the habitat;*
- ✓ *future prospects.*

TRENDS REGARDING THE CONSERVATION STATUS OF ECOSYSTEMS AND HABITATS

RO 40
Indicator code Romania: RO 40 EEA indicator code: SEBI 005
TITLE: **HABITATS OF EUROPEAN INTEREST IN ROMANIA**
DEFINITION: The indicator shows the changes in the conservation status of habitats of European interest.

The indicator presents the evolution of the conservation status of habitats of European interest (listed in Annex I of the Habitats Directive) and is based on the data collected/monitored in accordance with the reporting obligations provided for in Article 17 of the Habitats Directive.

The conservation status of species and habitats of community interest is assessed at national and biogeographic level, reported on a 3-level scale, known as"traffic lights",so:

- **Favorable conservation status: green indicator**– Any pressure or threat that influences the habitat is not significant, and the habitat is viable in the long term;
- **Unfavorable conservation status: orange indicator**– used for situations where a change in existing administration or policy is necessary, but the danger of extinction is not so great;
- **Unfavorable conservation status totally inadequate: red indicator**– serious threats and pressures influence the maintenance of the habitat.

The "unfavorable" category was split into two classes to allow reporting of further improvement or deterioration:

■ U1 - Unfavorable inadequate

■ U2 - Unfavorable bad.

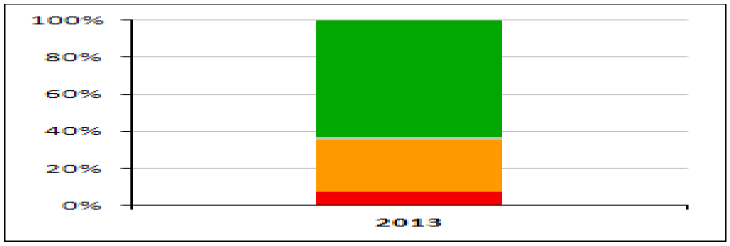
For the definition of this indicator at national level, relevant are the data and information reported by Romania in the country report, in accordance with article 17 of the Habitats Directive. In 2013, Romania prepared and submitted its first report on the conservation status of habitats of community interest to the European Commission. The monitoring data of the conservation status of habitats of community interest for the period 2012-2018, based on Article 17 of the Habitats Directive, will be updated as part of the project carried out by the Ministry of Environment, Waters, and Forests: *'Enhancing the level of biodiversity knowledge through the implementation of the monitoring system for the conservation status of species and habitats of community interest in Romania and reporting under Article 17 of Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora*. This report presents the results of monitoring the conservation status of habitats of community interest for the period 2007-2012, provided by experts within the project 'Monitoring the conservation status of species and habitats in Romania based on Article 17 of the Habitats Directive,' implemented by the Institute of Biology of the Romanian Academy, Bucharest, and completed in 2013. The project was implemented in partnership with the Ministry of Environment, Waters, and Forests - Biodiversity Directorate and funded through the Operational Sectoral Program - Environment (POS-Environment), priority axis 4. In the process of evaluating habitats of community interest across the entire national territory, both within and outside protected natural areas, in accordance with Article 17 of the Habitats Directive, the following major habitat classes have been identified: coastal habitats with halophilic vegetation; coastal sand dunes and continental sand dunes; freshwater habitats; temperate grasslands and shrublands; natural and semi-natural grassland formations; marshes and bogs; rocky habitats and caves; forests.

Table V.1. Number of habitats reported according to Annex I of the Habitats Directive

Bioregion	Habitats	
	Annex I	
	Non-priority	Priority
Number of habitats in Romania	**60**	**25**
	85	
Alpine (ALP)	37	11
Pontic Black Sea (BLS)	18	3
Continental (CON)	34	17
Pannonic (PAN)	11	5
Steppe (STE)	18	6
Black Sea (MBLS)	6	

Source: ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 by EC

Figure V.1. Global assessment of habitat conservation status

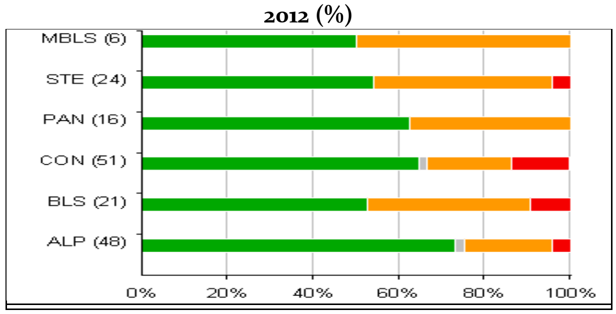


Source: ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 by EC

FV - Favorable
NA - Not reported
XX - Unknown
U1 - Unfavorable inadequate
U2 - Unfavorably Bad

It is observed that overall, the habitats in Romania that have been evaluated and reported are in a state of favorable conservation in over 60% of cases, while approximately 7% of them have been assessed as being in a "completely unfavorable" state

Figure V.2. Conservation status of habitats of European interest in Romania by biogeographic regions, reporting period 2007-2012 (%)

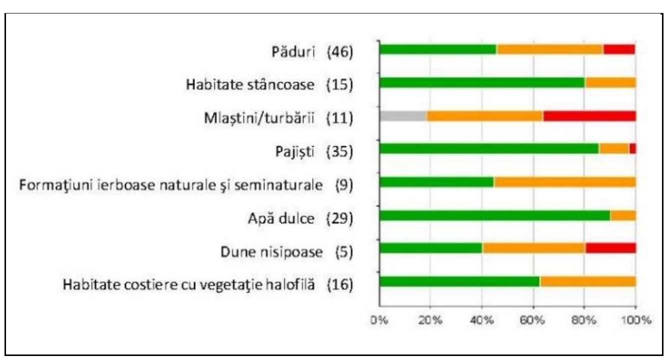


Source:ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 EC

***Note**:The number in each parenthesis corresponds to the number of assessments at the level of each biogeographical region for the reporting period 2007-2012*

According to the data reported to the Commission it is observed that the most habitats whose state of conservation is favorable are found in the alpine region, a region followed in order by the biogeographical regions: continental, pannonic, steppe and pontic.

Figure V.3. Conservation status by habitat classes of European interest in Romania, in the period 2007-2012 (%)

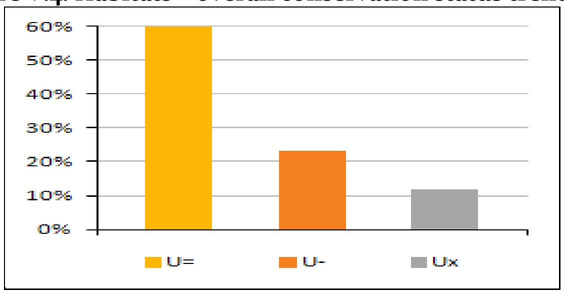


Source :ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 by EC

***Note**: The number in each bracket corresponds to the number of evaluations for the period 2007-2012*

The habitat class of marshes and bogs was assessed with an unfavorable conservation status in over 80% of cases during the period 2007-2012.

Figure V.4. Habitats – overall conservation status trend (%)



Source: ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 by EC

Note:
(U+) = unfavorable (inadequate or bad) with a trend to improve
(U=) = unfavorable stable
(U-) = unfavorable with worsening trend
(Ux) = unfavorable with unknown trend

TRENDS REGARDING THE STATUS OF PRIORITY SPECIES

RO 07
Indicator code Romania: RO 07 EEA indicator code: CSI 007 / SEBI 003
TITLE: **SPECIES OF EUROPEAN INTEREST**
DEFINITION: The indicator shows changes in the conservation status of species of European interest. It is based on the data collected as part of the monitoring obligations in accordance with Art. 11 of the Habitats Directive (92/43/CEE).

Indicator RO07 shows the changes in the conservation status of species of community interest based on data collected within the monitoring obligations in accordance with Article 11 of the Habitats Directive. It refers to species of community interest (listed in Annexes II, IV, and V of the Habitats Directive), with the exception of bird species. The conservation status of species is evaluated at both national and biogeographical levels and reported on a three-level scale, color-coded differently as mentioned for indicator RO40. Additionally, the overall conservation status during the reporting period and the general trends of conservation status are estimated (qualifiers: improved "+", declining "-", stable "=", unknown "x").

For the definition of the RO07 indicator at national level, relevant are the data and information that Romania reported to the European Commission, regarding the state of conservation of species of community interest, as a result of the monitoring carried out within the projects implemented by the Ministry of Environment, Water and Forests .The Ministry of Environment, Water and Forests is currently running a project co-financed from the Cohesion Fund through the Large Infrastructure Operational Program 2014-2020 "*Completing the level of knowledge of biodiversity by implementing the system for monitoring the state of conservation of species and habitats of community interest from Romania and reporting based on article 17 of the Habitats Directive 92/43/EEC*", which aims to monitor the species from the Annexes of the Habitats Directive throughout the national territory, both inside and outside protected natural areas.
The project falls under the categories of activities related to Priority Axis 4 - Environmental protection through biodiversity conservation measures, air quality monitoring and decontamination of historically polluted sites - Specific Objective (OS) 4.1 "*Increasing the degree of biodiversity protection and conservation through management measures adequate and restoring degraded ecosystems*", namely the implementation of a type C action - Actions to complete the level of knowledge of biodiversity and ecosystems (monitoring and evaluation of species and habitats, knowledge of the pressure factors exerted on

biodiversity.). The location area of the above-mentioned project includes the entire national territory, both inside and outside the protected natural areas. The present report shows the results of monitoring species of community interest for the period 2007-2012, provided by experts within the project "*Monitoring the conservation status of species and habitats in Romania based on Article 17 of the Habitats Directive*," implemented by the Institute of Biology of the Romanian Academy, Bucharest, in partnership with the Ministry of Environment, Waters, and Forests, and completed in 2013.

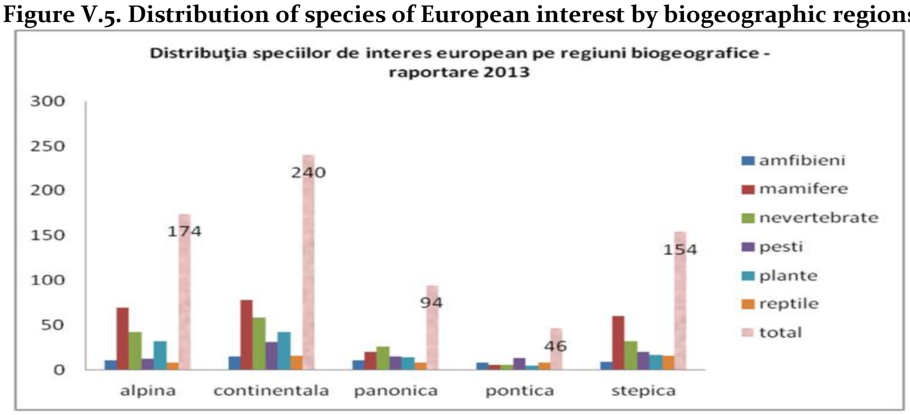
The number of species in each Annex of the Habitats Directive by biogeographical region for which reports have been sent to the Commission, according to Article 17 of the Habitats Directive, is presented in the table below:

Table V.2. The number of species from the Annexes of the Habitats Directive

Bioregion	SPECIES					
	Annex II		Annex IV		AnnexV	
	Non-priority	Priority	Including those in Annex II	Without those in Annex II	Including those in Annex II	Without those in Annex II
Number of species in Romania	147	15	174	50	35	26
	162		174		35	
Alpine (ALP)	74	7	94	33	20	18
Pontic Black Sea (BLS)	25	1	24	11	15	9
Continental (CON)	114	12	140	44	29	21
Pannonic (PAN)	49	2	55	20	14	10
Steppe (STE)	64	3	87	39	19	13
Black Sea (MBLS)	2		3	1		

Source: ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 by EC

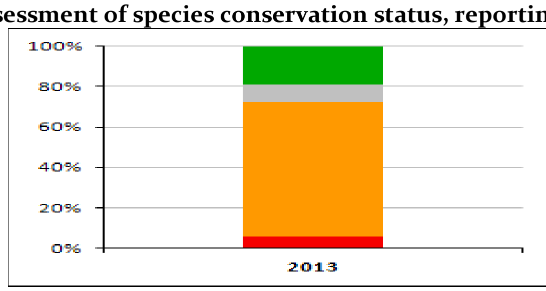
Figure V.5. Distribution of species of European interest by biogeographic regions



Source: ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 by EC

The biogeographical regions with the greatest wealth of species of European interest are: continental, alpine and steppe.

Figure V.6. Global assessment of species conservation status, reporting period 2007-2012 (%)



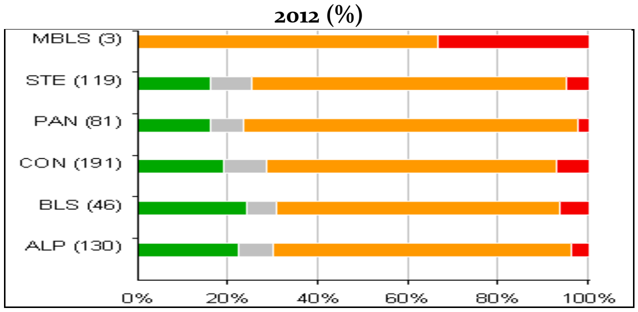
Source: ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 by EC

The legend

FV - Favorable
NA - Not reported
XX - Unknown
U1 - Unfavorable inadequate
U2 - Unfavorably Bad

According to the reported data, it is estimated that a significant percentage (67%) of the total evaluated species have an inadequately unfavorable conservation status, while 5% have a completely unfavorable status. As a result, with an overall value of 72% unfavorable conservation status for species of community interest, Romania stands well above the European average (54% in EU-25 - SOER 2010). 18% of the evaluated species have a favorable status (compared to 17% in the EU average), and the percentage of unevaluated species in Romania is lower compared to the EU average.

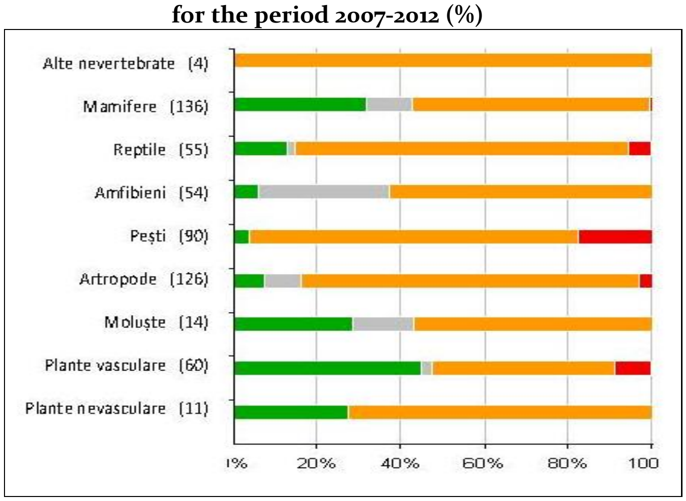
Figure V.7. Conservation status of species of European interest in Romania by biogeographic regions, reporting period 2007-2012 (%)



Source:ibis.anpm.roand National Summary for Article 17 Romania – 2007-2012 by EC

According to the data reported to the Commission, the situation in the Black Sea region is alarming since none of the evaluated and reported species have a favorable assessment.

Figure V.8. Conservation status of species of European interest in Romania by taxonomic groups, for the period 2007-2012 (%)

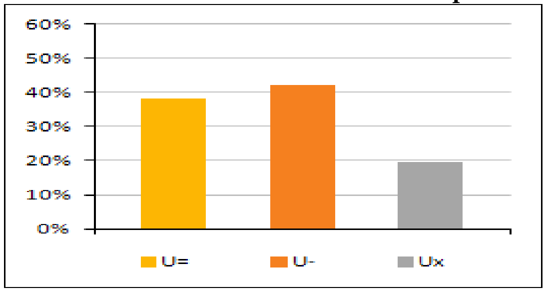


Source: ibis.anpm.ro and National Summary for Article 17 Romania – 2007-2012 by EC
Note:*The number in brackets represents the number of assessments per bioregion corresponding to the reporting period 2007-2012*

From the data and information reported in 2013, it results that among the evaluated species, fish have the weakest favorable conservation status, followed by amphibians and arthropods, then by reptiles, molluscs, mammals and plants.

According to the reported data, trends of improvement or deterioration for species with an unfavorable conservation status (U1 and U2) are shown in percentage on the graph below.

Figure V.9. Species – General trend of the conservation status of species of Community interest (%)



Note:
(U+) = unfavorable (inadequate or bad) with a tendency to improve
(U=) = unfavorable stable
(U-) = unfavorable with worsening tendency
(Ux)=unfavorable with unknown tendency

Within the project "***Completing the level of knowledge of biodiversity by implementing the monitoring system of the conservation status of bird species of community interest in Romania and reporting based on article 12 of the Birds Directive 2009/147/CE" MySMIS 119428***", whose beneficiary is the Ministry of the Environment, Waters and Forests, the species of birds as well as their populations and their distribution were evaluated. The information obtained was reported by Romania in 2020 to the European Commission, in accordance with Article 12 of the Birds Directive. The project was co-financed from the European Regional Development Fund through the Large Infrastructure Operational Program 2014-2020.

The trends of bird populations at the national level and the trends of breeding species distributions, evaluated based on the data reported in 2020, are presented in the tables and graphs below. The percentages represent the categories of trends (the initial data and official categories from the reporting tool are given in parentheses): increasing (I), stable (S), fluctuating (F), uncertain (U), and unknown (UNK). The population trends include both short-term and long-term trends, covering both the Breeding (B) and Wintering (W) phenological categories. For spatial distributions, both short-term and long-term trends are included, but only for breeding species (B).

- Total number of species reported: 291
- Total number of reports included (Breeding, Wintering and Passage categories): 366
- Number of species reported in the Breeding category: 251 (86.3% of species reported for the breeding period)
- Number of species reported in the Wintering category: 47 (16.2% of species reported for the wintering period)
- Number of species reported in the Passage category: 68 (23.4% of species reported for the nesting period).

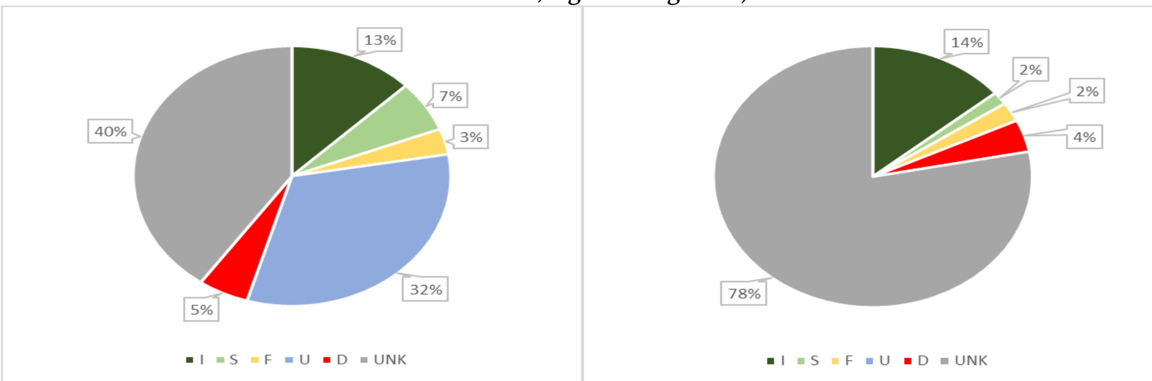
Regarding the synthesis of the data reported for the population numbers, the situation is presented in the table and figures below (short-term and long-term population trends are calculated only for the Nesting/Breeding and Wintering phenological categories).

Table V.3. Number of bird species by types of population trends, for each phenological category

Category	Short-term population trends						Long-term population trends						Total
	I	S	F	U	D	UNK	I	S	F	U	D	UNK	
Breeding	32	16	8	81	13	101	35	4	6	0	10	196	251
Wintering	5	3	0	30	8	1	10	8	0	17	11	1	47
Passage	-	-	-	-	-	-	-	-	-	-	-	-	68

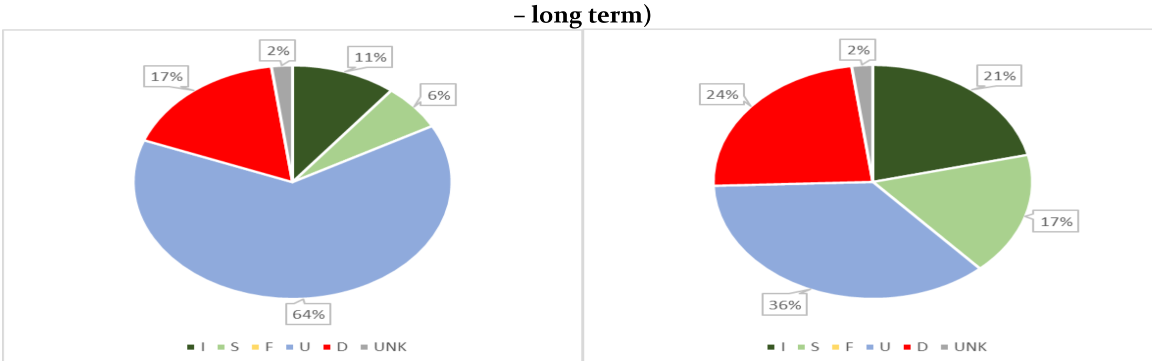
Source: SOR www.sor.ro

Figure V.10. Bird population trends, Reproduction/Breeding category. The percentage of different trends in the total (left – short term, right – long term)



Source: SOR www.sor.ro

Figure V.11. Bird population trends, Wintering category. The percentage of different trends in the total (left – short term, right – long term)



Source: SOR www.sor.ro

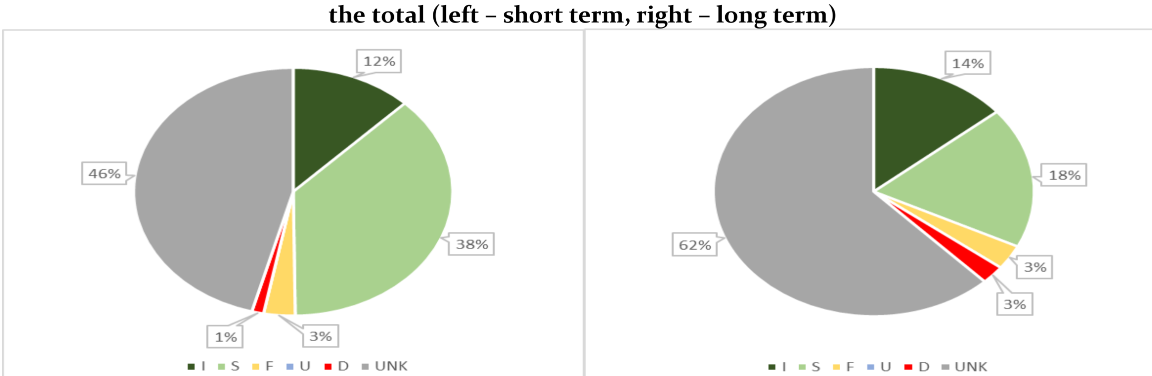
Regarding the synthesis of data reported for population distributions, the situation is presented in the table and figure below (the trends of the spatial distributions of bird species are calculated only for the Nesting/Breeding category).

Table V.4. Number of bird species by types of distribution trends

Category	Short-term population trends						Long-term population trends						Total
	I	S	F	U	D	UNK	I	S	F	U	D	UNK	
Nesting	31	94	8	0	3	115	35	46	8	0	6	156	251

Source: SOR www.sor.ro

Figure V.12. Trends in the distribution of bird species, Reproduction/Breeding category. The percentage of different trends in the total (left – short term, right – long term)



Source: SOR www.sor.ro

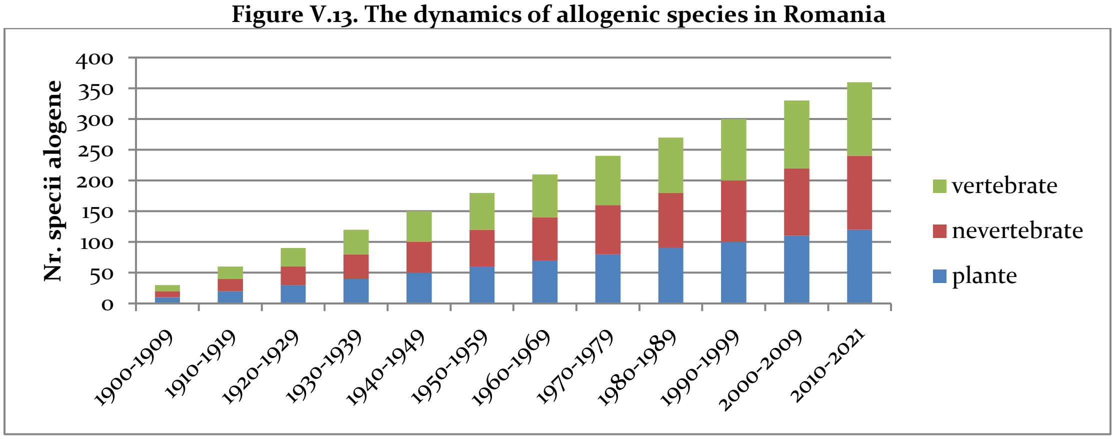
PRESSURES AND THREATS EXERTED ON BIODIVERSITY

INVASIVE SPECIES

RO 43
Indicator code Romania: RO 43 EEA indicator code: : SEBI 010
TITLE: **INVASIVE ALLOGENIC SPECIES**
DEFINITION: The indicator includes two elements: "The total number of allogenic species in Europe since 1900", which shows the evolution of species that have the potential to become invasive allogenic species, and "the most harmful invasive allogenic species that threaten biodiversity in Europe", which includes a list of invasive species with demonstrated negative impact.

At national level, invasive species have a major impact on biodiversity, representing a real threat to terrestrial and marine ecosystems.

Figure V.13. The dynamics of allogenic species in Romania



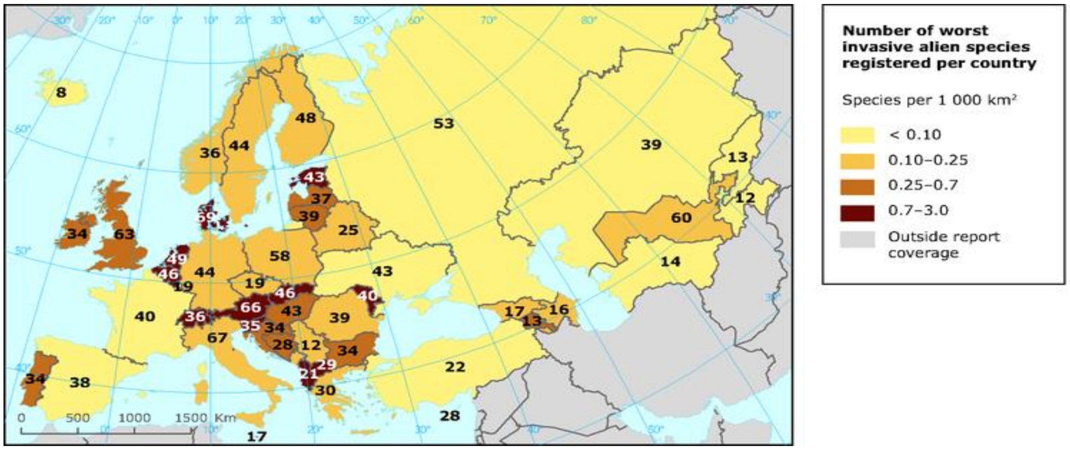
Source: DAISIE

The current situation in Romania can be characterized as follows:

- a low degree of awareness of public opinion and consequently an opposition of the civil society to the interventions of the government administration;
- extremely low degree of accessibility to scientific information, especially in relation to species identification, risk analysis, etc.;
- the absence of a priority approach to actions regarding the control of invasive species;
- rampant introduction of invasive species – often through the mail – as well as inadequate inspection and quarantine measures;
- inadequate monitoring capacity;
- lack of effective emergency measures;
- poor coordination between government agencies, authorities and local communities.

On the National Strategy and Action Plan for the Conservation of Biodiversity 2010 - 2020 it is stated that, at national level there is no clear record of the number of allogenic invasive species, the only centralization of data and information related to them being carried out in the European database DAISIE, by researchers, voluntarily.

Figure V.14. The number of the most dangerous invasive species per country

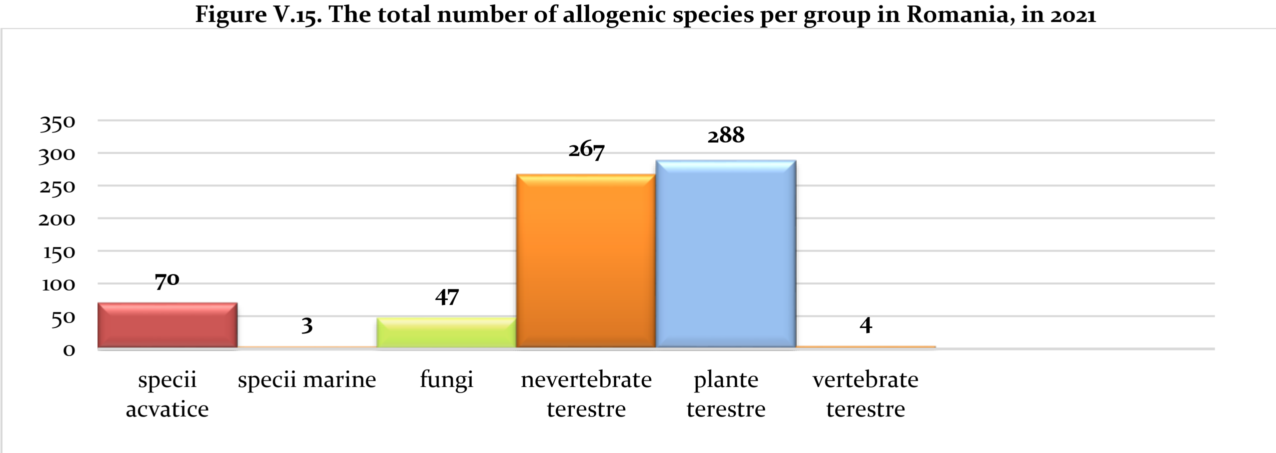


Source: DAISIE

In Romania, according to the data voluntarily recorded by numerous experts within the DAISIE application and the information reported by some environmental protection agencies, we find approximately a total number of 679 allogenic species, of which 70 aquatic species, 3 marine species, 267 species of terrestrial invertebrates, 47 species of fungi, 288 species of terrestrial vertebrates and 4 species of terrestrial plants.

The Romanian Government has adopted Law No. 62/2018 on combating the weed Ambrosia (Ambrosia artemisiifolia) at national level, as well as Government Decision No. 707/2018 approving the Methodological Norms for the implementation of Law No. 62/2018 on combating Ambrosia weed (Ragweed).
In accordance with legal competencies, environmental protection agencies conducted awareness campaigns throughout the year 2021 with the support of the mass media, targeting citizens and local public administrations regarding the provisions of Law No. 62/2018 on combating Ambrosia.
Additional information can be found on the website of the Ministry of Environment, Waters, and Forests at the following link:http://www.mmediu.ro/app/webroot/uploads/files/Ambrozia%20prezentare%20si%20combatere.pdf.

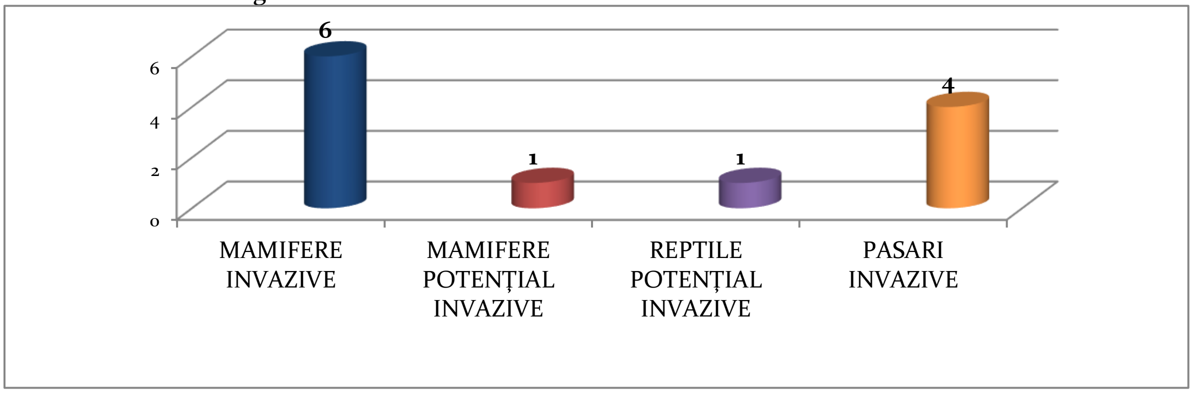
Figure V.15. The total number of allogenic species per group in Romania, in 2021



Source: DAISIE& EPA

The situation of invasive animals that threaten biodiversity in Romania makes a distinction of the most harmful, by ecosystems and taxonomic groups, regarding their impact on national biodiversity and changes in abundance or spread.

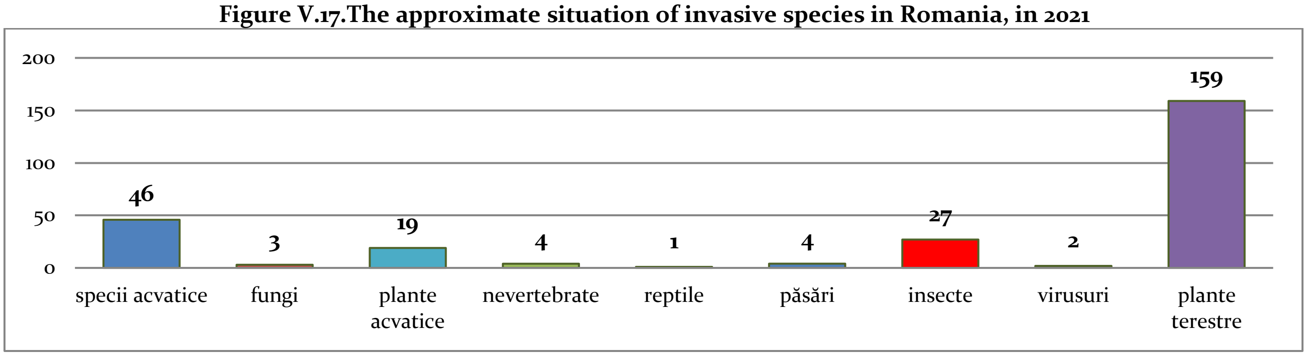
Figure V.16. The situation of invasive animals in Romania in 2021



Source Environmental Protection Agencies

According to the data sent by some of the environmental protection agencies, a number of approximately 265 invasive species have been established (aquatic species 46, fungi 3, aquatic plants 19, invertebrates 4, reptiles 1, birds 4, insects 27, viruses 2, plants terrestrial 159).

Figure V.17.The approximate situation of invasive species in Romania, in 2021



Source:Environmental Protection Agencies

During the period 2018-2022, the Ministry of Environment, Waters, and Forests, as the beneficiary, implemented the project "***Appropriate Management of Invasive Species in Romania, in accordance with EU Regulation 1143/2014 on the prevention and management of the introduction and spread of invasive allogenic species***" - Code SMIS 2014+120008. The project had a total budget of 29,507,870.54 lei.

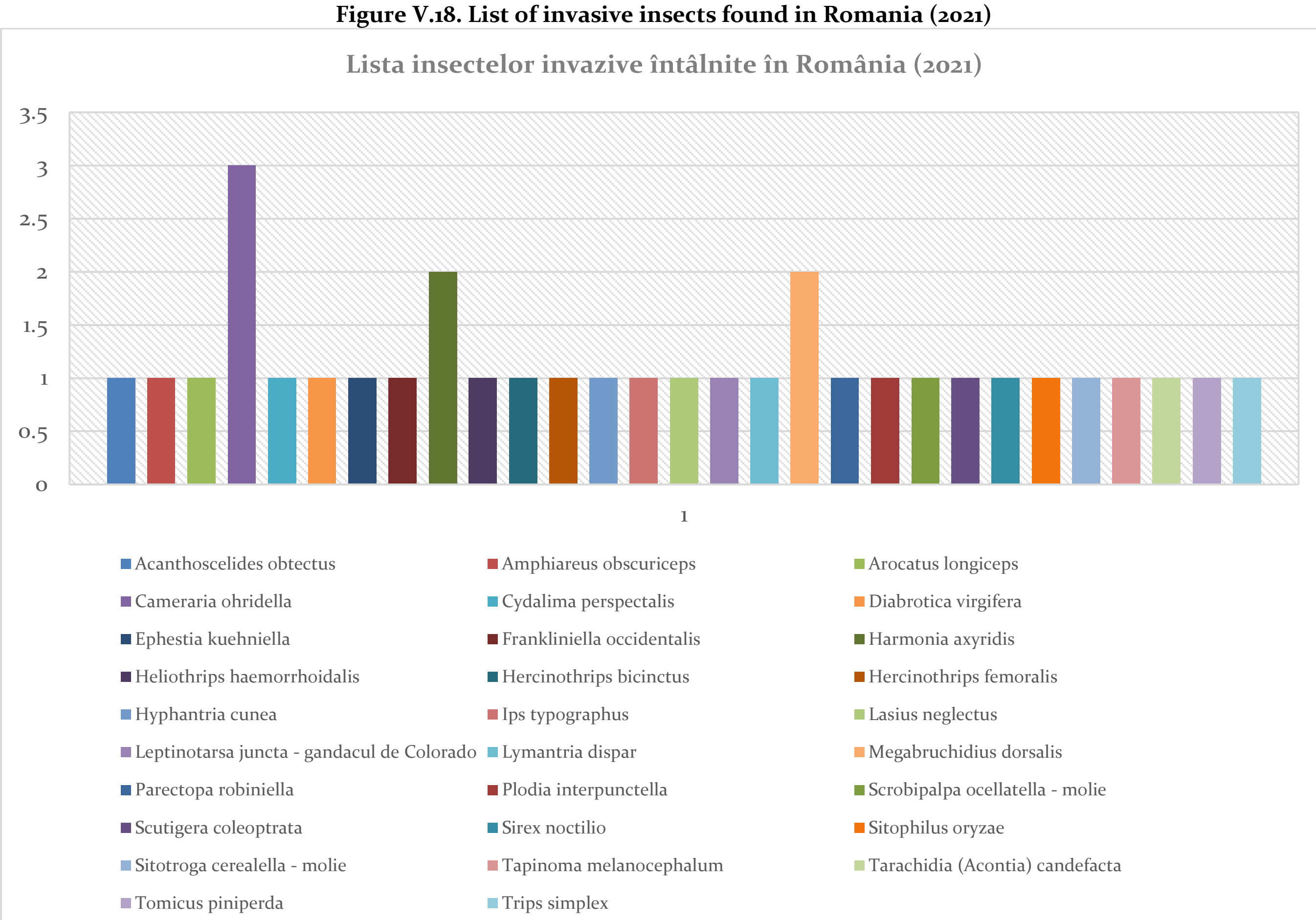
Specifically, the project contributes to achieving Objective 5 of the EU Biodiversity Strategy 2020 by identifying and prioritizing invasive allogenic species in Romania and their introduction pathways, as well as controlling and eradicating priority species. It will also create specific tools for managing introduction pathways to prevent the introduction and rapid identification of new invasive allogenic species. Additionally, the project will contribute to the appropriate management of Natura 2000 sites in Romania, a goal of the Natura 2000 Priority Action Framework, through the combat of invasive species. Additional information about the above-mentioned project can be found on the specially created page http://invazive.ccmesi.ro .According to the data provided by the project, the list of invasive species in Romania, of interest to the EU, includes 20 species (updated in June 2019), namely:

- *Ailanthus altissima*, -ashery or false vinegar
- *Asclepias syriaca*- beeswax
- *Baccharis halimifolia*- bacaris
- *Carolinian cabomba*- green kabomba
- *Elodea nuttallii*
- *Eichhornia crassipes*- water hyacinth
- *Eriocheir sinensis*, Chinese crab
- *Heracleum mantegazzianu*
- *Heracleum sosnowskyi*, the bear's paw

- *Impatiens glandulifera*, balsamine, lean
- *Lepomis gibbosus*
- *Lysichiton americanus*, water lantern
- *Myocastor coypus*- nutria
- *Myriophyllum aquaticum*
- *Nyctereutes procyonoides*, the enot dog, the bearded vizier
- *Muskrat zibethicus*- the bizam
- *Perccottus glenii*
- *Pseudorasbora parva*
- *Trachemys scripta*- the Florida turtle;
- *Orconectes limosus*- striped crayfish.

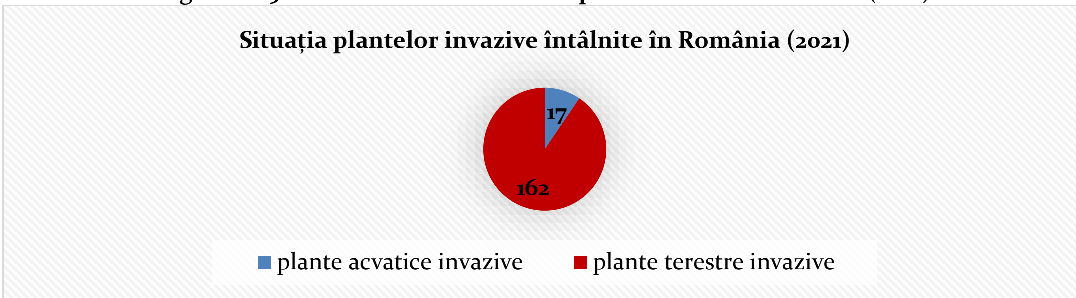
The Regional Development Agency Bucharest - Ilfov implemented, in the period 2018 - 2020, as a partner, together with 7 other regions from 7 EU member countries, the INVALIS (Protecting European Biodiversity from Invasive Allogenic Species) project, financed through the INTERREG EUROPE Program , within the Environment and Resource Efficiency priority. EPA Bucharest has a representative in its working group project. The aim of the project is to improve the specific regional policies addressed on biodiversity and environmental protection, by supporting policies for the prevention, early detection, control and eradication of invasive allogenic species in natural ecosystems.

Figure V.18. List of invasive insects found in Romania (2021)



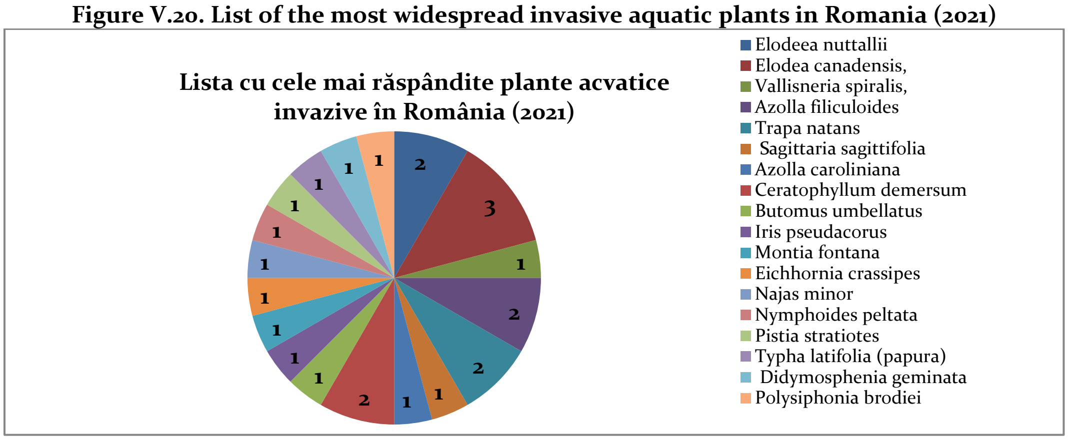
Source: Environmental Protection Agencies

Figure V.19. The situation of invasive plants found in Romania (2021)



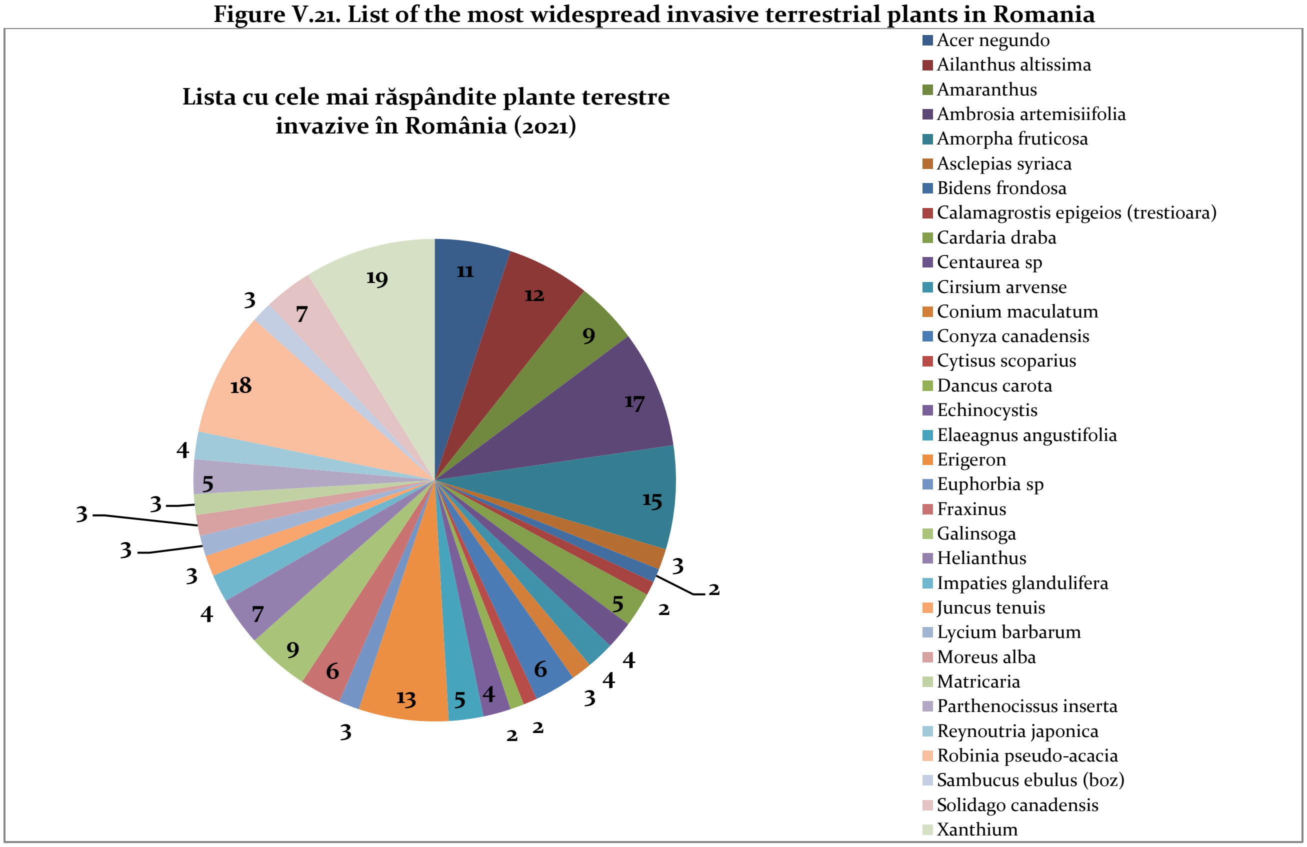
Source: Environmental Protection Agencies

Figure V.20. List of the most widespread invasive aquatic plants in Romania (2021)



Source: Environmental Protection Agencies

Figure V.21. List of the most widespread invasive terrestrial plants in Romania



Source: Environmental Protection Agencies

As part of the project "*Integrated Management of Biological Diversity and Landscape for Sustainable Regional Development and Ecological Connectivity in the Carpathians - BIOREGIO Carpathian*," in which the Sibiu Environmental Protection Agency (APM Sibiu) was a partner, an inventory of invasive species in the Romanian Carpathians was conducted. The list of identified invasive species includes: *Pseudorasbora parva, Robinia pseudacacia L., Oxalis corniculata L., Amaranthus albus L., Amaranthus retroflexus L., Veronica persica, Conyza canadensis, Erigeron annuus L., Galinsoga parviflora, Matricaria discoidea, Rudbeckia laciniata L, Xanthium italicum, Juncus tenuis Willd, Cameraria ohridella, Scrobipalpa ocellatella, Sitotroga cerealella, Ephestia kuehniella, Plodia interpunctella, Parectopa robiniella, Acanthoscelides obtectus, Sitophilus oryzae, Diabrotica virgifera, Leptinotarsa decemlineata, Harmonia axyridis*.

Although the control of invasive allogenic species is regulated by a series of European legislative acts, there is no national, regional, or local strategy for combating them. In Romania, there are very few initiatives for inventorying invasive allogenic species and preventing their voluntary or involuntary introduction, compared to the magnitude of problems caused by their presence. Similarly, the affected areas by invasions are not well known, and there is no system for rapid detection, identification, or quick response to the threats posed by invasive allogenic species.

At the level of each administration/custodian, an action plan is in place for landowners/users to periodically carry out elimination (mechanical) works of problematic species and maintain the limits of these affected areas by prohibiting the establishment of new resting places for domestic animals.

In 2021, activities were planned after the completion of the LIFE 10/NAT/RO/00740 project for eradicating certain invasive tree species that eliminate the tree species forming habitats with Salix alba, namely: conducting educational campaigns to encourage citizens to clear their properties of invasive tree species and carrying out cleaning campaigns of invasive tree species from the shores, especially Amorpha fruticosa and Ailanthus altissima.

The list of species that have entered various Black Sea ecosystems is quite impressive; however, very few invasive species have had a major impact on the ecosystems. Most invasive species have integrated into native communities, producing relatively minor changes. However, there are species whose entry has caused significant modifications to various organism groups, in some cases severely affecting other communities beyond those directly involved. In Constanta County, the following groups of allogenic and invasive organisms have been identified: Aquatic marine and freshwater species: algae - 6 species, invertebrates - 44 species, fish - 38 species, reptiles - 2 species, mammals - 2 species; Terrestrial species: invertebrates - 2 species, higher plants - 140 species.

Prevention and combat actions carried out in 2021:

- ✓ *Implementation by the central environmental protection authority of an awareness campaign regarding invasive allogenic species;*
- ✓ *Seminars, conferences, and training programs have been conducted for horticulturists, farmers, hunting personnel, veterinarians, traders of plant and/or animal materials, aquarium and terrarium keepers, zoo garden administrators, etc.;*
- ✓ *Local authorities and institutions have undertaken cleaning and sanitization campaigns in rural communities along roads, as these areas serve as transient habitats for invasive species towards natural habitats. Each species, without exception, appears in these rural communities without conservation value, thus regular mowing or eradication with herbicides would be an appropriate way to eliminate them;*
- ✓ *Prohibition of planting with invasive species, particularly referring to Robinia pseudacacia, but also to Ailanthus altissima, Amorpha fruticosa, Gleditsia triacanthos.*

Conclusions regarding the impact of invasive species on natural ecosystems:

- ⌘ elimination of rare or threatened species from the native flora by invasive plant species;
- ⌘ changes in biodiversity;
- ⌘ microclimate change;
- ⌘ increase the economic costs for their removal from the ecosystem;
- ⌘ competition of invasive species with native vegetation for space, light, water and nutrients;
- ⌘ altering the natural cycles of nutrients and water in the invaded ecosystems;
- ⌘ affecting mycorrhizal fungi, with direct effects on the decrease in vitality of many of the mycorrhizal species;
- ⌘ changing soil chemistry (elimination of allelopathic substances, etc.), with the effect of changing the structure of plant

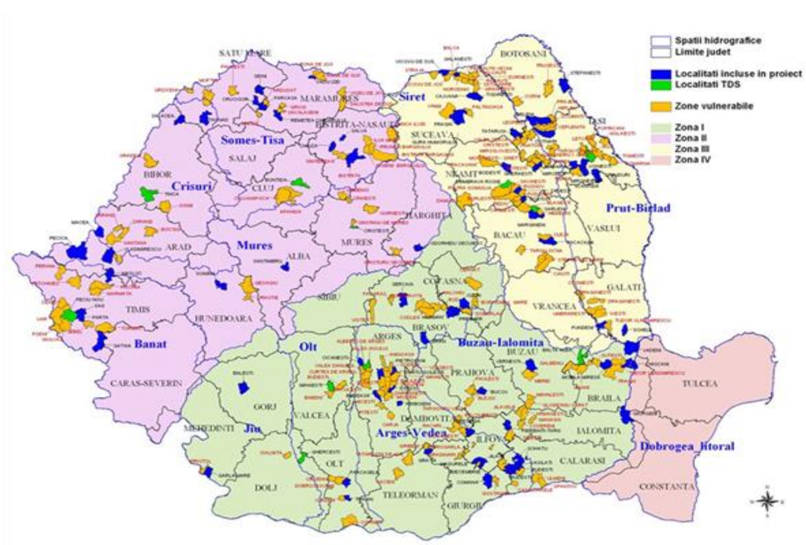
communities;
⌘ reduction of food sources for native fauna;
⌘ changes in the sequence of phytocenoses, food chains, etc.;
⌘ increase in the incidence of pathogens and the appearance of exotic diseases.

http://ec.europa.eu/environment/nature/invasivealien/index_en.htm
LAW No. 62/2018 of March 9, 2018 regarding the fight against ragweed

POLLUTION AND NUTRIENT LOADING

In the process of implementing the Nitrates Directive, Codes of Good Agricultural Practices and Action Programs were developed and applied. Starting from June 2013, the decision was taken to apply the Action Program throughout Romania, in accordance with art. 3 paragraph 5 of the Nitrates Directive.
Thus, according to the mentioned provisions, Romania no longer has the obligation to designate areas vulnerable to nitrates from agricultural sources, as the Action Program applies without exception, throughout the country.
The provisions of the Action Program are mandatory for all farmers who own or manage agricultural holdings and for the local public administration authorities of communes, cities and municipalities on the territory of which there are agricultural holdings.
The Integrated Nutrient Pollution Control is the only project in Romania that finances direct investments for the implementation of the Nitrates Directive by rural communities, bringing significant environmental and socio-economic benefits. The project supports investments primarily concentrated in communes designated as Nitrate Vulnerable Zones, located in ten river basins. In the initial implementation period, the project supported the establishment of 11 Demonstration and Training Centers, after which the project's investments began to be developed in other communes, resulting in a total of 81 communes benefiting from project-supported investments. Since 2017, the Additional Funding to the Initial Project has replicated the successful interventions of the Initial Project at the national level, reaching approximately 90 more communes.

Figure V.22 - Map of nitrate-vulnerable areas in Romania



Source:www.inpcp.ro(Integrated Nutrient Pollution Control Project)

Exposure of ecosystems to acidification, eutrophication, ozone:
Acidification is the process of changing the natural chemical character of an environmental component, as a result of the presence of halogenated chemical compounds, which cause chemical reactions in the atmosphere, in quantities exceeding certain critical concentrations, which lead to changes in the pH of precipitation, soil, water, with the potential to affect terrestrial and/or aquatic ecosystems. Gases with an acidifying effect on the atmosphere are sulfur dioxide and nitrogen oxides.

Eutrophication of waters (lakes, marine waters) consists in the excessive development of planktonic algae, which leads to the increase in the accumulation of organic matter. The development of algae leads to a decrease in water transparency, a decrease in the concentration of dissolved oxygen in the water, the appearance and subsequent amplification of anaerobic degradation processes, with the formation of methane and ammonia gas, phenomena accompanied by the disappearance of aquatic fauna and finally, a swamp may form.

Ozone (O_3). Most of the vegetation and agricultural crops were exposed to ozone concentrations that exceeded the long-term objective established by the EU Air Quality Directive. Also, a significant part was exposed to levels that exceed the target value established by the directive for the year 2010.

All forms of pollution threaten biodiversity, but especially nutrient loading (nitrogen and phosphorus), which is a major and continuously increasing cause of biodiversity loss and ecosystem degradation. Atmospheric nitrogen deposition is a major threat to Europe's biodiversity. Nitrogen emissions in the atmosphere have increased substantially in the last 100 years, especially in the form of ammonium from agriculture and nitrogen oxides from industry. As a result of deposition from the atmosphere, these forms of nitrogen are deposited throughout Europe, affecting sensitive habitats. In addition, nitrogen compounds can also produce eutrophication of ecosystems. The studies carried out showed that nitrogen deposits generate a decrease in species richness.

Just as the lack of nutrients limits the ability of plants to develop, too many nutrients have a negative effect, because they weaken the immune system of plants, making them more vulnerable to diseases and pests. At the same time, excess nutrients reduce plants' resistance to excessive heat, drought or cold. In agriculture, nutrient pollution leads to a decrease in production and the quality of crops.

The major consequences on biodiversity can be found in a number of significant qualitative and quantitative changes in the structure and functioning of ecosystems.

The eutrophication process takes place in the following stages:

- Increase in the concentration of nutrients above the normal values in the water mass of the lake;
- Proliferation and excessive development of algae and aquatic plants (water bloom);
- Decomposition of algae and other aquatic plants that cause an increase in oxygen consumption at the level of the hypolimnion and, consequently, the appearance of anaerobic life conditions in the water, implicitly the formation of hydrogen sulphide, ammonia, manganese, carbon dioxide, etc.;
- The release of hydrogen sulphide and ammonia prevents the sedimentation of nutrients on the bottom of the lake, with direct consequences in the excess of nutrients in the water mass of the lake and in the self-maintenance of the eutrophication process in the lake basin.

From the perspective of the principles and objectives of conservation and sustainable use of biodiversity components, the main relevant consequences are:

- ⇨ Manifestation of an active process of erosion of biological diversity that is expressed by the disappearance of some species;
- ⇨ Fragmentation of habitats for many species and the interruption of longitudinal connectivity (by damming watercourses) and lateral connectivity (by embanking floodplains, blocking or severely restricting migration routes of fish species and access to suitable breeding and feeding areas);
- ⇨ Restriction or elimination of certain habitat types or ecosystems from transition zones (forest buffers, tree alignments, wetlands within large agricultural exploitations) with profound negative effects on biological diversity and the functions of diffuse pollution control, soil erosion, surface runoff, flood wave evolution, biological control of pest populations for agricultural crops, and recharge of groundwater reserves or bodies;
- ⇨ Appearance in water of toxic substances eliminated by certain species of cyanobacteria (Microcystis aeroginosa and Anabaena flos-aquae) and the replacement of valuable fish species with lower quality species due to the change in water quality indicators in these ecosystems;
- ⇨ Widespread modification, sometimes beyond the critical threshold, of the structural configuration of hydrographic basins and watercourses, associated with a significant reduction in the capacity of aquatic systems to absorb the pressure of anthropic factors operating at the scale of the hydrographic basin and with an increase in their vulnerability and that of socio-economic systems depending on them. Many hydrographic basins have been torrentialized;
- ⇨ Excessive simplification of the structure and multifunctional capacity of ecological formations dominated or formed exclusively by intensive agricultural ecosystems and increasing their degree of dependence on commercial material and energy inputs;
- ⇨ Destructuring and reducing the productive capacity of biodiversity components in the agricultural sector.

At national level, localities with areas vulnerable to nitrate pollution have been identified, some included totally or partially in *sites of community importance or areas of special avifaunistic protection, but there are no centralized data available for the indicators that can determine how biodiversity is threatened.*

CLIMATE CHANGE

Climate change leads to a global loss of species, as abiotic conditions begin to exceed the tolerance limits of species. According to the EU's 2030 Biodiversity Strategy, climate change is one of the five main direct drivers of biodiversity loss alongside with changes in land and sea use, overexploitation, pollution and invasive allogenic species. Biodiversity is affected by climate change, with negative consequences for humanity. At the same time, biodiversity, through the ecosystem services it supports, has an important contribution both to mitigating and adapting to climate change.

Climate evolution and its consequences

According to data from the World Meteorological Organization (WMO) based in Geneva, the average global temperature has increased by 0.60°C during the period 1901-2000, which is extremely significant. **According to the National Meteorological Administration (NMA)**, in 2020, the average annual temperature in Romania (10.8°C) was 1.7°C higher than the standard climatological norm (for the reference period 1981-2010). The year 2020 ranks second among the warmest years in the period 1961-2020. The average annual temperature ranged from -0.4°C at Mount Omu to 14.4°C in Constanța. In most parts of the country, annual temperature averages exceeded 10°C, and only in mountainous areas and intramontane depressions were they below this limit. The total annual precipitation, averaged across the country, was 653.2 mm, which was 4% higher than the climatological norm for the reference period 1981-2010. Negative deviations were recorded in 5 out of the 12 months, ranging from 30% in August to 75% in April, while positive deviations were recorded in the remaining 7 months, ranging from 6% in July to 69% in October.

According to the United Nations Convention to Combat Desertification (UNCDD), **the aridity index** (annual precipitation/ potential evapotranspiration - ETP) for arid and desert areas is 0.05, and for semi-arid dry areas is 0.65, above which a territory is considered to be close to normal. According to this international convention, the ETP for steppe and forest-steppe regions is between 400 and 900 mm, and for mountainous areas, it is 300 mm of water.

Table V. 5 - The percentage distribution of relief forms in Romania by altitude

Altitudes (m)		% of the territory of Romania (237.5 thousand km2)	from which:		
			Mountains	Hills	Plains
over 2000		1	3		
1500 - 2000		3	7		
1000 - 1500		6	19		
700 - 1000		12	36	3	
500 - 700		10	16	12	
300 - 500		18	12	38	1
200 - 500		12	7	24	5
100 - 200		18		18	35
0 - 100		20		5	59
Over 500 m		**32**	**81**	**15**	
Below 500 m *)		**68**	**19**	**85**	**100**

**) territory affected by aridification and desertification in the event of an average air temperature increase of 3° C, forecast until 2070*
Source: The treaty Geography of Romania vol. I, 1983

By increasing the average air temperature in Romania by 3° C, it is predicted that Dobrogea, Southern Moldova, Western Transylvania, Banat, Southern Oltenia and a good part of the Southern Romanian Plain, i.e. over 30% of the country will be subjected to a process of desertification and the rest of approx. 38% of a process of accentuated aridification, which will further include all our plains, up to 85% of the surface of the hills and almost 20% of the mountains at lower altitudes of the country.

Forecast of bioclimatic changes

Biodiversity reacts to global warming and tends to migrate to areas with optimal temperature for development and reproduction. The geographic distribution is changing, and the current trend is to increase with latitude and altitude. As the tat leaves, the birds that depend on it follow. Thus, in the future, it is possible to meet at high altitudes, in the mountains, bird species specific to hilly areas, and in the more northern regions, birds that normally lived much further south. But due to the fact that nature cannot adapt so quickly to the accelerated pace of global warming, many habitats and implicitly the characteristic species will disappear for good. Birds play an important role in the food chain of the ecosystem in which they live. The network connecting these nutritional relationships is very fine and any alteration of one or more component elements spills over into all the others. The disappearance or change in the geographical distribution of some bird species can have devastating effects on some habitats. Most bird species are very sensitive to climate change. Climate change coupled with habitat loss or fragmentation and pollution endangers all life. In the general context of climate change, extreme temperatures are considered to be some of the most sensitive climate parameters. In the last 50 years, the average annual temperature has increased in the north-eastern region of Romania by 0.16 – 0.33°C/decade. The increase in air temperature values was not equal over the course of a year. The greatest increase in air temperature was recorded in the summer season (0.18 - 0.49°C/decade). Extreme amounts of precipitation usually generate extreme hydrological events such as floods or droughts, phenomena that have a profound impact on the environment. The increase in the frequency, as well as the intensity of the amounts of precipitation falling in short intervals of time, can be attributed to global warming which contributes to the increase of water evaporation from the land surface and to the increase of the amounts of precipitation. The projected climate changes will have a significant impact on the current distribution of vegetation across zones and altitudinal belts, which, in turn, will affect habitats and economic performance. According to the forecasts for the year 2070, with an increase of 3°C in the average air temperature in the mountainous region, following the current altitudinal gradients (-0.5°C / 100 m altitude), an approximate 600 m increase in the current vegetation belts is estimated. ***For the mountainous region of our country, these bioclimatic changes for the year 2070*** are presented in the table below.

Table V.6 - Changes in the bioclimatic and vegetation levels when the average air temperature increases by 3° C

Current floors (areas).	Altitude (m)	Average annual TEMPERATURE (oC)		Annual PRECIPITATION (mm)		Floors (areas) changed after decades
		Actuator	Year 2070 level	Actuator	Year 2070 level	
Alpine	2200-2400	-1	2	1500	1250	Pine
Dwarf Pine	2000-2200	0	3	1450	1150	Pine
Dwarf Pine	1800-2000	1	4	1350	1050	Pine + Beech
Spruce	1600-1800	2	5	1250	950	Beech
Spruce	1400-1600	3	6	1150	850	Beech
Spruce + Beech	1200-1400	4	7	1050	800	Turkey oak
Beech	1000-1200	5	8	950	700	Oak
Beech	800-1000	6	9	850	600	Silvosteppe
Turkey Oak	600-800	7	10	800	500	Steppe
(Oaks)	Gradients	-0.5 oC	-0.5 oC	+ 45 mm	+ 45 mm	(Semiwet -dry)
(Silvosteppe)	**for 100 m alt.**					(Semi-arids)
(Steppe)						(Arid - deserts)

Source: "Treaty on ecological reconstruction of meadow habitats and degraded mountain lands", 2010, Teodor Marușca - coordinator

From this data, it can be inferred that in the high mountains, the alpine and subalpine zones (of the dwarf pine) will disappear, being replaced by the zone of spruce and beech forests. In parallel, the steppe zone will replace the upper part of the oak forests, and the silvosteppe will replace the lower part of the beech forests. These major changes in the altitudinal distribution of woody vegetation in the mountainous area will lead to a natural reduction of 40 - 70% of the current forest areas, with even more dramatic consequences for the hydrological balance and precipitation.

Forecast of mountain soil changes

Climate changes will also modify the physical-chemical properties of mountain soils. Thus, the thickness of the soil layer in the next 60-70 years will be approximately the same considering that 1 cm of soil in the temperate zone is formed in approx. 100 years. On the other hand, some agrochemical properties may undergo changes over a period that is difficult to define, until reaching a specific balance imposed by the temperatures and precipitation forecast for the year 2070.

Table V. 7 - Change in soil conditions at an increase in the average air temperature by 3° C (forecast for the year 2070)

Current floors (areas).	Altitude (m)	Soil layer thickness (cm)		Horizon A			
		Current	Distant future	pH in water		V %	
				Current	Nearer future	Current	Nearer future
Alpine	2200-2400	20	Very slow growth (approx. 1 cm per 100 years)	3.6	4.5	6	24
Dwarf Pine	2000-2200	35		3.9	4.8	12	30
Dwarf Pine	1800-2000	50		4.2	5.1	18	36
Spruce	1600-1800	65		4.5	5.4	24	42
Spruce	1400-1600	80		4.8	5.7	30	48
Spruce + Beech	1200-1400	95		5.1	6.0	36	54
Beech	1000-1200	110		5.4	6.3	42	60
Beech	800-1000	125		5.7	6.6	48	66
Turkey Oak	600-800	140		6.0	6.9	54	72
(Oaks) (Silvosteppe) (Steppe)	**GRADIENTS for 100 m. alt**	**- 7.5 mm**		**- 0.15**	**- 0.15**	**- 3 %**	**- 3 %**

Source: "Treaty on ecological reconstruction of meadow habitats and degraded mountain lands", 2010, Teodor Marușca - coordinator

The soil reaction (pH) and the degree of base saturation (V%) will undergo corresponding changes with the increase in altitude, following the upward shift of more active bioclimatic indicators for vegetation (Marușca, 2007). The much slower changes at the soil level will result in relatively low productivity of natural vegetation and agricultural crops, despite the more favorable heat conditions that will be present at higher altitudes in the future.

Productivity forecast of mountain meadows

As a result of the climatic changes and the physical-chemical properties of the soils, the productivity of the meadows at altitude will change in the sense of reaching a maximum between 1600 - 1800 m, compared to the current 1000 - 1200 m altitude, respectively 600 m higher. The production level, on the other hand, will be lower than the current ones, due to the reduction of approx. 45 cm of soil layer thickness and acidity more pronounced by 0.9 units.

Table V. 8 - Forecast of meadows productivity at an increase in the average air temperature by 3° C (year 2070)

Floors (areas) possible after decades	Altitude (m)	Productivity of natural meadows					
		Dry matter production (DU) t/ha		Average duration of grazing (days)	Specific consumption kg SU/kg gain	Livestock production weight gain (kg/ha)	
		Unfertilized	N100P50K50 kg/ha			Unfertilized	N100P50K50 kg/ha
Spruce	2200-2400	1.8	4.8	100	30	60	160
Spruce	2000-2200	2,3	6.0	115	28	80	220
Spruce + Beech	1800-2000	2.8	7.2	130	26	100	280
Beech	1600-1800	3.3	7.4	145	24	130	310
Beech	1400-1600	2.8	6.8	160	22	120	310
Turkey Oak	1200-1400	2,3	6.2	175	20	110	310
Oak	1000-1200	1.8	5,6	160	18	100	310
Silvosteppe	800-1000	1.3	5.0	130	16	80	310
Steppe	600-800	0.8	4.4	100	14	60	310

Source: "Treaty on ecological reconstruction of meadow habitats and degraded mountain lands", 2010, Teodor Marușca - coordinator

As a result of the decrease in active temperatures at altitude and the increase in the amount of precipitation, a heat-humidity balance is created between 600-1800 m a.s.l., an interval between which the productivity of the meadows, expressed in live weight gain, remains almost constant, being around 300 kg/ha on the fertilized surfaces at an average level. The soil and climate conditions in the mountainous area, and more unfavorable at altitude for traditional agricultural crops, require the development of herbivorous animal breeding on the better-performing natural meadows and the practice of agritourism on a larger scale, similar to the Alpine countries.

The effects of climate change materialize through:

- changes in species behavior resulting from their inability to adapt (disruption of animal metabolism, alteration of animal behavioral physiology due to water, heat, or solar radiation stress, leading to erratic migrations, inability to maintain normal physiological transpiration levels, irreversible negative effects on migratory species, imbalances in

plant evapotranspiration);
- ➢ changes in the distribution and composition of habitats as a result of the change in species composition;
- ➢ increase in the number of exotic species within current natural habitats and the increased potential for them to become invasive due to the discovery of favorable conditions or ecological niches resulting from the disappearance of native species;
- ➢ changes in the distribution of ecosystems specific to wetlands, with the possible restriction to their disappearance;
- ➢ changes in freshwater aquatic ecosystems generated by water warming;

- ➢ increased risk of biodiversity decline through the disappearance of certain plant and animal species, due to reduced capacities for adaptation and survival, as well as the potential for transformation into more resilient species to new climate conditions.

MODIFICATION OF HABITATS

Biological diversity is under constant threat due to the intensification of economic activities that exert strong pressure on the environment. The evaluation of the impact on biodiversity is based on evaluation criteria that refer to:
- ❖ Degree of damage to species and natural habitats in the impact area;
- ❖ Modification of ecosystem parameters;
- ❖ Ecosystem fragmentation;
- ❖ Impact reduction measures.

The main **causes that determine the modification of habitat structures** are represented by:
- o development of residential areas;
- o illegal cutting of trees;
- o pollution of surface, underground and soil waters with petroleum products or salt water, household water, waste;
- o changing the morphology of the lands due to the activity of exploiting some mineral resources (quarries, ballast yards);
- o the conversion of land in favor of the development of urban, industrial, agricultural, tourist or transport infrastructure, this being the main cause of the loss of biodiversity, leading to the degradation, destruction and fragmentation of habitats and implicitly to the decline of natural populations;
- o improper application of agricultural technologies;
- o the use of pesticides;
- o uncontrolled tourism in leisure areas.

The evaluation criteria that form the basis of the evaluation of the impact on biodiversity must take into account:
- ▪ ecosystem fragmentation and modification of ecosystem parameters;
- ▪ degree of damage to species and natural habitats in the impact area;
- ▪ measures to reduce the impact.

The activities that can lead in the medium and long term to the modification of habitats:
- ❖ The regularization works of the torrents, in general, and, especially, the transversal works carried out in the river bed, negatively affect fish species by fragmenting the habitats;
- ❖ The construction of microhydropower plants has a possible impact on fish species in protected natural areas;
- ❖ Hydrotechnical constructions are the main cause that can lead to the degradation/loss of aquatic habitats characteristic of Natura 2000 sites;
- ❖ Drainage of wetlands by channeling along rivers, on lowland areas, works to regularize water courses; major change in aquatic habitat (building dams);
- ❖ Large-scale practice of intensive agriculture by changing land cultivation methods from traditional ones to intensive agriculture, with monocultures, excessive use of chemical substances (phytosanitary);
- ❖ Practicing mowing during the nesting and hatching period of birds, destroying nests, mowing pastures too early, catching birds with traps and practicing hunting in the area of nesting sites of endangered species;
- ❖ Mass sport fishing disturbs migratory birds.

Land conversion leads to the loss of biodiversity and the degradation of soil functions
While a slight increase in forest area is a positive development, the decline of natural and semi-natural habitats - including grasslands, wetlands, muddy areas, and ponds, all with a high content of organic soil - is a major cause for concern. A recent EU Green Paper focuses on the potential implications of climate change in the management and protection of forests in Europe and on enhancing monitoring, reporting, and knowledge exchange. There are also concerns about the future balance between wood supply and demand, given the planned increases in bioenergy production.

In general, urban areas have continued to expand at the expense of all other land cover categories, except for forests and water bodies. Urbanization and the expansion of transport networks are causing habitat fragmentation, making animal and

plant populations more vulnerable to local extinctions due to hindered migration and dispersal.

Fragmentation of ecosystems

RO 44
Indicator code Romania: RO 44 EEA indicator code: SEBI 013
TITLE: **FRAGMENTATION OF NATURAL AND SEMI-NATURAL AREAS**
DEFINITION: The indicator shows differences in the average of natural and semi-natural surfaces, based on land cover maps made by interpreting satellite images. The indicator is intended to address the issue of ecosystem integrity by providing a "measure" of land disintegration over the entire surface of Romania.

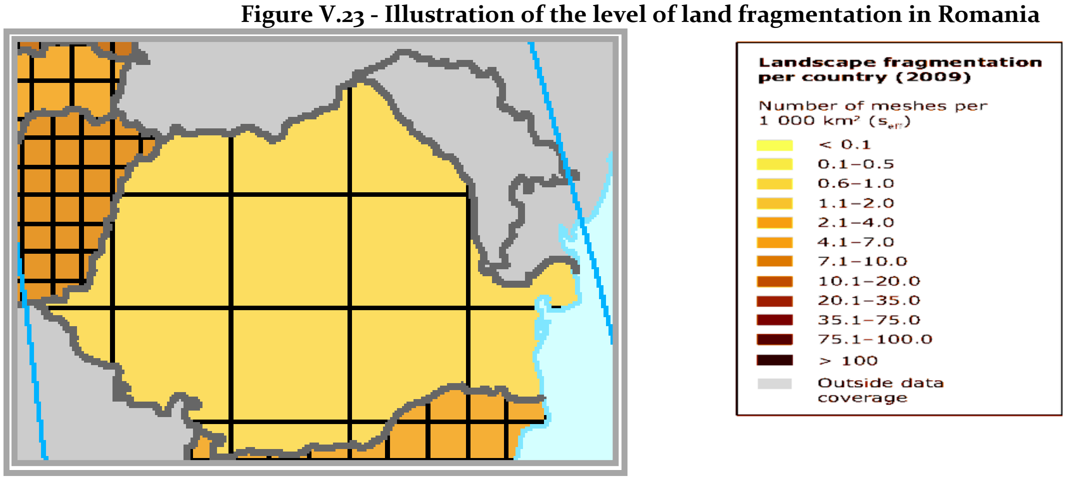
In terms of biodiversity, the indicator is relevant as it provides information on the evolution of natural and semi-natural areas for any type of ecosystem. If the area of these habitats decreases significantly, it will have a negative impact on habitat types and species dependent on them.

The conclusions of the report "Landscape fragmentation in Europe Joint EEA-FOEN report" still show a lower fragmentation of Romania's territory compared to other EU countries, similar to the situation in Nordic countries.

The evolution of the percentage of forest area losses between 1990-2000 is presented in the form of a map (using the Corine Land Cover database).

In the map below, habitat fragmentation is represented by the number of network meshes within a certain area. The effective mesh size (Meff) is proportional to the probability that two randomly chosen points in the region are connected. The higher the number of network meshes, the more fragmented the landscape is.

Figure V.23 - Illustration of the level of land fragmentation in Romania

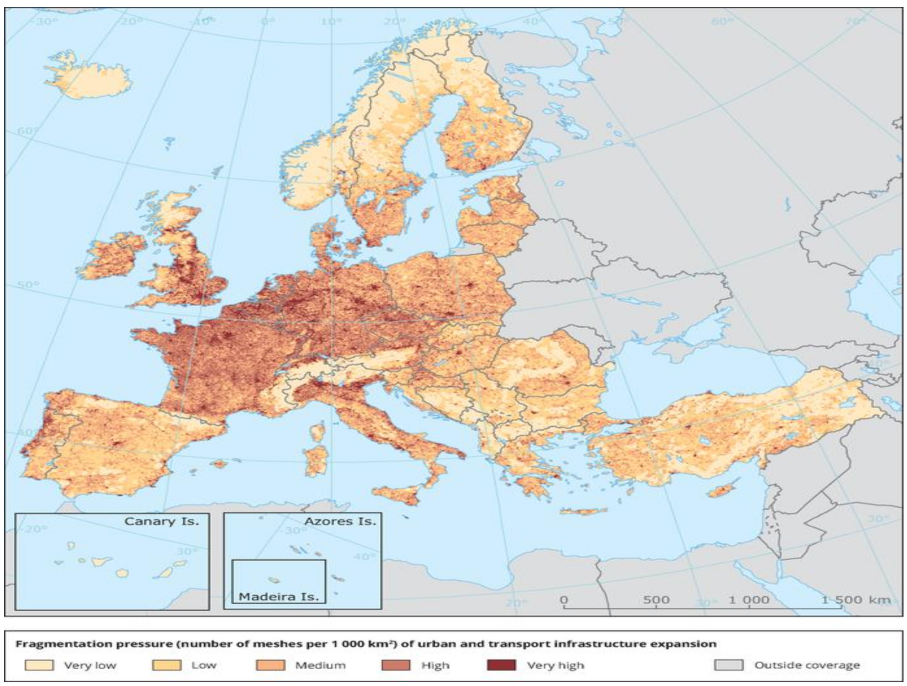


Source: http://www.eea.europa.eu/data-and-maps/figures/illustration-of-the-level-of

The spatial expansion of the human socio-economic system, the increased complexity of its component subsystems, as well as the growing interconnections between them, lead to the **destruction, degradation, and fragmentation of natural and semi-natural ecological systems.** The alteration of terrestrial and freshwater ecological systems is considered one of the most serious threats to global biodiversity. The most visible and impactful form of this threat is the **direct destruction** of ecological systems (e.g., deforestation, draining of wetlands, construction of dams, conversion of steppe/prairie/savannah areas into agroecosystems). Often, the impact of direct destruction is further amplified by the **fragmentation** of the remaining ecological systems. Fragmentation can lead to the disruption of the structural or functional continuity of ecological systems due to the distribution of remaining habitat in small, isolated patches. The end result of the development of human socio-economic components in a region is an ensemble of natural and semi-natural areas with reduced and isolated surface areas, true islands in a "sea" of agroecosystems, urban, and rural ecosystems.

The map below shows the fragmentation of ecosystems in Europe due to the pressure of urban and transport infrastructure development; our country is included in the "very low" and "low" category, which means a reduced fragmentation of habitats as a whole.

Figure V. 24 - Fragmentation of ecosystems in Europe due to the pressure of development of urban infrastructure and transport



Source: http://www.eea.europa.eu/data-and-maps/figures/illustration-of-the-level-of

Causes of ecosystem fragmentation are the following:

➢ A primary cause of the fragmentation of natural and semi-natural areas is the conversion of land for the development of urban, industrial, agricultural, tourist, or transportation infrastructure. This represents the main cause of biodiversity loss, leading to the degradation, destruction, and fragmentation of habitats and, consequently, to the decline of natural populations;

➢ Another cause of fragmentation is generated by the process of expansion and development of human settlements. Currently, it is considered that approximately 6.5% of the country's surface is intended for housing construction. Fragmentation of habitats also occurs when there are large agglomerations of housing, but also in the case of isolated ones, due to the additional construction of access roads and utilities. Chaotic construction, without respecting a coherent and consistent urban planning strategy, leads to the injudicious use of areas intended for construction and their expansion to the detriment of natural ones.

Natural and semi-natural ecosystems represent approximately 47% of the country's surface, 45% represent agricultural ecosystems, the remaining 8% is represented by constructions and infrastructure. The major categories of ecosystem types are as follows: forest ecosystems, grassland ecosystems, freshwater and brackish ecosystems, marine and coastal ecosystems, and underground ecosystems.

Fragmentation of habitats is not exclusively due to direct human activity, the change of use categories or infrastructure investments, often the process of general degradation of habitats leads to a higher degree of fragmentation. Fragmentation has multiple effects on species. Among these, the most important are:

- Decreasing the area/perimeter ratio leads to the intensification of the edge effect in a habitat. The larger the marginal area of a habitat, the greater the vulnerability of existing species to disturbances. A large perimeter can expose the interior habitat to greater climatic variations.
- Deforestation affects isolated forest fragments much more often than densely forested areas. It also increases the risk of opportunistic predators entering, often represented by domestic animals such as dogs or cats.
- Food chains shorten in the remaining habitat fragments.
- Fragmentation leads to the reduction or even the disappearance of species at the top of the trophic pyramid and of large species, because both the occupied surface and the density of individuals on the remaining habitat fragments are reduced. Conversely, species characterized by a small size, fast growth, short generation duration and increased habitat specificity, remain at a similar density in the remaining fragments.
- Fragmentation of habitats can change the ratio between competing species or between prey and predator. Increasing the number of habitat fragments can favor species that are weakly competitive, but with a good dispersal capacity. They can colonize unoccupied patches of habitat before better competitors arrive and eliminate them. In the time interval between colonization and elimination, the population produces offspring that colonize other available habitats.

The consequences of fragmentation manifests itself in stages. Thus, in a first stage there is the extinction of endemic species or species that are specialized in occupying certain habitats (initial exclusion). It then increases the degree of isolation of the remaining populations due to the emerging barriers, which can lead to inbreeding and genetic drift, increasing the chances of extinction. The resulting habitat fragments become overpopulated and can be inhospitable to many native species susceptible to extinction. The problem of combating the effects of fragmentation of natural and semi-natural systems as well as the development of appropriate conservation strategies has several aspects, namely:

Effects of habitat fragmentation	Control measures
○ the total decrease of the habitat surface	• the effective increase of the area's surface
○ habitat fragmentation into isolated plots	• increasing connectivity between habitat fragments
○ selective loss of species	• species-specific conservation actions

Ecological effects of fragmentation

The ecological effects of fragmentation are very complex. These effects are as follows:

- fragmentation reduces the expansion of habitat types with a high degree of compatibility with the ecological needs of protected species;
- fragmentation can prevent the free dispersion of species, hinder the occupation of new habitats or repopulation;
- prevents access to food sources, wintering sites, breeding sites, finding partners, etc.;
- it can isolate local populations from the metapopulation, which leads to their genetic degradation, thus increasing the chances of their extinction.

Reduction of natural and semi-natural habitats

Land occupancy

RO 14
Indicator code Romania: RO 14 EEA indicator code: CSI 014
TITLE: **LAND OCCUPANCY**
DEFINITION:: The indicator presents the quantitative change in the occupancy of agricultural, wooded, semi-natural and natural lands, through the expansion of urban and artificial lands. It includes construction areas and urban infrastructure, as well as urban green spaces, sports and recreation complexes.

Land is a finite resource, and the way in which it is exploited represents one of the main determining factors of environmental changes, with a significant impact on the quality of life and ecosystems, as well as on infrastructure management.

The main determining factors in land occupancy are grouped in processes resulting from expansion:
- housing, services and recreation spaces;
- industrial and commercial areas;
- transport networks and infrastructure;
- mines, quarries and undeveloped waste deposits;
- construction sites.

Another factor that leads to the degradation and/or total destruction of natural habitats is *the change in land use*. The increase in space requirements for civil and/or industrial constructions, the expansion of agricultural crops, the expansion of the road network and energy transport networks, the expansion of hydrotechnical constructions and the surface of reservoirs, the opening of quarries for the extraction of mineral aggregates and areas of sorting and storage of the resulting ballast, are only some of the anthropogenic activities that lead to the change of land use and obviously to the degradation and especially to the destruction of some natural habitats. Natural phenomena, such as landslides, collapses or torrents, they also lead to the change of land use and of course to the degradation and destruction of habitats. The extension of the inner city in the areas in the immediate vicinity of the protected natural areas or even inside them with the aim of later building some residential areas or even tourist resorts generates a strong pressure on the protected natural areas.

EXCESSIVE EXPLOITATION OF NATURAL RESOURCES

The unsustainable use of natural resources and their overexploitation, which occurs when consumption exceeds the reproductive power of plants and animals, is one of the major threats to biodiversity. The Convention on Biological Diversity states: "*Sustainable use consists of using the components of biological diversity in a manner and at a rate that does not lead to the long-term decline of biological resources, thereby maintaining their potential to meet the needs and aspirations of present generations and future*".The introduction of the phrase "sustainable development" into the usual vocabulary of economic science represented an objective necessity, as a response to the economic and ecological crisis that the world went through at the end of the 20th century and continues to go through.

Forest exploitation

RO 45
Indicator code Romania: RO 45 EEA indicator code: SEBI 017
TITLE: **FOREST FUND, FOREST GROWTH AND TIMBER HARVESTING**
DEFINITION:The indicator shows the evolution of the forest fund, the net annual growth and the annual cuttings, as well as the rate of forest use (the fraction of annual cuttings from the annual growth).

Until 2008, the maximum amount of wood mass that could be harvested annually from the forests was established by government decision, being, as a rule, lower than the annual possibility, due to the wood mass located in inaccessible forest basins. Between 2000 and 2008, the volume of wood set to be harvested experienced an upward trend, as a result of the application of the provisions of Ordinance no. 70/1999, regarding the necessary measures to make the forest fund accessible, through the construction of forest roads. After the entry into force of Law no. 46/2008 – Forestry Code, the volume of wood that can be harvested annually from the forests cannot exceed the annual possibility established by the forestry facilities.

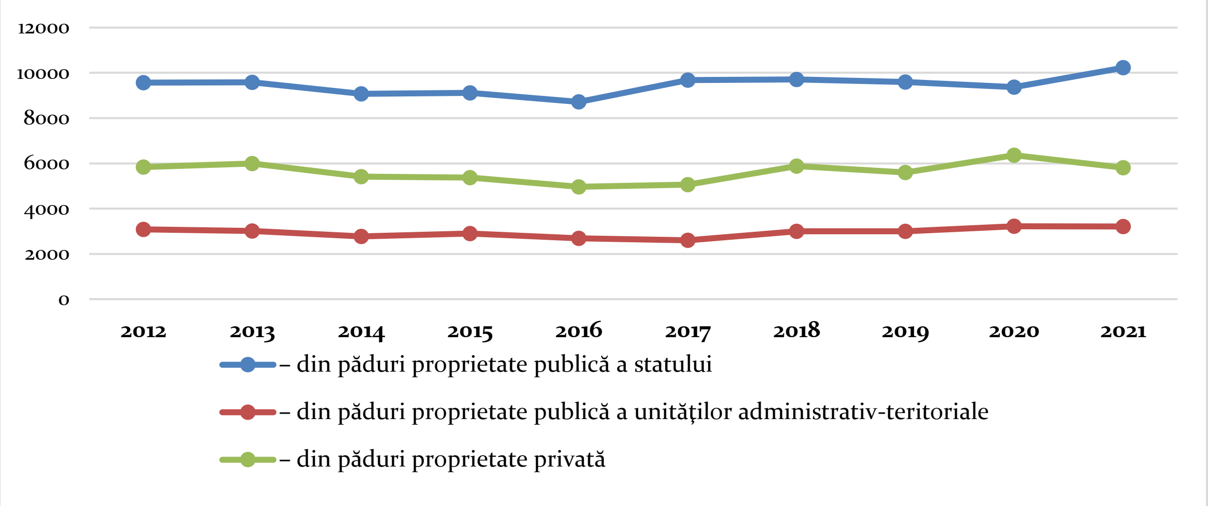
Table V.9 - The volume of wood mass harvested in the period 2012-2021

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Harvested wood mass	19081	19282	17889	18133	17198	18316	19462	18904	19652	19994

Source: NIS

The wood mass harvested in 2021 was higher than in 2020 by 342 thousand cubic meters. The volume extracted in 2021 exclusively from the national forest fund was 19,243 thousand cubic meters, the remaining 751 thousand cubic meters was harvested from the forest vegetation located on lands outside the forest fund.

Figure V. 24 - The volume of timber harvested in the period 2012-2021 - by forms of ownership



Source: MEWF

The main danger to which Romanian forests are subjected is climate change. The permanent economic and social changes and the progress of the process of the retrocession of forest lands to the former owners without them being simultaneously accompanied by appropriate legislative and institutional measures, they also had a role in putting pressure on the forests.
Confronted with the real danger of the irreversible degradation of large areas of forest, to prevent and combat illegal cutting but also to fulfill the obligations assumed by the government program and those established by the Decision of the Supreme Council of National Defense, the Ministry of Environment, Water and Forests adopted a set of measures as follows:

- On legislative level, the goal was to ensure an updated and adequate normative framework, which would suppress the laconic permissive or interpretable nature of the current regulations in the field;
- On institutional level, the aim was to strengthen the action capacity of the Forest Guards by expanding, both in terms of the attributions and in terms of the number of personnel and logistics, the forestry and hunting territorial commissariats;
- Ensuring the financial funds necessary for the reforestation of forest land areas from which the wood mass was harvested and which were not reforested within the legal term;
- The development of the integrated IT system for tracking SUMAL wood materials, the operationalization of the FMIMS system and the development of the "*Forest Radar*" system, for alerting the institutions with responsibilities in the matter.
- Establishment of anti-monopoly measures in the timber industry, elimination of abuses of dominant position and monopoly, as well as regulations for the sustainable utilization of timber to benefit local communities.

NATURE PROTECTION AND BIODIVERSITY: FORECASTS AND ACTIONS TAKEN

In the new Biodiversity Strategy for 2030, adopted at EU level in May 2020, it is proposed to restore Europe's biodiversity, with benefits for people, the climate and the planet.The key commitments on nature protection for 2030 are:

- protecting at least 30% of the EU's land area and 30% of the EU's sea area;
- the integration of ecological corridors, as part of the trans-European nature network;
- strict protection of at least a third of the EU's protected areas, including all virgin forests;
- efficient management of protected natural areas by clearly defining conservation objectives and their appropriate monitoring measures.

NETWORK OF NATURAL PROTECTED AREAS

In Romania, the following categories of protected natural areas have been designated for the purpose of ensuring special protection and conservation measures in situ for the natural heritage:
a) *of national interest*: scientific reserves, national parks, natural monuments, natural reserves and natural parks;
b) *of international interest*: natural sites of the universal natural heritage, geoparks, wetlands of international importance and biosphere reserves;
c) *of community interest or "Natura 2000" sites*: sites of community importance, (SCI) and avifaunistic special protection areas (SPA);
d) *of county or local interest*: established only on the public/private domain of administrative-territorial units, as the case may be.

In the Annual Report on the State of the Environment in Romania, the protected natural areas categories mentioned in points a-c are addressed. The data regarding the total number and areas of each category of protected natural area for the year 2021 are presented in the tables below.

RO 41
Indicator code Romania: RO 41 EEA indicator code: SEBI 007
TITLE: **NATURAL PROTECTED AREAS DESIGNATED AT NATIONAL LEVEL**
DEFINITION: The indicator illustrates the growth rate of the number and total surface of protected areas of national interest over time. The indicator can be characterized according to: IUCN categories, biogeographical region and country.

Data changes regarding protected natural areas occurred in 2015 as a result of the implementation by the Ministry of the Environment of the project "***Realization of spatial data sets in accordance with INSPIRE technical specifications for protected natural areas, including Natura 2000 sites, considering the optimization of their management facilities***", through which the limits of the protected natural areas were analyzed, following the collection of data from the field based on the existing documentation. The last designations of protected natural areas have been made in 2016: 1 natural park - Văcărești Natural Park, 23 avifaunistic special protection areas (SPA), 54 sites of community importance (SCI), new and expanded areas of several SCI existing, and in 2020 the Ramsar site Eleșteele Jijia from Iasi.

As of 2021, there are 944 protected natural areas of national interest in Romania, according to the data and information reported to the European Environment Agency.

Table V.10 - Categories of protected natural areas in Romania at the level of 2021

Categories of protected natural areas	Number	Area (ha)
Scientific reserves, natural monuments, natural reserves	915	317970
National parks	13	317419.19
Natural parks	16	770026.529
Areas of special avifaunistic protection (SPA)	171	3875297.58
Sites of Community Importance (SCI)	435	4650970.00
Biosphere reserves	3	662047

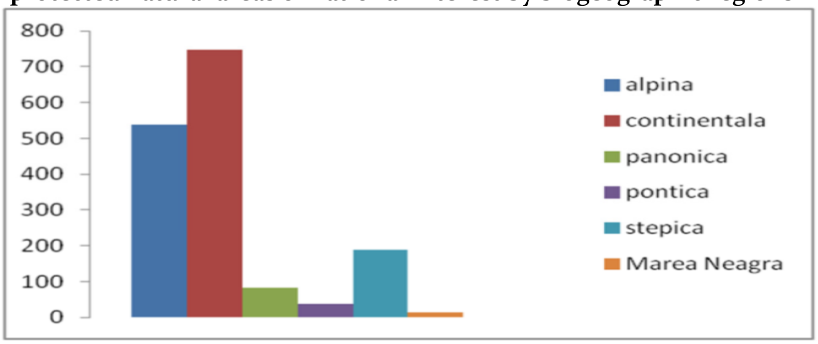
Wetlands of international importance (Ramsar sites)	20	1110748
Natural sites of the universal natural heritage	1	311915.88

Source: MEWF /https://en.unesco.org/biosphere/eu-na/https://www.Ramsar.org/wetland/romania

The establishment of the Bucegi Natural Reserve in 1926 initiated the process of designating protected natural areas in Romania. The number of protected natural areas increased to 425 by 1990, but the largest number of nationally designated protected areas was recorded during the period 2000-2007.

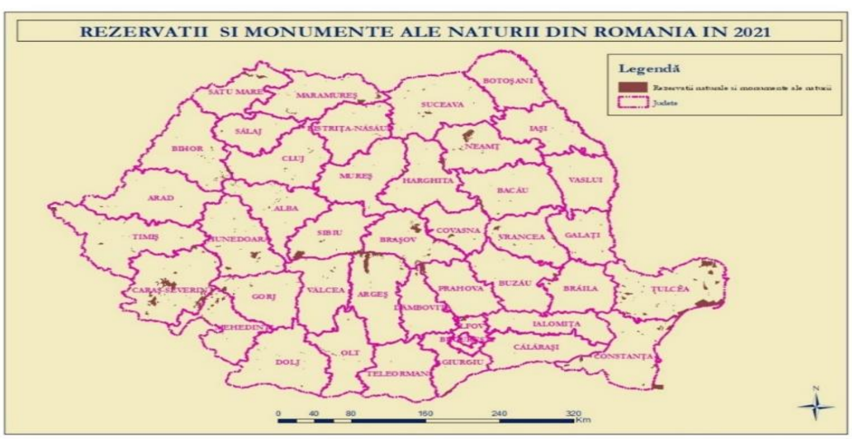
Currently, Romania has over 1500 protected natural areas, of which approximately 2/3 are of national interest.

Figure V. 25 -Distribution of protected natural areas of national interest by biogeographic regions



Source:ibis.anpm.ro MEWF

Figure V.26 - National distribution of protected natural areas of national interest: nature reserves and monuments, natural and national parks



Source: MEWF

TableV. 11 - National parks in Romania, in 2021

Name	County	Area (ha)
	Total	**317419.2**
Domogled-Valea Cernei	Caraş - Severin, Mehedinţi, Gorj	61661.28
Munţii Rodnei	Bistriţa - Năsăud, Maramureş,	47202.31
Retezat	Hunedoara, Caraş - Severin, Gorj	38315.95
Cheile Nerei-Beuşniţa	Caraş - Severin	36811.52
Semenic-Cheile Caraşului	Caraş - Severin	36100.29
Călimani	Bistriţa - Năsăud, Harghita, Mureş, Suceava	24435.47
Cozia	Vâlcea	16725.23
Piatra Craiului	Argeş, Braşov	14789.21
Munţii Măcinului	Tulcea	11247.02
Defileul Jiului	Gorj, Hunedoara	10976.39
Ceahlău	Neamţ	7763
Cheile Bicazului-Hăşmaş	Harghita, Neamţ	6912.82
Buila-Vânturariţa	Vâlcea	4478.7

Source: MEWF

Table V. 12 - Natural parks in Romania, in 2021

Name	County	Area (ha)
Total		770026.5
Apuseni	Alba, Bihor, Cluj	76054.97
Munţii Maramureşului	Maramureş	133450.43
Porţile de Fier	Caraş-Severin, Mehedinţi	128101.71
Geoparcul Platoul Mehedinţi	Mehedinţi	106376.34
Geoparcul Dinozaurilor–Ţara Haţegului	Hunedoara	100049.66
Grădiştea Muncelului-Cioclovina	Hunedoara	38106.85
Putna-Vrancea	Vrancea	38060.18
Bucegi	Prahova, Braşov, Dâmboviţa	32519.7
Vânători-Neamţ	Neamţ	30705.62
Comana	Giurgiu	25107
Balta Mică a Brăilei	Brăila	20665.48
Lunca Mureşului	Arad, Timiş	17397.39
Defileul Mureşului Superior	Mureş	10158.58
Lunca Joasă a Prutului Inferior	Galaţi	8109.96
Cefa	Bihor	4977.94
Văcăreşti	Bucureşti-sector 4	184,719

Source: MEWF

RO 42

Indicator code Romania: RO 42
EEA indicator code: SEBI 008

TITLE: **PROTECTED AREAS OF COMMUNITY INTEREST DESIGNATED UNDER THE HABITAT AND BIRDS DIRECTIVE**

DEFINITION: The indicator presents the current status of the application of the Habitats (92/43/EEC) and Birds (79/409/EEC) directives by the Member States through 2 sub-indicators:
(a) highlighting the spatial coverage trends with proposals for Natura 2000 sites;
(b) calculation of a sufficiency index based on these proposals.

As a member state of the European Union, Romania contributes to ensuring biodiversity at European level by conserving natural habitats, as well as wild fauna and flora. In this sense, it was established on the territory of Romania The Natura 2000 Ecological Network through which the species and habitats considered to be of community importance are conserved, by designating sites of community interest SCI -**Sites of community importance** and SPA -**Areas of special avifaunistic protection**. This ecological network of sites has the role of ensuring the maintenance or restoration of natural habitat types and species in a favorable state of conservation within their natural distribution areas.

In 2016, Romania designated a number of 23 SPA and 54 SCI thus reaching a total of 606 Natura 2000 sites, of which 435 SCIs and 148 SPAs. The area covered by Natura 2000 sites has increased from about 18% in 2007 to about 23% of the country's surface today.

In the context of ensuring the coherence of the Natura 2000 network and responding to the European Commission's requests in infringement procedures concerning the insufficient designation of sites for the protection of species and habitats of community interest, an analysis was conducted at the level of the Ministry of Environment, Waters, and Forests. Several new Special Conservation Interest areas (SCIs) were identified to be added to the current list, as well as others for which modifications are proposed. The procedure for designating new SCIs was still ongoing at the end of 2021.

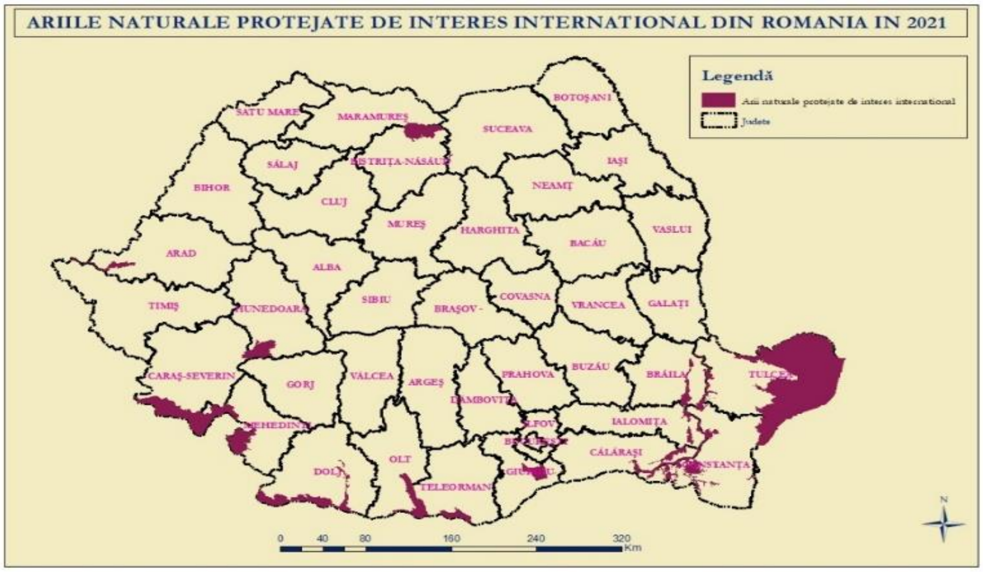
Figure V. 27 - National distribution of Natura 2000 sites

Source: MEWF

The standard forms of Natura 2000 sites were updated in 2021 with information provided by the management plans developed within projects implemented in the protected natural areas. Information regarding the "reference area for the favorable condition of the habitat type in the protected natural area" or the "reference population size for the favorable condition in the protected natural area" was updated to finalize the list of SCIs to be designated as Special Areas of Conservation (SACs). **_This information is available on the European Environment Agency's website (https://cdr.eionet.europa.eu/ro/eu/n2000/) and can also be accessed through the online application Integrated Environmental System (SIM) implemented by the National Environmental Protection Agency (ANPM), which includes a component dedicated to nature conservation known as RNI-IBIS or SIM-CN available at natura.anpm.ro_**.
In 2021, the Ministry of Environment, Waters, and Forests continued the process of updating data and information related to the designation of Special Protection Areas (SACs). Romania is in the process of approving the first set of SACs for SCIs with approved management plans. The designation of SACs will be done progressively as new SCIs have approved management plans.

Another category of protected natural areas is the protected natural areas of international interest, respectively biosphere reserves, wetlands of international importance also known as Ramsar sites and natural sites of the universal natural heritage.

Figure V. 28 - National distribution of protected natural areas of international interest



Source: MEWF

Biosphere reserves

Three Biosphere Reserves have been declared in Romania:

- The Danube Delta (1991);
- Pietrosul Rodna (1979);
- Recut (1979).

The concept and designation of "Biosphere Reserve" were promoted in 1971 through the "Man and the Biosphere" (MAB) Program, under the auspices of UNESCO. This concept aimed to conserve characteristic natural areas, representative ecosystems capable of maintaining and expanding endangered or threatened plant and animal species.

Table V. 13 - Biosphere reserves in 2021

Name	County	Area (ha)
Total		662047
The Danube Delta	Tulcea, Constanta	580000*)
Pietrosul Rodnei	Maramureș, Bistrita-Năsăud,	44000
Retezat	Caraș-Severin, Hunedoara, Gorj	38047

**)only the area related to Romania from the total area of the Danube Delta Biosphere Reserve mentioned on the website: https://en.unesco.org*
Source:https://en.unesco.org/biosphere/eu-na

The Danube Delta- The mosaic of habitats developed in the Danube Delta Biosphere Reserve is the most varied in Romania with a great diversity of plant and animal communities whose number has been estimated at over 5000 types.The Danube Delta is the largest wetland and the largest reed area in Europe.

Pietrosul Rodnei
Retezat -During the meeting in Abuja, Nigeria from September 13-17, 2021, the International Coordinating Board of the Man and the Biosphere Program (MAB) took the decision to withdraw the Biosphere Reserve status for Retezat, as a result of not fulfilling one of the new requirements of the Strategy from Seville for Biosphere Reserves, namely, the existence of resident com

munities in the transition zone of the Biosphere Reserve.

Ramsar sites

At the end of 2021, Romania had 20 Ramsar sites designated by the Secretariat of the Ramsar Convention, with a total area of **1110748** *ha, representing about 5% of the country's surface.*

The Eleșteele Jijia site, also nicknamed the "Delta of Moldavia", is the last Ramsar site designated in Romania, in June 2020, and the first Ramsar site in the region of Moldova, the proposal for inclusion on the Ramsar list being developed by Iași Environmental Protection Agency and Iași Environmental Guard in collaboration with Alexandru Ioan Cuza University–The Faculty of Biology with the support of Romanian Ornithological Society (ROS). In July 2021, Romania expanded the area of the Dumbrăvița Fisheries Complex by about 5 times, from 414 to 2282 hectares, to include the Rotbav fish pond complex and to align with the wetland habitats of the Natura 2000 site. The need for its expansion it was based on several pertinent reasons, such as: the inclusion of all wet habitats in the Dumbrăvița and Rotbav areas (fish farms, lakes, marshes, flowing waters, dead arms, meadows, temporarily or permanently flooded lands, etc.). In this way, the old Ramsar Site "Dumbrăvița Fish Complex" became "Dumbrăvița-Rotbav Fish Complex",

More information about these sites can be found on the Ramsar website: https://www.Ramsar.org/wetland/romania.

Table V. 14- Ramsar sites in Romania in 2021

No.	Name	County	Area (ha)
	Total		**1110748**
1.	The Danube Delta	Tulcea, Constanța	580000*)
2.	Parcul Natural Porțile de Fier	Caraș-Severin, Mehedinți	115666
3.	Ostroavele Dunării-Bugeac-Iortmac	Călărași, Constanța, Ialomița	82832
4.	Confluența Olt-Dunăre	Olt, Teleorman	46623
5.	Blahnița	Mehedinți	45286
6.	Calafat-Ciuperceni-Dunăre	Dolj	29206
7.	Bistreț	Dolj	27482
8.	Parcul Natural Comana	Giurgiu	24963
9.	Dunărea Veche - Brațul Măcin	Brăila, Tulcea, Constanța	26792
10.	Brațul Borcea	Călărași, Ialomița	21529
11.	Confluența Jiu-Dunăre	Dolj	19800
12.	Suhaia	Teleorman	19594
13.	Eleșteele Jijia	Iași	19432
14.	Insula Mică a Brăilei	Brăila	17586
15.	Parcul Natural Lunca Mureșului	Arad, Timiș	17166
16.	Canaralele de la Hârșova	Ialomița, Constanța	7406
17.	Iezerul Călărași	Călărași	5001
18.	Lacul Techirghiol	Constanța	1462
19.	Tinovul Poiana Stampei	Suceava	640
20.	Complexul Piscicol Dumbrăvița-Rotbav	Brașov	2282

**)only the area related to Romania from the total area of the Ramsar Danube Delta site mentioned on the website: ramsar.org*

Source: Ramsar website:https://www.ramsar.org/wetland/romania

The most important Ramsar sites are:

- *Insula Mică a Brăilei*
- *Lunca Mureșului*
- *Lacul Techirghiol*
- *Parcul Natural Comana*
- *Parcul Natural Porţile de Fier*
- *Tinovul Poiana Stampei*
- *Bistrețul*
- *Iezerul Călărași*
- *Balta Suhaia*

Natural sites of the universal natural heritage

Since 1991, the Danube Delta has been included in the List of the UNESCO World Heritage Convention, as a recognition of the universal natural heritage value of this territory. The management of this site is carried out in accordance with the regulations and own protection and conservation plans, in compliance with the provisions of the Convention on the protection of the world cultural and natural heritage, under the auspices of UNESCO.

MANAGEMENT OF NATURAL PROTECTED AREAS

The authority responsible for providing the necessary framework for the management of protected natural areas is the National Agency for Protected Natural Areas (ANANP), through its territorial structures, in accordance with the provisions of Law no. 95/2016, as amended and supplemented.

According to the data and information provided by ANANP, in 2021, a total of 349 protected natural areas were entrusted for management to various entities based on the provisions of article 18 (1) letter b) of Government Emergency Ordinance no. *57/2007 on the regime of protected natural areas, conservation of natural habitats, wild flora, and fauna, approved with subsequent amendments and completions through Law 49/2011, with subsequent amendments and completions*. Except for 27 protected natural areas, which are under the administration of the Administration of the Danube Delta Biosphere Reserve (ARBDD), according to the provisions of article 18 (1) letter c) of the aforementioned ordinance, the other protected natural areas are managed by ANANP, through its territorial structures, in accordance with the provisions of article 18 (1) letter a) of the same ordinance.

During 2021, ANANP analyzed 5 management plans for which additional information and/or clarifications were requested, and these were subsequently submitted, in accordance with legal provisions, to the central public authority for environmental protection for approval. As a complement to the methodology for designating protected natural areas, ANANP developed the Procedure for concluding partnerships for the administration of protected natural areas, provided for in article 16 (31) of Government Emergency Ordinance no. 57/2007, with subsequent amendments and completions. The situation with approved management plans can be found at the Ministry of Environment, Waters, and Forests.

VI. FORESTS

NATIONAL FOREST FUND: STATUS AND CONSEQUENCES

Evolution of the forest fund area

RO 45

Indicator code Romania: RO 45
EEA indicator code: SEBI 17

TITLE: FORESTS: Forest Fund, Forest Growth, and Timber Harvesting

DEFINITION: The indicator shows the evolution of the forest fund, the net annual growth and the annual cuttings, as well as the rate of forest use (the fraction of annual cuttings from the annual growth).

The national forest fund of Romania had an area of 6,607 thousand hectares at the end of 2021, representing 27.7% of the country's total area. As of December 31, 2021, compared to the same date in 2020, the forest fund area recorded an increase of 3 thousand hectares, mainly due to the afforestation of pastures and the inclusion of degraded lands into the forest fund, under the provisions of Law no. 46/2008 on the Forestry Code, republished, with subsequent amendments and completions.

Table VI.1 Evolution of the area of forests in the forest fund with the main categories of species, in the period 2012 – 2021

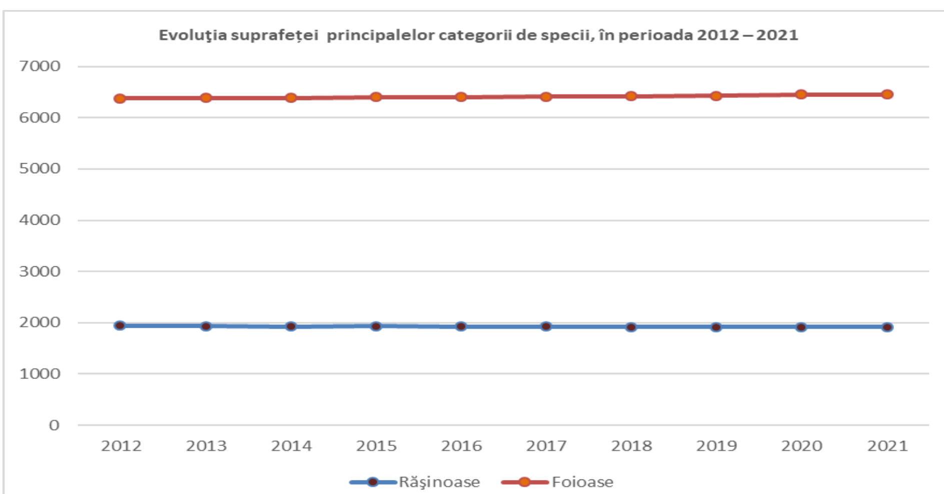
thousands of hectares

Main species Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Forest area - total	6373	6381	6387	6399	6404	6406	6418	6427	6449	6450
Pine trees (Coniferous)	1945	1937	1930	1931	1929	1924	1917	1915	1916	1919
Deciduous trees (Broadleaf)	4428	4444	4457	4468	4475	4482	4501	4512	4533	4531

Source: MEWF-DPSS

Figure VI.1 Evolution of the area of the main categories of species from the forest fund, in the period 2012 – 2021

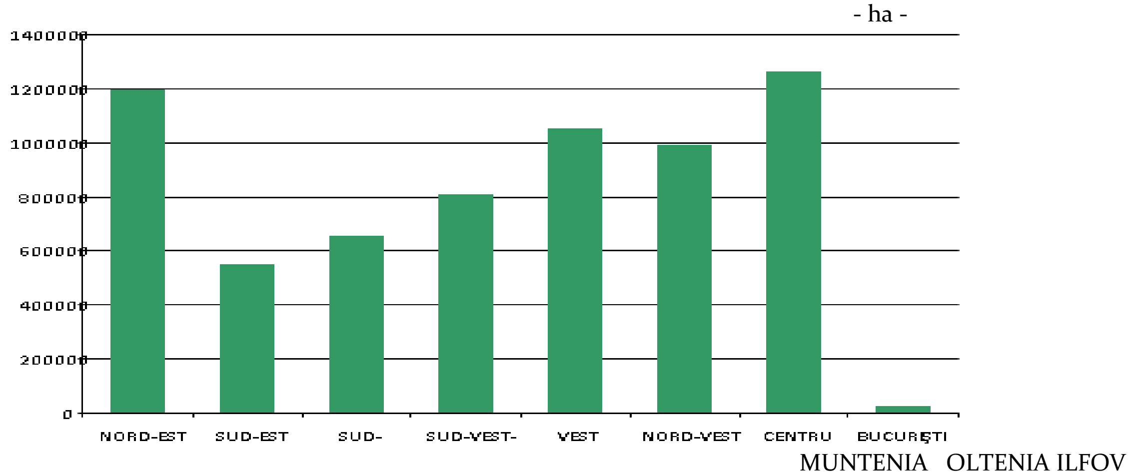
-thousands ha-



Source: MEWF-DPSS

Due to the relief and favorable climatic conditions in our country for the development of deciduous tree species, the area occupied by deciduous trees is 2.3 times larger than the area occupied by coniferous trees.
Approximately 42% of the forest fund's area is distributed in the following counties: Suceava (6.6%), Caraș-Severin (6.5%), Hunedoara (4.8%), Argeș (4.2%), Vâlcea (4.1%), Bacău (4.1%), Harghita (4%), Neamt (4%), and Maramureș (3.9%).
The distribution of the forest fund by development regions indicates a significant proportion of forests in the CENTRAL (19.3%) and NORTH-EAST (18.2%) development regions, followed by the WEST (16.2%), NORTH-WEST (15.2%), SOUTH-WEST-OLTENIA (12.3%) regions, and the lowest proportions in SOUTH-MUNTENIA (10.0%), SOUTH-EAST (8.4%), and BUCHAREST-ILFOV (0.4%) regions.

Figure VI.2 Distribution of the forest fund, by development regions, at the end of 2021



Source: MEWF-DPSS

The forest area per inhabitant is 0.34 ha (on January 1, 2021 the resident population was 19,186 thousand people - www.insse.ro), close to the European one of 0.31 ha.

The average annual increase, at the level of 2021, was 7.8 m^3/year/ha (according to data provided by the Forest Fund Inventory), above the European average of 4.4 m^3/year/ha.

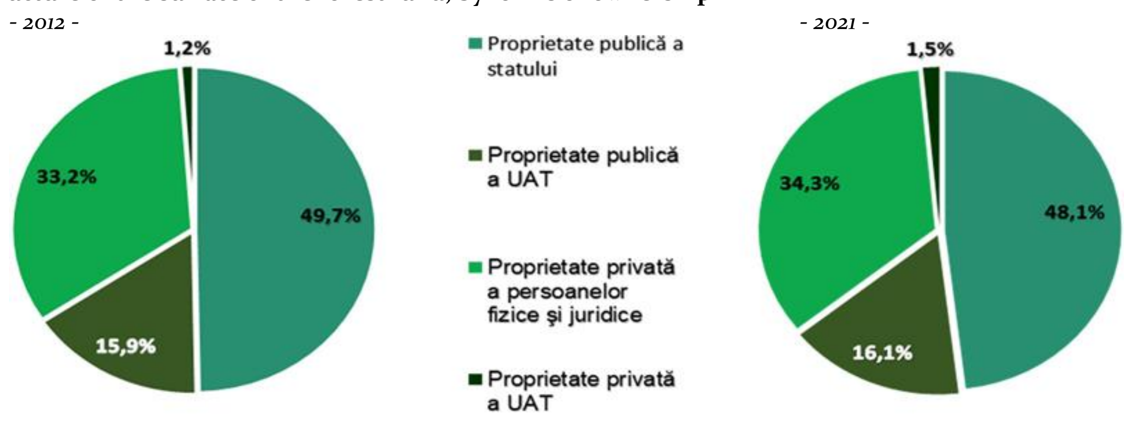
Table VI.2 Timber harvesting index - m^3/year/ha in the period 2015-2021

Year	2015	2016	2017	2018	2019	2020	2021
Timber harvesting index - mc/year/ha	2.8	2.7	2.8	2.95	2.95	2.94	2.98

Source: IFN,MEWF-DPSS

In 2021, public ownership represented 64.3% of the total area of the national forest fund, mainly administered by the National Forestry Authority - Romsilva, while private ownership accounted for 35.7%, mostly managed by private forestry structures. In 2012, public ownership represented 65.6%, and private ownership accounted for 34.4%, both categories having similar majority administration since then. The area of the forest fund in private ownership shows an increasing trend, at the expense of the area in public ownership, due to the ongoing process of forest restitution.

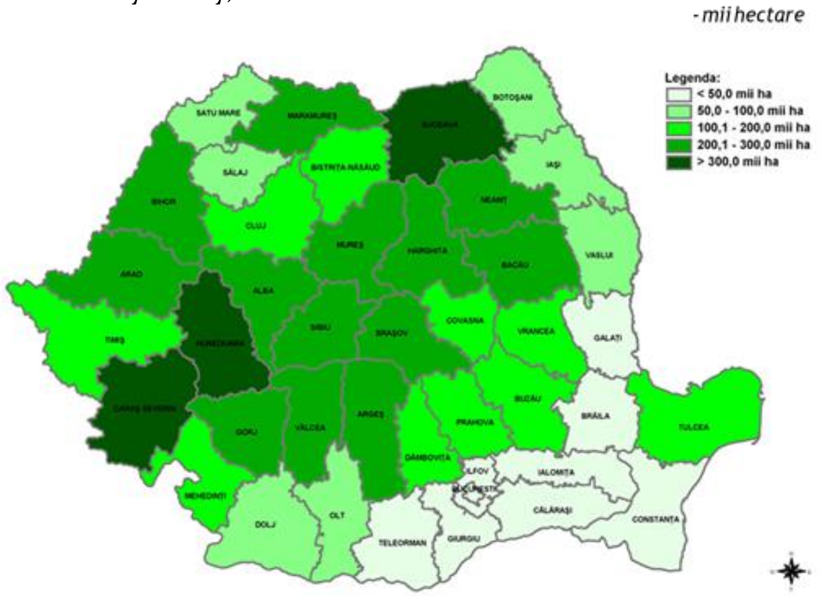
Figure VI.3 Structure of the surface of the forest fund, by forms of ownership



Source: Statistics of Forestry Activities in 2021
https://insse.ro/cms/ro/content/statistica-activit%C4%83%C5%A3ilor-din-silvicultur%C4%83-%C3%AEn-anul-2021

The distribution of the national forest fund by counties is uneven, depending on the physical-geographical conditions and economic-social development of the area.

Figure VI.4 The area of the forest fund by county, at the end of 2021



Source: Statistics of Forestry Activities in 2021
https://insse.ro/cms/ro/content/statistica-activit%C4%83%C5%A3ilor-din-silvicultur%C4%83-%C3%AEn-anul-2021

Larger forest areas were registered, in 2021, in the counties: Suceava (438 thousand hectares), Caraş-Severin (434 thousand hectares), Hunedoara (316 thousand hectares), Argeş (277 thousand hectares), Vâlcea (274 thousand hectares) Bacău (273 thousand hectares), Harghita (264 thousand hectares), Neamţ (262 thousand hectares) and Maramureş (260 thousand hectares).

The forestry fund, public property of the state, under the administration of the National Forestry Authority – Romsilva occupied, on December 31, 2021, according to the statistical reports sent by the forestry departments, a total area of 3,128,295 ha.
The evolution of the state-owned public forest fund between 2014-2021 is presented in table VI.3.

Table VI.3 Evolution of the state-owned public forest fund between 2014-2021

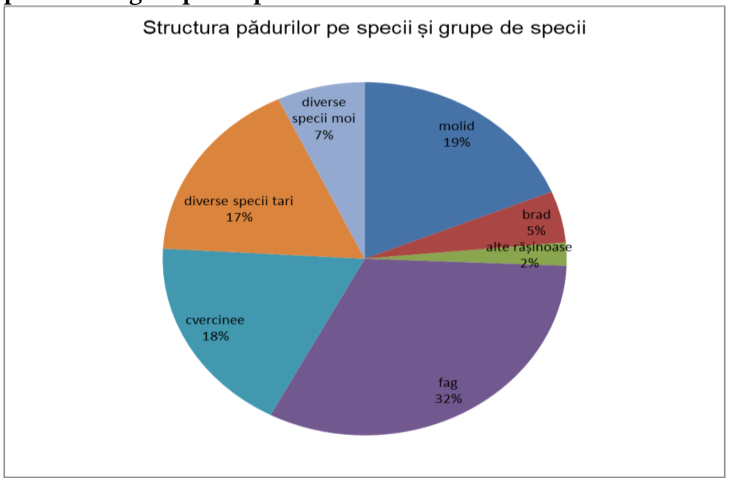
Year	2014	2015	2016	2017	2018	2019	2020	2021
Surface -ha-	3,217,017	3,202,656	3,145,793	3,138,761	3,135,927	3,132,469	3,128,367	3,128,295

Source: National Directorate of Forests-Romsilva

The surface changes were mainly determined by:
- possessions carried out as a result of the application of land fund laws;
- the corrections of surfaces operated during the redevelopment works of some forest bypasses (carrying out elevations in the plan, changing the cartographic base, planimetry errors, boundary corrections following the confrontation of the basic plans with OCPI, determining the surfaces through the GIS technique);
- the definitive removal of some lands from the forest fund;
- compensation for lands definitively removed from the forest fund;
- the passing of some forest roads and the lands occupied by them from the public domain of the state and from the administration of the National Forestry Authority - Romsilva into the public domain of some administrative-territorial units and into the administration of their local councils;
- correction of previous reporting errors.

From the point of view of the species structure, the beech is the majority species in the composition of the forests, occupying 32% of their surface. The structure of forests by species and groups of species is presented in figure VI.5.

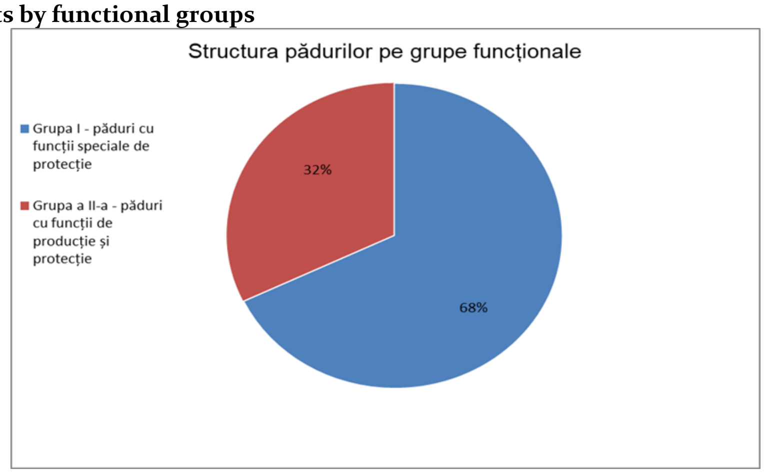
Figure VI.5 Forest structure by species and groups of species



Source: National Directorate of Forests-Romsilva

From a functional point of view, the forests included in functional group I, respectively those with special protection functions, are the majority, representing 68% of the total area of forests, while forests with production and protection functions (functional group II) occupy only 32% of the respective area.

Figure VI.6 Structure of forests by functional groups



Source: National Directorate of Forests-Romsilva

Until 31.12.2021, the **reconstitution of the ownership right** for the area of **3,079,713 ha** was validated and the area of **2,965,909 ha** was taken into possession.

The reasons for the non-possession by individuals/legal entities of forest lands validated as ownership rights by the county land fund commissions are as follows:

- Lack of government resolutions to transfer the forest lands subject to restitution from public to private ownership;
- Absence of authorized land surveyors within the local land fund commissions to measure the forest lands subject to restitution;
- Lack of cadastral plans at the level of administrative-territorial units, based on which delimitation and possession procedures are carried out;
- Validation of the ownership right only as an extent, without preparing/validating annexes with cadastral and management location of the forest lands subject to restitution, to be made available to the local land fund commissions;
- Perpetuation of the practice of some county land fund commissions not subjecting court judgments in cases where forestry directorates were not involved, recognizing the plaintiffs' ownership right as an extent, and local land fund commissions were obligated to carry out the possession, and county land fund commissions to issue ownership titles, in which situations forest districts are requested to hand over the forest lands specified in the court judgments to the local land fund commissions;
- Owners do not agree with the surfaces and locations of the forest lands validated by the county land fund commissions;
- Validation of ownership right on annexes with agricultural lands on old locations, while the possession is carried out

with forest lands, without applying the provisions of Article 29 of Law no. 1/2000 for the reconstitution of ownership rights over agricultural and forest lands, and without preparing Annex 38, in such cases;

- Lawsuits are filed to challenge the validation decisions issued by the county land fund commissions, with violations of the land fund laws' provisions.

Source: National Directorate of Forests-Romsilva

Forests health

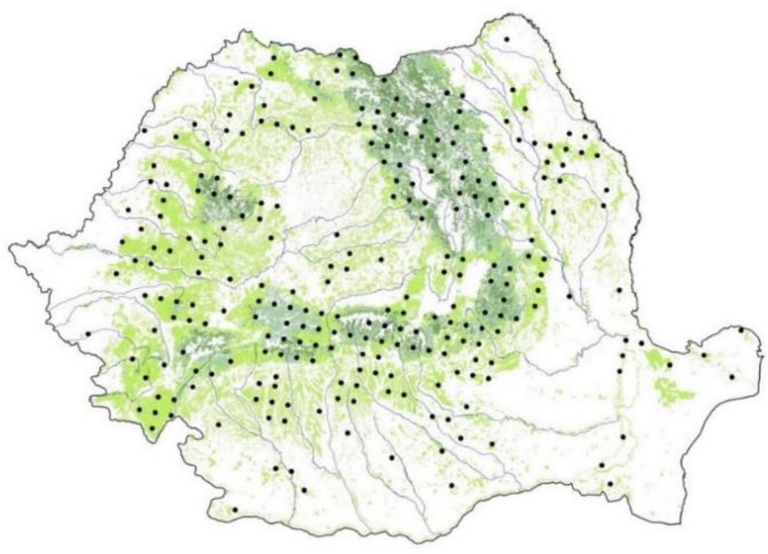
RO 46
Indicator code Romania: RO 46 EEA indicator code: SEBI 18
TITLE: FORESTS: dead wood (dry)
DEFINITION: The indicator presents the volume of dead wood, in the form of dry or felled trees, by forest type (m^3/ha)

The state of health of the forests, assessed through forest monitoring activity

In 2021, the assessment of the health status of existing trees within the pan-European forest health monitoring network (16x16 km -Level I) was carried out in 234 surveys, the difference up to the maximum number of surveys (264) being represented by temporarily inaccessible stands, exploited or undergoing regeneration that did not meet the minimum dimensional criteria to be evaluated. It is important to mention that this network is not representative at the level of Romania (the sampling error is ±8%), the results showing only the dynamics of health status from one year to another and even over longer periods in the past. The information obtained from this network, regarding Romania's forests, is integrated at European level with that obtained from similar networks of the ICP-Forests member countries (the error being ± 1. 3%). A total number of 5616 trees were evaluated, 192 more than the previous year, of which 923 resinous trees (16.4%) and 4693 deciduous trees (83.6%). At the species level, a total of 6 coniferous species were evaluated, of which spruce is predominant (72.9%), followed by fir (20.9%), and 30 deciduous species, with beech being the dominant species (43.1%), followed by oak (13%) and hornbeam (11.3%).

The average defoliation percentage (average defoliation), at the level of the pan-European network for forest monitoring in Romania, is 15.4%, which is 0.2% lower than in 2020. Among species groups, there is a slight increase compared to the previous year in conifers (15.2% in 2019, 15.3% in 2020, and 16.0% in 2021), while for deciduous trees, there is a small decrease (14.8% in 2019, 15.3% in 2020, and 15.2% in 2021).

Figure VI.7 Pan-European forest health surveillance network (16x16 km -Level I)



Source: INCDS

Table VI.4 Dynamics of the percentage of healthy trees (Def≤25) and damage (Def>25)

Year	No of trees	Share %	Def≤25%	def>25%
Species group	**Pine trees (Coniferous)**			
2016	1120	19.3	89.6	10.4
2017	1092	18.6	89.3	10.7
2018	1051	18.0	87.3	12.7
2019	989	17.3	86.3	13.7
2020	831	15.3	82.6	17.4
2021	923	16.4	83.6	16.4
Species group	**Deciduous trees (Broadleaf)**			
2016	4688	80.7	85.8	14.2
2017	4788	81.4	85.0	15.0
2018	4781	81.9	86.1	13.9
2019	4732	82.7	88.8	11.2
2020	4593	84.7	87.9	12.1
2021	4693	83.6	88.8	11.2
Species group	**Total species**			
2016	5808	100	86.5	13.5
2017	5880	100	85.8	14.2
2018	5832	100	86.3	13.7
2019	5721	100	88.4	11.6
2020	5424	100	87.1	12.9
2021	5616	100	88.0	12.0

Source: INCDS

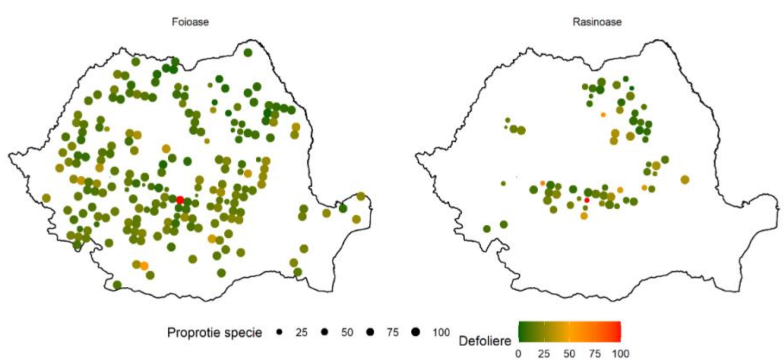
In 2021, the average percentage of damaged trees (defoliation classes 2-4) at national level was 12.0%, a decrease of 0.9 percentage points compared to 2020. Among species groups, in recent years, there has been a consistent increase in the average percentage of damaged coniferous trees, starting from 10.7% in 2017, 12.7% in 2018, 13.7% in 2019, and reaching 17.5% in 2020. However, in 2021, the average percentage of damaged coniferous trees decreased by 1.1%. This is still a low value compared to the percentage of damaged trees recorded in 2017, but it does halt the upward trend of worsening health conditions for coniferous trees, a trend that has been observed not only in Romania but also at European level (FOREST EUROPE, 2020). In the case of deciduous trees, in 2021, a value of 11.2% was recorded, a decrease of 0.9% compared to 2020, maintaining the decreasing trend of values recorded in recent years.

The level of mortality (defoliation class 4) was again very low at 0.6% for all species, with dry tree specimens being recorded for both species groups, with the highest mortality rate attributed to poplar, hornbeam, acacia, or "other deciduous species."

From the analysis of field data regarding the intensity of fruiting in 2021, fruiting was observed in 34% of the evaluated trees, with 20% having poor fruiting, 15% having normal fruiting, and only 2% having abundant fruiting.

At regional level, higher percentages of average defoliation were observed for deciduous species in the central and western parts of the country. For coniferous trees, slightly higher values were noted in the curved Carpathians and the northern part of the Eastern Carpathians (Figure VI.8)

Figure VI.8 Spatial distribution of average defoliation in 2021



Source: INCDS

Keeping the trend of the past years, the results of the assessments carried out in the period 2016-2021 within the pan-European network of permanent surveys (Level I) indicate that the state of health of the country's forests is relatively constant with small differences from one year to the next in terms of the percentage of trees with crown defoliation greater than 25% (damaged trees), which in 2021 recorded a value of 12.0%, 1.5 percentage points lower than in 2016 (13.5 %).

Source: INCDS

Forest areas affected by logging

RO 45
Indicator code Romania: RO 45 EEA indicator code: SEBI 17
TITLE: FORESTS: Forest Fund, Forest Growth, and Timber Harvesting
DEFINITION: The indicator shows the evolution of the forest fund, the net annual growth and the annual cuttings, as well as the rate of forest use (the fraction of annual cuttings from the annual growth).

At regional and global levels, considerable pressures are exerted on forest ecosystems stemming from expanding economies and growing populations, seeking to satisfy consumption and profit needs as quickly as possible (forest owners aiming for maximum profit in the shortest time, which contradicts the availability and capacity for forest ecosystem regeneration). Conservation efforts for forest ecosystems are supported by countries with higher living standards, while poorer countries are often willing to sacrifice their forest resources without considering the disastrous effects accompanying these processes.

Table VI.5 Evolution of timber harvesting, in the period 2015-2021

cubic meters/year/ha

Year	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*
Growth index	7,8	7,8	7,8	7,8	7,8	7,8	7,8
Timber harvesting index	2.8	2.7	2.8	2.95	2.95	2.94	2.98

Source: MEWF-DPSS

Table VI.6 Evolution of forest areas affected by logging, in the period 2015-2021 (ha)

Year	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*
Regeneration cut in virgin forest	69791	65127	70321	64507	74258	68724	75309
Regeneration cut in coppice forest	3665	3229	3212	3573	4022	3499	4226
Substitution-regeneration cut	776	755	728	867	576	872	549
Conservation cut	24221	68107	103035	112614	111754	112244	97536
TOTAL	98453	137218	177296	181561	190610	185339	177620

Source: MEWF-DPSS

The evolution of the growth of the forest fund and the harvesting of timber in Romania is illustrated by the forest utilization rate (the ratio between the harvesting index and the growth index).

Table. VI.7 Forest utilization rate in the period 2015-2021

Year	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*
Percent	36%	35%	36%	37%	37%	37%	38%

Source: Ministry of Environment, Waters and Forests

Table VI.8 Harvested timber, by development regions, in 2021

Development regions	Total
TOTAL	*100%*
- NORTHWEST	12.9%
- CENTER	24.3%
- NORTH-EAST	25.5%

- SOUTH EAST	6.9%
- SOUTH-MUNTENIA	10.7%
- BUCHAREST-ILFOV	0.2%
- SOUTH-WEST OLTENIA	7.3%
- WEST	12.2%

Source: MEWF-DPSS

The largest volume of timber was harvested in the NORTH-EAST development region, 25.5% of the total volume of timber harvested, followed by the CENTRAL development region with 24.3% and a lower share was recorded in the development regions NORTH-WEST with 12.9%, WEST with 12.2%, SOUTH-MUNTENIA with 10.7%, SOUTH-WEST OLTENIA with 7.3%, SOUTH-EAST with 6.9% and BUCHAREST-ILFOV with 0.2 %.

Table VI.9 Forest regeneration works (%), by development regions, in 2021

Development regions	Regeneration
TOTAL	**100%**
NORTHWEST	14.3%
CENTER	17.5%
NORTH EAST	26.3%
SOUTH EAST	13.6%
South-Muntenia	8.5%
Bucharest-Ilfov	0.7%
South-West Oltenia	8.7%
WEST	10.4%

Source:www.insse.ro

The NORTH-EAST development region achieved 26.3% of the regeneration works in 2021, a region from which a quarter of the volume of wood extracted in 2021 was achieved. At the opposite pole is the BUCHAREST-ILFOV development region with only 0 .7% share of the regenerated surface in 2021.

Source: MEWF-DPSS

Wood mass harvested in the year 2021

In 2021, 19,994 thousand m^3 (gross volume) of wood were harvested, 342 thousand m^3 more than in 2020.

By tree species, conifers represent 40.1% of the total volume of harvested timber, beech 30.8%, various hardwood species (acacia, maple, ash, walnut, etc.) 11.3%, oak 10.1%, and various softwood species (lime, willow, poplar, etc.) 7.7%.

Table VI.10 Volume of wood harvested, by main species, in the period 2012 – 2021

- thousands of m^3 -

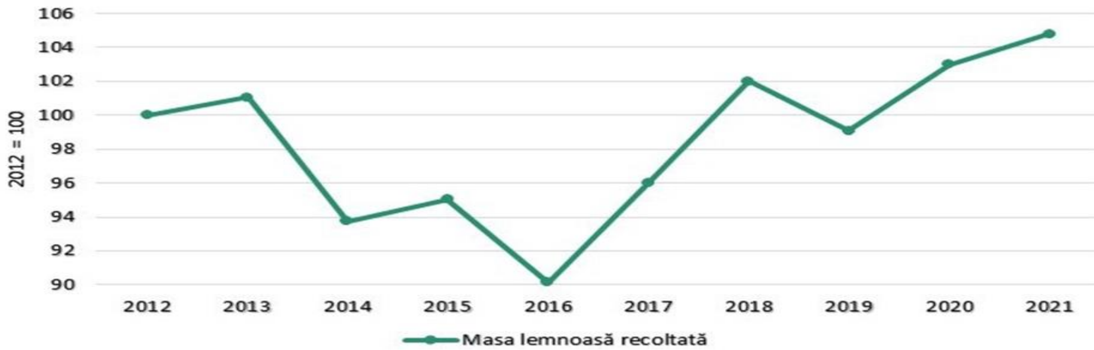
Main species Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
The volume of wood mass harvested - total	*19081*	*19282*	*17889*	*18133*	*17198*	*18316*	*19462*	*18904*	*19652*	*19994*
Conifers	7615	7922	7225	6782	6268	6531	7128	6962	8261	**8024**
Beech	6332	6226	5836	6215	5799	6212	6584	6431	6110	**6146**
Oak	1687	1742	1664	1769	1688	1788	2041	1927	1894	**2019**
Various hardwood species	2014	1969	1876	1951	2008	2228	2191	2163	2096	**2261**

Various softwood species	1433	1423	1288	1416	1435	1557	1518	1421	1291	1544

Source: Statistics of Forestry Activities in 2021
https://insse.ro/cms/ro/content/statistica-activit%C4%83%C5%A3ilor-din-silvicultur%C4%83-%C3%AEn-anul-2021

The evolution of harvested wood mass has an oscillating trend compared to the first year of the series, being lower by 9.9% in 2016 and higher by 4.8% in 2021.

Figure VI.9 Evolution of harvested wood mass, in the period 2012 – 2021



Source: Statistics of Forestry Activities in 2021
https://insse.ro/cms/ro/content/statistica-activit%C4%83%C5%A3ilor-din-silvicultur%C4%83-%C3%AEn-anul-2021

The wood harvested in 2021 was destined in proportion of 96.4% to legal entities certified in the activity of forest exploitation and in proportion of 3.6% to natural persons who can exploit wood from the forests they own. In 2012, the proportion was almost identical, 96.6% and 3.4%, respectively.

According to Law no. 46/2008 – Forestry Code with subsequent amendments and additions, the exploitation of timber is done by legal entities certified by the central public authority responsible for forestry; as an exception, legal and natural persons may exploit, without attestation, a maximum volume of 20 m^3/year from the forests they own.

Table VI.11 The volume of wood mass harvested, on the main destinations, in the period 2012 – 2021

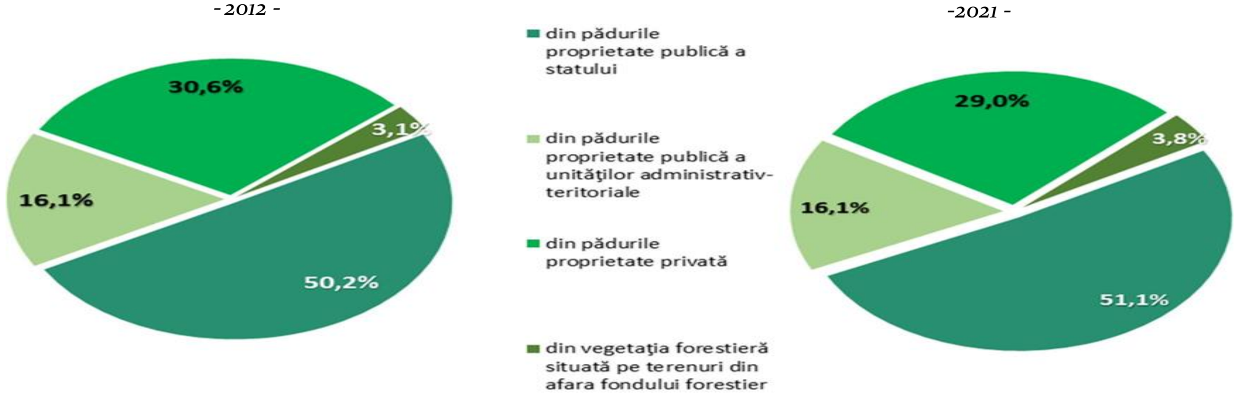
- thousands of m^3 -

Main destinations / Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Volume of wood mass harvested - total	***19081***	***19282***	***17889***	***18133***	***17198***	***18316***	***19462***	***18904***	***19652***	**19994**
– for certified legal entities	18441	18654	17335	17552	16571	17460	18561	18055	18840	**19265**
– for natural persons who own forests	**640**	**628**	**554**	**581**	**627**	**856**	**901**	**849**	**812**	**729**

Source: Statistics of Forestry Activities in 2021
https://insse.ro/cms/ro/content/statistica-activit%C4%83%C5%A3ilor-din-silvicultur%C4%83-%C3%AEn-anul-2021

In 2021, 13,438 thousand m^3 of wood were harvested from publicly owned forests, representing 67.2% of the total volume of wood mass harvested, the rest being harvested from privately owned forests (29.0%) and from forest vegetation located on land from outside the forest fund (3.8%). Between the first and the last year of the analyzed series, approximately the same structure of the volume of wood mass harvested by forms of ownership is preserved, thus in 2021 13,438 thousand m^3 of wood were harvested from publicly owned forests, the share in the total harvested wood being higher by about one percentage point than in 2012 when 12,650 thousand m^3 were harvested.

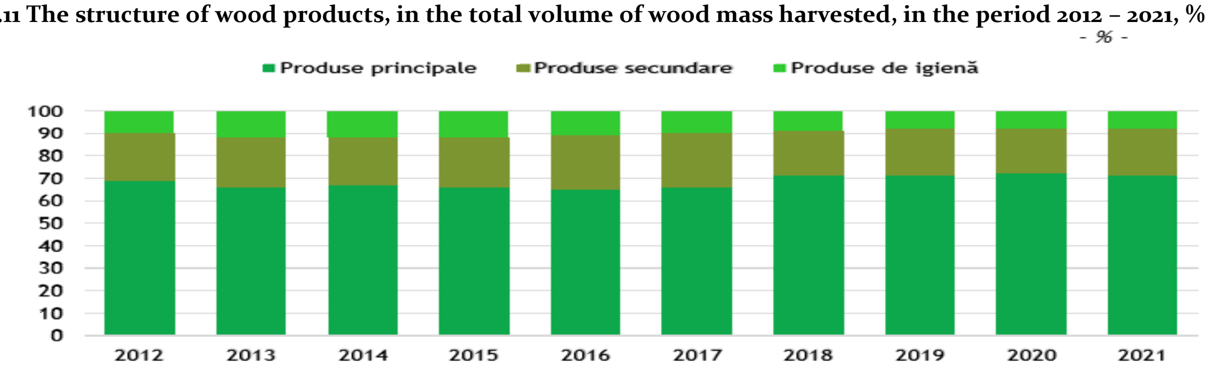
Figure VI.10 Structure of the volume of wood mass harvested by property types



Source: Statistics of Forestry Activities in 2021
https://insse.ro/cms/ro/content/statistica-activit%C4%83%C5%A3ilor-din-silvicultur%C4%83-%C3%AEn-anul-2021

In 2021, compared to 2020, the volume of timber harvested from non-forest land increased by 6.7%, from state-owned public forests increased by 9.1%, while from privately-owned forests decreased by 8.7%, and from publicly-owned forests of administrative-territorial units decreased by 0.2%.
In 2021, the main timber products accounted for 71.1% of the total volume of harvested timber, secondary timber products for 21.1%, and hygiene timber products for 7.8%.

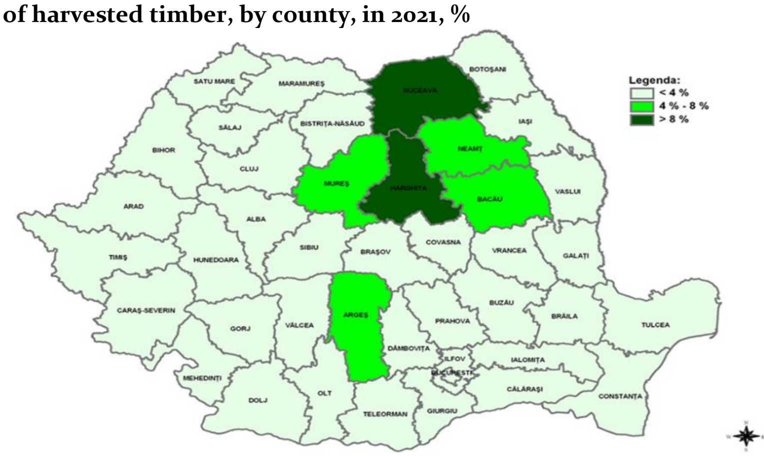
Figure VI.11 The structure of wood products, in the total volume of wood mass harvested, in the period 2012 – 2021, %



Source: Statistics of Forestry Activities in 2021
https://insse.ro/cms/ro/content/statistica-activit%C4%83%C5%A3ilor-din-silvicultur%C4%83-%C3%AEn-anul-2021

At county level, in 2021, the largest amount of wood was harvested in Suceava county (10.6%), followed by Harghita (8.8%), Neamţ (6.0%) and Bacău (5. 6%), and the smallest quantities were harvested in Giurgiu county (approximately 0.6%), Olt, Ialomiţa and Brăila (approximately 0.4%), Teleorman, Ilfov, Constanţa and Galati (0.3%) .

Figure VI.25 The distribution of harvested timber, by county, in 2021, %



Source: Statistics of Forestry Activities in 2021
https://insse.ro/cms/ro/content/statistica-activit%C4%83%C5%A3ilor-din-silvicultur%C4%83-%C3%AEn-anul-2021

The harvesting of wood mass from the forest fund, the public property of the state, managed by the National Forestry Agency - Romsilva

A. Volume of harvested wood mass

In accordance with the provisions of Law no. 46/2008 - the Forest Code, with subsequent amendments and completions, and the provisions of forest management plans and actual conditions for timber exploitation, in 2021, a total volume of 10,063.5 thousand m3 of timber was harvested from the state-owned public forest fund. The situation of timber harvesting by utilization methods is presented in table VI.20.

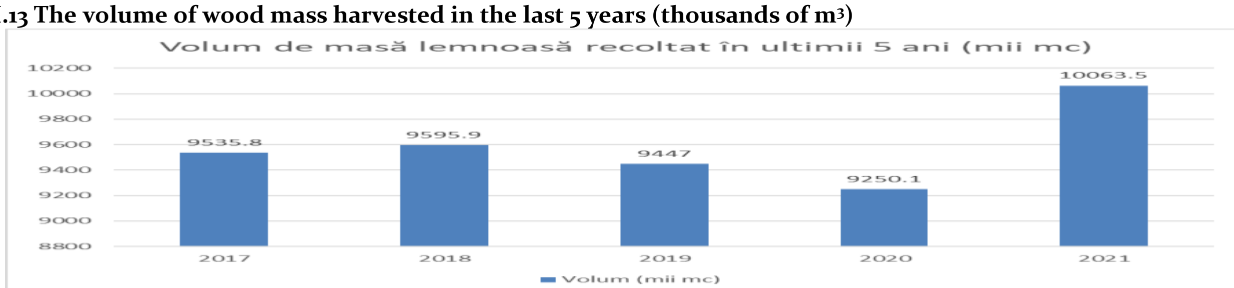
Table VI.12 The situation of harvested wood mass by utilization methods

- thousands of cubic meters -

YEAR	Total volume of harvested timber	from which:		
		utilized as standing timber	exploited through service contracts	self-exploited
2017	9,535.8	7,556.2	441.9	1,537.7
2018	9,595.9	5,622.2	2,005.3	1,968.4
2019	9,447.0	6,497.6	1,048.6	1,900.8
2020	9,250.1	6,469.1	892.0	1,889.0
2021	10,063.5	7,456.9	793.7	1,812.9

Source: National Directorate of Forests-Romsilva

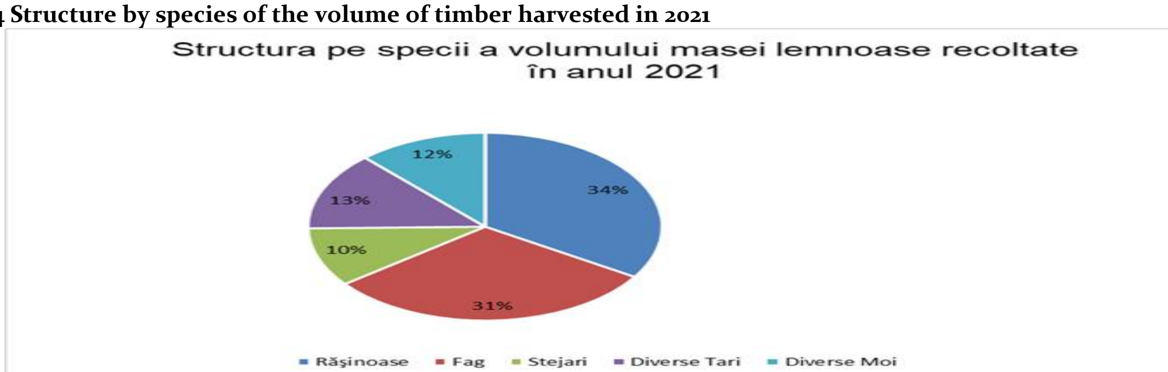
Figure VI.13 The volume of wood mass harvested in the last 5 years (thousands of m³)



Source: National Directorate of Forests-Romsilva

The structure by species of the volume harvested in 2021 is, in general, similar to that of previous years, being represented in figure VI.14:

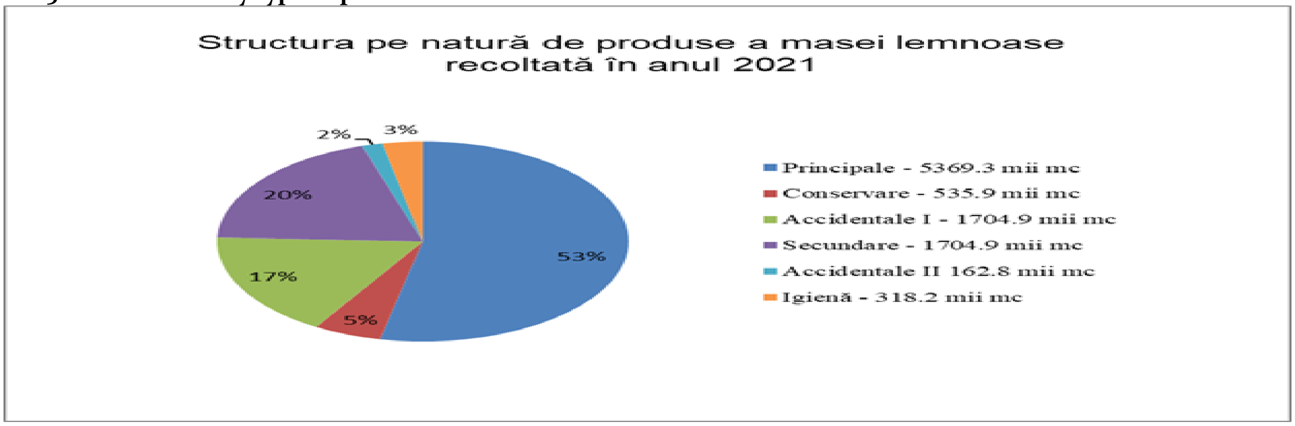
Figure VI.14 Structure by species of the volume of timber harvested in 2021



Source: National Directorate of Forests-Romsilva

By type of products, 7,610.1 thousand m³ represent the main products and those assimilated to them (preservation cuts and accidental products I), 2,135.2 thousand m³ are secondary products (including the volume of accidental products II) and 318.2 thousand m³ represent hygiene products.

Figure VI.15 The structure by type of product of the wood harvested in 2021



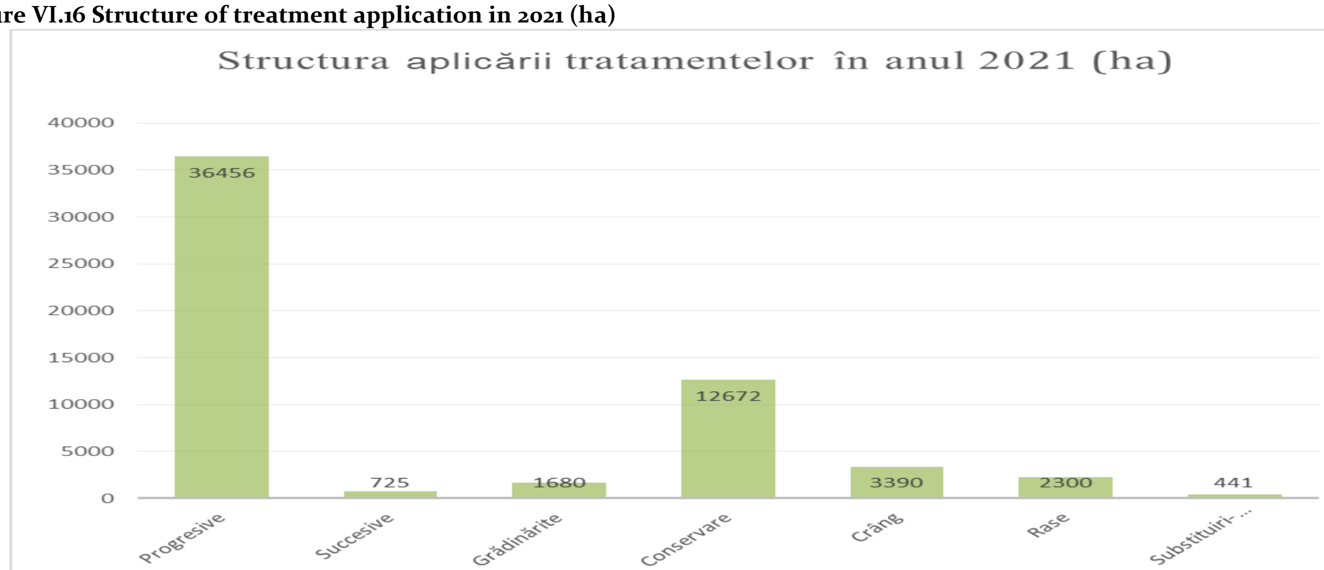
Source: National Directorate of Forests-Romsilva

Due to the action of destabilizing factors, both biotic and abiotic, in the year 2021 accidental products were harvested, totaling 1,867.7 thousand cubic meters (19% of the total volume of timber harvested in 2021), of which 1,704.9 thousand cubic meters were accidental products I and 162.8 thousand cubic meters were accidental products II.

The rational and sustainable management of the state-owned public forest required the implementation of a wide range of treatments aimed at promoting valuable native species, ensuring the continuous exercise of multiple functions (ecological, economic, and social) that forests can fulfill. Through the application of treatments, the focus was on ensuring the regeneration of scheduled tree stands and achieving optimal functional structures, with clearcutting carried out only on small areas and only in situations provided for in the forest management plans.

The proportion of treatment application (methods of tree regeneration) as a percentage of the total area is presented in figure VI.16.

Figure VI.16 Structure of treatment application in 2021 (ha)



Source: National Directorate of Forests-Romsilva

B. Care work for young trees

In the state-owned public forest managed by RNP - Romsilva, care activities were carried out on a total area of 102,619 hectares in the year 2021, in accordance with the provisions of the forest management plans. The situation regarding the implementation of care activities is presented in table VI.13.

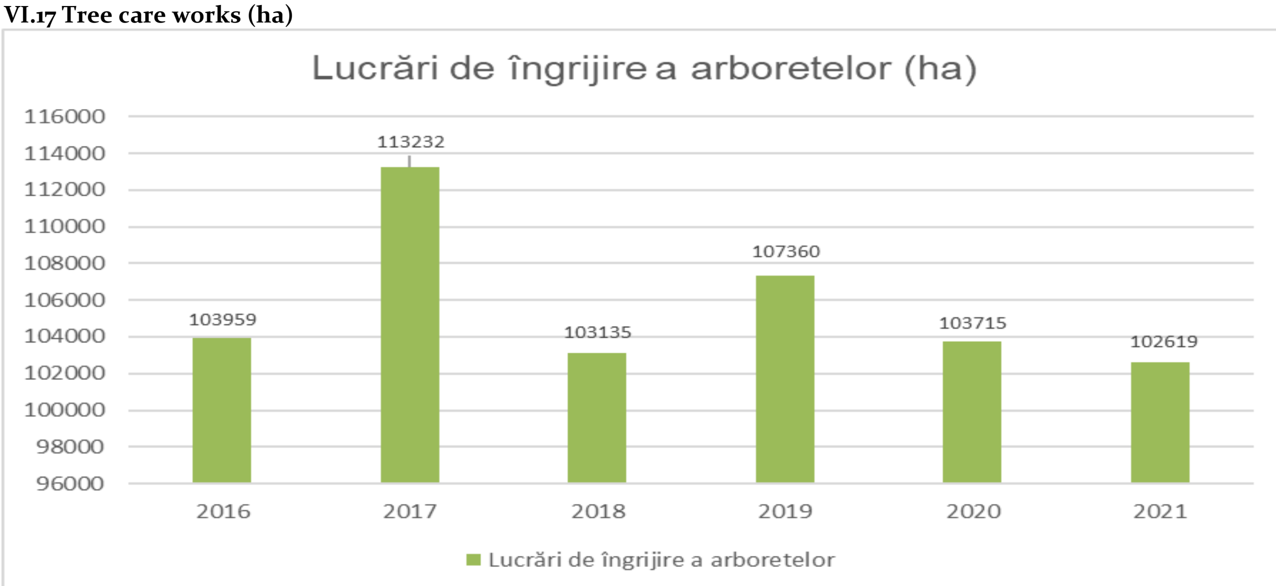
Table VI.13 Implementation of care activities - by type of works

-Ha-

Type of works	2016	2017	2018	2019	2020	2021
Clearings	10,220	10,614	12,797	11,334	10,776	9,400
Cleaning	16,388	17,040	18,723	17,533	17,711	16,679
Thinnings	75,814	83,067	69,978	76,430	73,506	74,955
Artificial pruning	1,537	2,511	1,637	2,063	1,722	1,585
TOTAL	**103,959**	**113,232**	**103,135**	**107,360**	**103,715**	**102,619**

Source: National Directorate of Forests-Romsilva

Figure VI.17 Tree care works (ha)



Source: National Directorate of Forests-Romsilva

In the forestland of other owners, based on the management/service contracts concluded with RNP - Romsilva, the forestry directorates aimed to carry out care work for young stands and in the forestland of other owners, in accordance with the provisions of the forest management plans and the condition of the stands.

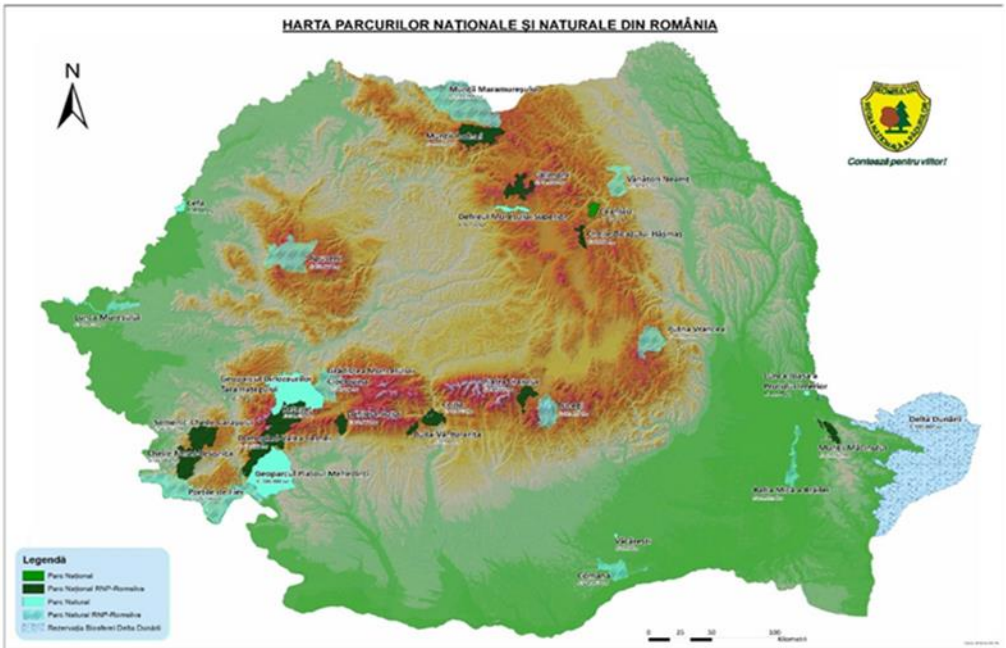
In 2021, in the respective forests, care work was carried on 13,798 ha, of which:

- clearings: 524 ha;
- cleanings: 981 ha;
- thinnings: 12,293 ha.

C. PROTECTED AREAS

In 2021, from the total of 30 major protected natural areas designated at national level, whose total area represents approx. 1.67 million ha, the National Forestry Authority – Romsilva continued to administer 22 national and natural parks, through the 22 administrative structures with legal personality in its structure. The total area of the 22 parks in the management structure, according to the GIS measurement made by the staff of the park administrations, is approx. 853 thousand ha, with a total area of forest land of approx. 599 thousand ha, of which approx. 373 thousand ha of forest fund public property of the state.

Figure VI.18 Map of National and Natural Parks in Romania



Source: National Directorate of Forests-Romsilva

Taking into account the internal zoning of the parks, it should be mentioned in particular that, from the total area of the forest fund publicly owned by the state in the parks managed by the directorate, approx. 109 thousand ha are found in the strict protection zone - (ZPS) and the integral protection zone - (ZPI) (areas where the exploitation of natural resources is prohibited). The situation of the surfaces in the national and natural parks administered by RNP-Romsilva is detailed in table VI.14:

Table VI.14 The situation of the surfaces in the national and natural parks administered by RNP-Romsilva

No. crt.	NAME OF THE PARK	County	Park area (cf. GIS) (ha)	from which:			
				Forest Fund		from which: forest fund the property of the state	
				total	of which: ZPI+ZPS	total	of which: ZPI+ZPS
NATIONAL PARKS							
1	Buila - Vânturarița	VL	4,465	3,873	1,459	2,087	532
2	Călimani	BN, SV, MS, HR	24,556	17,933	10,601	10,190	5,462
3	Cheile Bicazului - Hășmaș	NT, HR	7,072	6,644	4,889	2,081	1,878
4	Cheile Nerei-Beușnița	CS	36,661	30,982	13,951	29,372	13,947
5	Cozia	VL	16,813	16,072	8,134	8,661	5,184
6	Defileul Jiului	GJ, HD	10,941	9,443	8,930	1,993	1,970
7	Domogled - Valea Cernei	CS, MH, GJ	61,211	46,544	20,135	44,278	19,854
8	Munții Măcinului	TL	11,200	11,158	3,839	11,148	3,839
9	Munții Rodnei	BN, MM	47,202	29,116	14,322	2,497	2,198
10	Piatra Craiului	AG, BV	14,766	10,880	6,223	3,771	2,490
11	Retezat	HD	38,259	20,494	11,143	6,989	2,787
12	Semenic – Cheile Carașului	CS	36,052	30,775	11,187	30,091	11,179
TOTAL NATIONAL PARKS			**309,198**	**233,914**	**114,813**	**153,158**	**71,320**
NATURAL PARKS							
13	Apuseni	AB, BH, CJ	76,067	60,447	13,978	26,275	8,434
14	Balta Mică a Brăilei	BR	24,123	13,446	3,453	11,799	1,947
15	Bucegi	BV, DB, PH	32,497	21,411	6,643	10,862	4446
16	Comana	GR	25,107	8,024	870	7,423	856

17	Grădiștea Muncelului - Cioclovina	HD	38,116	26,698	4,672	17,655	2,092
18	Lunca Mureșului	AR, TM	17,420	6,468	811	5,821	528
19	Munții Maramureșului	MM	133,484	86,968	12,638	48,318	7,290
20	Porțile de Fier	CS, MH	128,196	82,089	9,526	73,471	9,497
21	Putna Vrancea	GR	38,116	33,618	7,617	2,710	2,523
22	Vânători Neamț	AR, TM	30,631	26,204	616	15,268	243
TOTAL NATURAL PARKS			**543,757**	365,373	**60,824**	**219,602**	**37,856**
GRAND TOTAL			**852,955**	**599,287**	**175,637**	**372,760**	**109,176**

Source: National Directorate of Forests-Romsilva

As for the ownership structure of the forest land in the national and natural parks managed by RNP-Romsilva, it can be noted that, at this date, the Romanian state predominates as the owner with approximately 65%. The decrease in the area of state-owned forest land represents a challenge for park administrations, which must put more effort into raising awareness among the local population regarding conservation measures, given the delayed or non-provision of compensation for income loss incurred by private forest owners.

The parks where privately owned forest land represents over 50% are: Munții Rodnei National Park, Piatra Craiului National Park, Retezat National Park, Cheile Bicazului National Park, Defileul Jiului National Park, Putna Vrancea Natural Park, and Bucegi Natural Park.

The administration of the 22 national and natural parks, along with the Natura 2000 sites and nationally protected natural areas overlapping with them, is carried out based on management contracts concluded with the central environmental protection authority and additional agreements with the National Agency for Protected Natural Areas. The number of protected natural areas covered by these management contracts is 271.

Regarding the composition of park management structures (in accordance with specific legislation), they include a park director, chief guard, economist, legal advisor, public awareness and environmental education officer, information technology specialist, biologist, as well as between 6 and 20 field agents, depending on the area's size and the specific nature of the protected natural area.

The main objectives of the national and natural parks are biodiversity conservation, landscape preservation, cultural identity preservation, as well as promoting tourism, traditions, etc. The means of achieving these objectives are established through management plans developed by the park administration.

Out of the 22 national and natural parks administered by the National Forestry Authority - Romsilva:

- 13 parks have an approved management plan, as follows:
  1. Balta Mică a Brăilei Natural Park: GD no. 538/2011 *for the approval of the Management Plan of the Balta Mică a Brăilei Natural Park;*
  2. Porţile de Fier Natural Park: *GD no. 1048/2013 for the approval of the Management Plan and the Regulations of the Porţile de Fier Natural Park;*
  3. Muntii macin National Park: *GD no. 1074/2013 for the approval of the Management Plan of the Muntii Macin National Park;*
  4. Buila-Vânturarița National Park: Order of the Minister of Environment, Water and Forests *no. 1151/2016 regarding the approval of the Management Plan and the Regulations of the Buila-Vânturarița National Park, of the Natura 2000 sites ROSCI0015 Buila – Vânturarița, ROSPA0025 Cozia-Buila-Vânturarița and of the protected natural areas included therein*;
  5. Cheile Bicazului-Hăşmaş National Park: Order of the Minister of Environment, Water and Forests no. 1523/2016 *regarding the approval of the Management Plan and the Regulations of the Cheile Bicazului - Hăşmaş National Park and the Natura 2000 sites ROSCI0027 and ROSPA0018 Cheile Bicazului - Hăşmaş (without the overlap area with ROSCI0033 Cheile Şugaului - Munticelu*);
  6. Cheile Nerei-Beușnița National Park: Order of the Minister of Environment, Water and Forests *no. 1642/2016 regarding the approval of the Management Plan and the Regulations of the Cheile Nerei - Beusnița National Park and the Natura 2000 sites ROSCI0031 Cheile Nerei - Beusnița and ROSPA0020 Cheile Nerei - Beusnița;*
  7. Cozia National Park: Order of the Minister of Environment, Water and *Forests no. 1060/2016 regarding the approval of the Management Plan and Regulations of the Cozia National Park and the Natura 2000 sites in its area ROSCI0046 Cozia and ROSPA0025 Cozia – Buila - Vânturarița;*
  8. Domogled-Valea Cernei National Park: Order of the Minister of Environment, Water and Forests *no. 1121/2016 regarding the approval of the Management Plan and the Regulations of the Domogled-Valea Cernei National Park and the Natura 2000 sites ROSCI0069 and ROSPA0035;*
  9. Lunca Mureșului Natural Park: Order of the Minister of Environment, Water and Forests *no. 1224/2016 regarding the approval of the Management Plan and the Regulation of the Lunca Mureșului Natural Park;*

10. Muntii Maramureș Natural Park: Order of the Minister of Environment, Water and Forests *no. 1157/2016 regarding the approval of the Management Plan and the Regulations of the Muntii Maramureș Natural Park, of the site of community importance ROSCI0124 Maramureș Mountains, of the avifaunistic special protection area ROSPA0131 Maramureș Mountains and of the overlapping protected natural areas of national interest;*
11. Vânători Neamț Natural Park: Order of the Minister of Environment, Water and Forests *no. 1246/2016 regarding the approval of the Management Plan and the Regulations of the Vânători Neamț Natural Park and the Natura 2000 sites ROSCI0270 Vânători Neamț and ROSPA0107 Vânători Neamț;*
12. Munii Rodnei National Park: Order of the Minister of the Environment *no. 307/2019 regarding the approval of the Management Plan and the Regulations of the Muntii Rodnei National Park, of the ROSCI0125 of the Rodnei Mountains, of the ROSPA0085 of the Rodnei Mountains and of the other protected natural areas of national interest included;*
13. Piatra Craiului National Park: Order of the Minister of Environment, Water and Forests *no. 296/21 February 2020 regarding approval of the Management Plan and the Regulations of the Piatra Craiului National Park and the Natura 2000 site ROSCI0194 Piatra Craiului*.

- In the case of 4 parks, Putna– Vrancea Natural Park, Comana Natural Park, Călimani National Park, Grădiștea Muncelului– Cioclovina Natural Park, the management plans are in the final stage of approval by the relevant ministry;
- 1 management plan, of the Bucegi Natural Park, is currently in the approval stage, at the National Agency for Natural Protected Areas;
- 2 management plans, of the Apuseni Natural Park and the Retezat National Park, are drawn up through POIM projects;
- In the case of 2 parks, Defileul Jiului National Park and Semenic–Cheile Carașului National Park management plans are in the regulatory procedure with the competent environmental authorities.

In terms of biodiversity management, in 2021, 896 actions were carried out to inventory plant/animal species and natural habitats, and mapping was updated for 460 plant/animal species and 47 natural habitats. Additionally, activities were conducted to monitor species and natural habitats within the protected areas under administration.

Park administrations conducted awareness and information campaigns for the local population regarding the importance of nature protection and the promotion of ecotourism for sustainable development in the area. In 2021, a total of 550 awareness actions and 403 ecological education actions were implemented, which were significantly lower in number compared to the previous year.

To minimize the negative impact of tourist activities on the parks, park administrations have been developing various tourist facilities over time, including the year 2021, using both their own funds and external projects. Some of these facilities include visitor centers, information points, camping areas, rest areas with benches, tables, informative and educational panels, themed trails, fire pits, and barriers installed on forest roads entering the protected areas. Maintenance of the visitor infrastructure is also a significant part of the activity, funded from the revenues generated by park administrations from the visitation of the protected areas.

To prevent illegal activities, 10,873 patrolling actions were carried out, some of which were conducted in cooperation with the Jandarmeria (Gendarmerie), Romanian Police, Environmental Guard, Forestry Guard, and other institutions.

The basic funding for the 22 parks is provided by the National Forest Administration - Romsilva, based on the 10-year management contracts. In 2021, RNP-Romsilva allocated a total budget of approximately 31.2 million lei (excluding amounts related to external funds) for these 22 administrations.

A major concern is **to attract funds through projects** to achieve management objectives. The amount attracted by park administrations in 2021 from various sources of funding is 32.35 million lei, with the majority of funds coming from the Large Infrastructure Operational Program, followed by LIFE program, Interreg, etc.

Source: National Directorate of Forests-Romsilva

Land use change

Fragmentation of ecosystems

RO 44
Indicator code Romania: RO 44 EEA indicator code: SEBI 013
TITLE: FRAGMENTATION OF NATURAL AND SEMI-NATURAL AREAS
DEFINITION: The indicator shows differences in the average of natural and semi-natural surfaces, based on land cover maps made by interpreting satellite images. It is based on a simple methodology, including mathematical calculations and GIS analysis, based on Corine Land Cover (CLC) data.

In the last two centuries, under the impact of anthropogenic activities combined with those induced by disturbing natural factors, the way of using and covering land has undergone numerous transformations due to the reduction of forest areas and the expansion of agricultural lands, or those intended for transport routes and/or constructions . The local reduction of the surface of forest ecosystems has led to the fragmentation of ecosystems, sometimes with irreversible consequences on biological diversity. In recent years, special emphasis has been placed on protecting and preserving forest ecosystems, as well as increasing the percentage of reforestation and reducing the level of fragmentation.
The main cause of fragmentation is the radical change in the forms of ownership of forest land. Thus, it went from forests fully owned by the state to the gradual change, starting in 1990, to other forms of ownership, so that in 2021 we find forests in the public or private ownership of territorial administrative units, property of natural persons or property of legal entities, as well as lands from the forest fund in different stages of the retrocession process.
In the application of the forestry regime, forest land owners have specific obligations and responsibilities. Forests in the private ownership of natural persons (approximately 900,000) are under major pressure due to the large number of properties, apparently individual, in fact small collective properties until the succession debate, situations that cause multiple administrative and legal problems. Also, the fragmentation of the forest fund occurs frequently in the case of the construction of isolated houses that subsequently require access roads and utilities.

Source: MEWF-DPSS

VII. MATERIAL RESOURCES AND WASTE

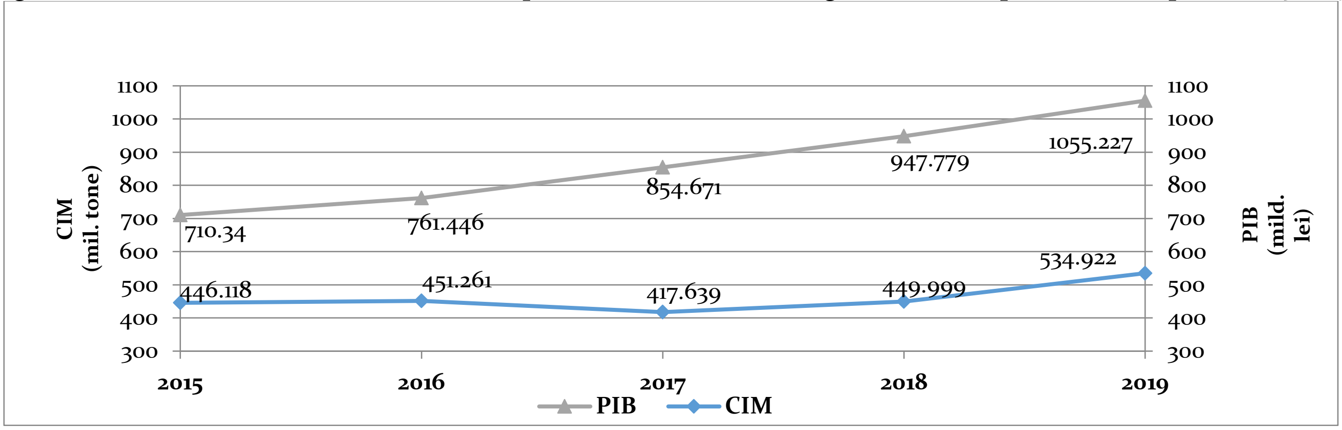
USE OF MATERIAL RESOURCES: STATUS AND TRENDS

Preventing waste generation through the use of modern and innovative technologies, as well as transforming generated waste into a resource, are the main objectives of the European policy, established and regulated by legislation, that must be fully implemented across the entire Union. This includes the application of the waste hierarchy and the effective use of economic instruments to progressively eliminate waste landfills, restricting energy recovery only to non-recyclable materials, utilizing recycled waste as a major and reliable source of raw materials for the EU, safely managing hazardous waste and reducing its generation, eradicating illegal waste shipments, and removing barriers in the internal market, ensuring that all recycling activities are carried out to the highest environmental protection standards.

In the following, *the evolution of the representative indicators in Romania* is presented:

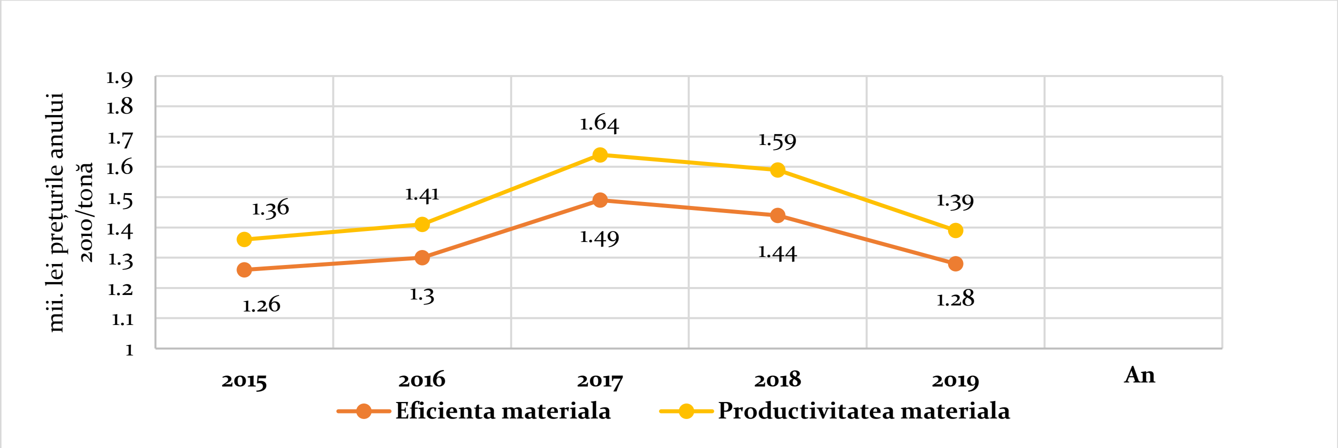
- *Internal consumption of materials* includes the total amount of materials used directly in the economy (domestic extraction and imports);
- *Quarterly gross domestic product* at market price (PIBT), the main macroeconomic aggregate of the national accounting, represents the final result of the production activity of resident productive units, during a period, respectively a quarter.
- *Material efficiency* measures material inputs to the economy in relation to GDP;
- *Material productivity is the inverse of material intensity and is calculated as the ratio of GDP to material consumption.*

Figure VII.1. Evolution of the domestic consumption of materials and the gross domestic product in the period 2015-2019



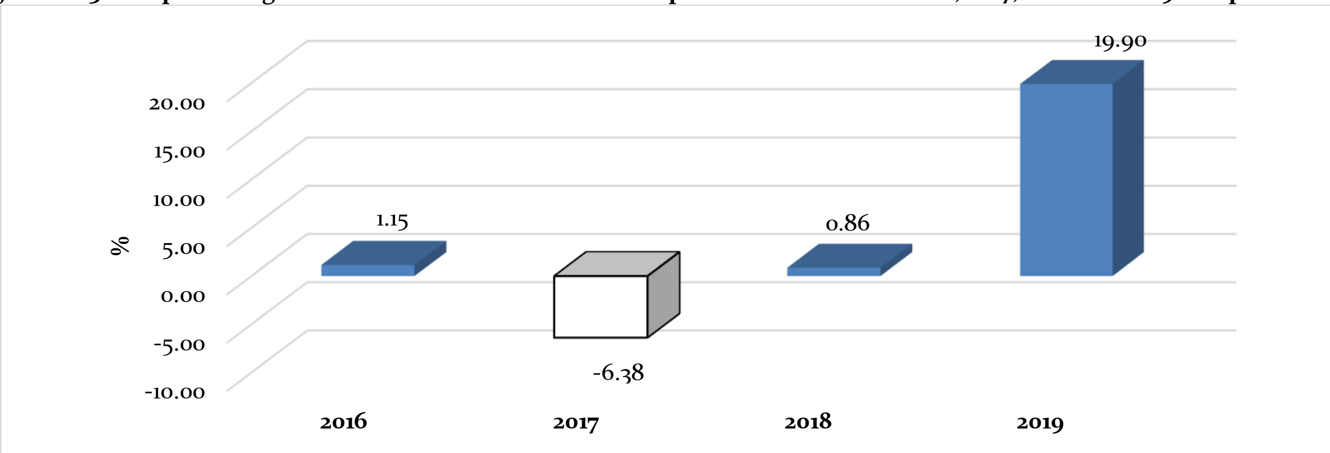
Source: National Institute of Statistics - 2022

Figure VII.2. Evolution of material efficiency and material productivity in the period 2015-2019



Source: National Institute of Statistics - 2022

Figure VII.3. The percentage evolution of the internal consumption of materials in 2016, 2017, 2018 and 2019 compared to 2015



Source: National Institute of Statistics – 2022

As can be seen from the graphs above, in the analyzed period, material efficiency and productivity have a slight downward trend, while GDP and domestic material consumption have an upward trend.

WASTE GENERATION AND MANAGEMENT: TRENDS, IMPACTS AND FORECASTS

GENERATION AND MANAGEMENT OF MUNICIPAL WASTE

RO 16
Indicator code Romania: RO 16 EEA indicator code: CSI 16
TITLE: **GENERATION OF MUNICIPAL WASTE**
DEFINITION: The indicator expresses the total amount of municipal waste generated per capita (kg per capita and year.)

In accordance with the provisions of the National Waste Management Plan, approved by GD no. 942/2017, "municipal waste is household waste and other waste, which, by nature or composition, are similar to household waste".

According to Emergency Ordinance no. 92/2021 on the waste regime, municipal waste means:
a) mixed waste and waste collected separately from households, including paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, electrical and electronic equipment waste, battery and accumulator waste and bulky waste, including mattresses and furniture;
b) mixed waste and waste collected separately from other sources, if that waste is similar in nature and composition to household waste.

Municipal waste does not include waste from production, agriculture, forestry, fishing, septic tanks, sewerage and treatment network, including sludge, end-of-life vehicles, or waste from construction and demolition activities. This definition applies even when waste management responsibilities are shared between public and private actors. The collection of municipal waste is the responsibility of municipalities, which can fulfill these duties either directly (through specialized departments within Local Councils) or indirectly (by contracting specialized and authorized companies to carry out sanitation services).

Generated municipal waste

The value was calculated by summing the quantities generated for the following types of waste:
- household and assimilated waste and from municipal services collected by sanitation operators, excluding inert waste;
- household waste generated and not collected by sanitation operators;
- recyclable waste from the population, collected through authorized economic operators, other than sanitation operators (paper and cardboard, metals, plastic, glass, wood, textiles, WEEE, waste batteries and accumulators).

It includes bulky waste, waste from parks, gardens and street cleaning, including the contents of street waste bins, as well as electrical and electronic equipment waste from households.

Excluded are:

- Sludges from urban wastewater treatment;
- Construction and demolition waste.

According to the method of collection, municipal waste is:

- Collected by or on behalf of municipalities;
- Collected directly by private economic operators - valid for WEEE and other types of recyclable waste;
- Generated and not collected by a sanitation operator, but managed directly by the generator.

The amounts of waste generated by the population not served by sanitation services are calculated using the generation indices provided for in the National Waste Management Plan. For the year 2020, the generation indices taken into account are: 0.61 kg/place/day for the urban environment and 0.29 kg/place/day for the rural environment.

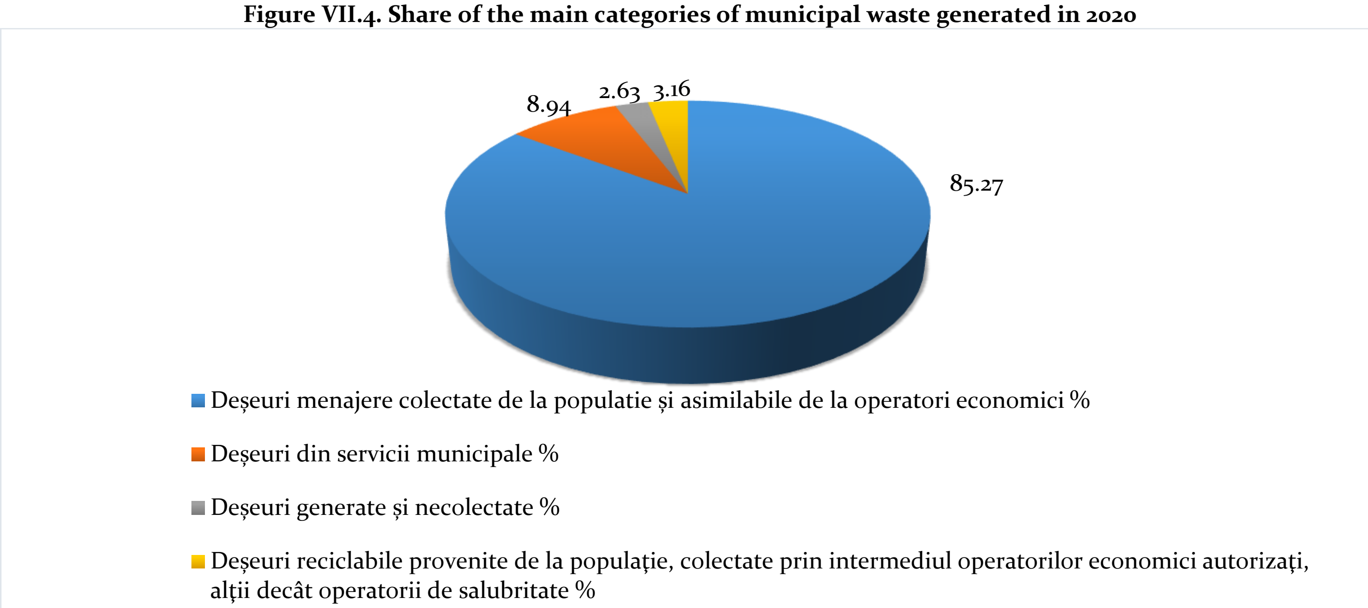
The table below shows the amounts of municipal waste generated by waste category in the period 2016-2020.

Table VII.1 – Quantities of municipal waste generated during 2016-2020

Indicator name	2016	2017	2018	2019	2020
Amount of municipal waste generated (tons)	5142542	5333171	5296239	5430341	5587893
From which:					
- Household waste collected from the population and assimilated from economic operators (tons)	3894853	4162921	4249988	4632802	4764923
- Waste from municipal services (tons)	454170	400228	430097	419429	499450
- Generated and uncollected waste (tons)	523670	419444	314022	178470	146873
- Recyclable waste from the population, collected through authorized economic operators, other than sanitation operators (tons)	269849	350578	302132	199640	176647
- Municipal waste generation indicator (Kg/place/year)	261	272	272	280	289

Source: National Environmental Protection Agency

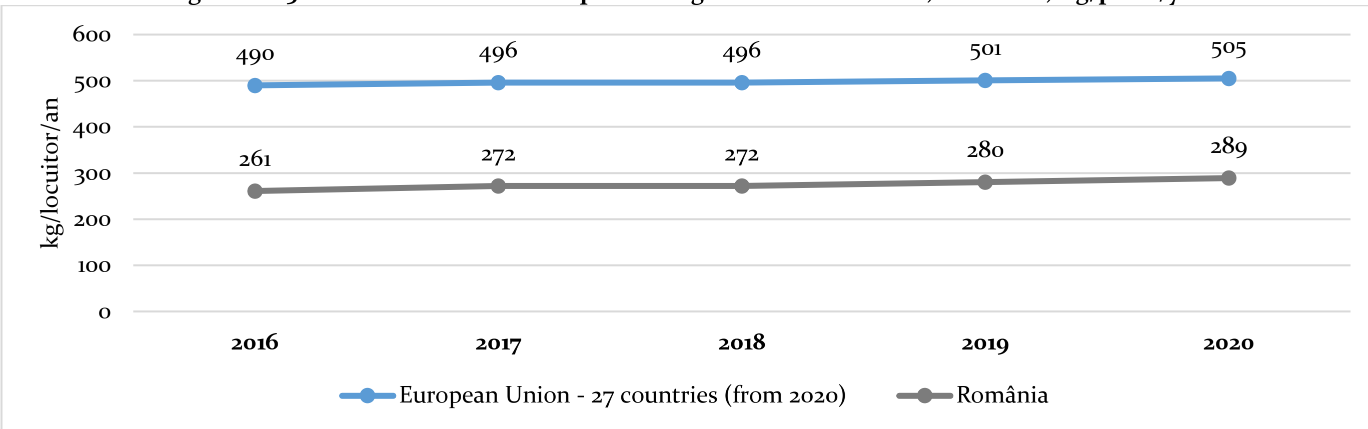
Figure VII.4. Share of the main categories of municipal waste generated in 2020



Source: National Environmental Protection Agency

The figure below shows the evolution of the municipal waste generation indicator in Romania compared to the average recorded in the European Union.

Figure VII.5. Evolution of the municipal waste generation indicator, 2016-2020, Kg/place/year



Source: EUROSTAT and the National Environmental Protection Agency - 2022

Sustainable development indicators regarding municipal waste

Sustainable development indicators regarding municipal waste refer to:

- Municipal waste generated;
- Municipal waste treated by: recycling (exclusive of composting and anaerobic digestion), composting, energy recovery and storage.

Considering the above, based on the data reported by sanitation operators and authorized waste collectors (other than sanitation operators) and authorized waste treatment operators, the following indicators of sustainable development related to municipal waste have been calculated at national level:

- The degree of connection to the sanitation service
- The amount of municipal waste collected separately
- The amount of municipal waste recycled (including composting)
- The degree of recycling achieved for municipal waste
- The amount of municipal waste used for energy
- The amount of biodegradable waste stored.

Table VII.2 – Specific information on municipal waste in the period 2016-2020

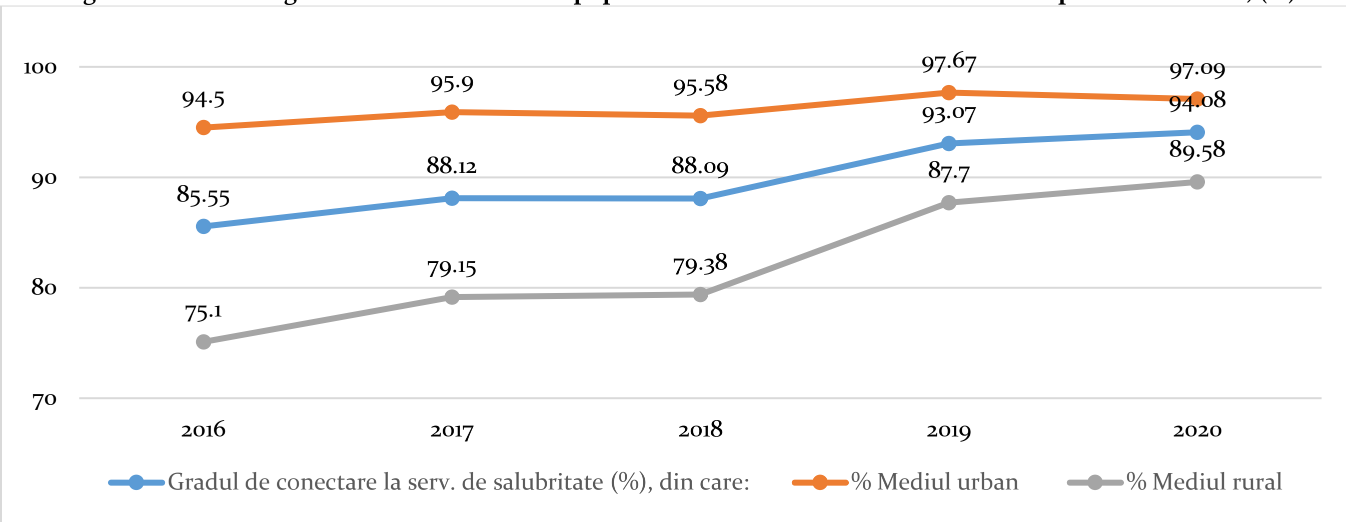
Indicator name	2016	2017	2018	2019	2020
The degree of connection to the sanitation service (%)	85.55	88.12	88.09	93.07	94.08
- Urban area	94.5	95.9	95.58	97.67	97.09
- Rural area	75.1	79.15	79.38	87.7	89.58
Amount of municipal waste collected separately (tons)	580602	696742	634536	576816	685092
Amount of municipal waste recycled * (tons)	689443	745427	586406	623214	662979
The degree of recycling achieved for municipal waste (%)	13.41	13.98	11.07	11.48	11.86
The amount of municipal waste used for energy (tons)	219608	227280	241445	251277	298421
The amount of biodegradable waste from municipal waste deposited (tons)	1913329	2159103	2068288	2120022	2077089
Number of compliant municipal warehouses in operation	37	42	43	44	46
Number of transfer stations in operation	51	52	53	84	95
Number of sorting stations in operation	101	103	105	103	107

**recycled waste comes from both separate collection and waste collected in a mixture, entered into treatment processes*

Source: National Environmental Protection Agency

According to what is presented in the table above, at national level, in 2020 the degree of connection of the population to the sanitation service increased to 94%. In urban areas this is approximately 97%, and in rural areas approximately 90%. The figure below shows the evolution of the degree of connection to the sanitation service in the period 2016-2020.

Figure VII.6. The degree of connection of the population to the sanitation service in the period 2016-2020, (%)

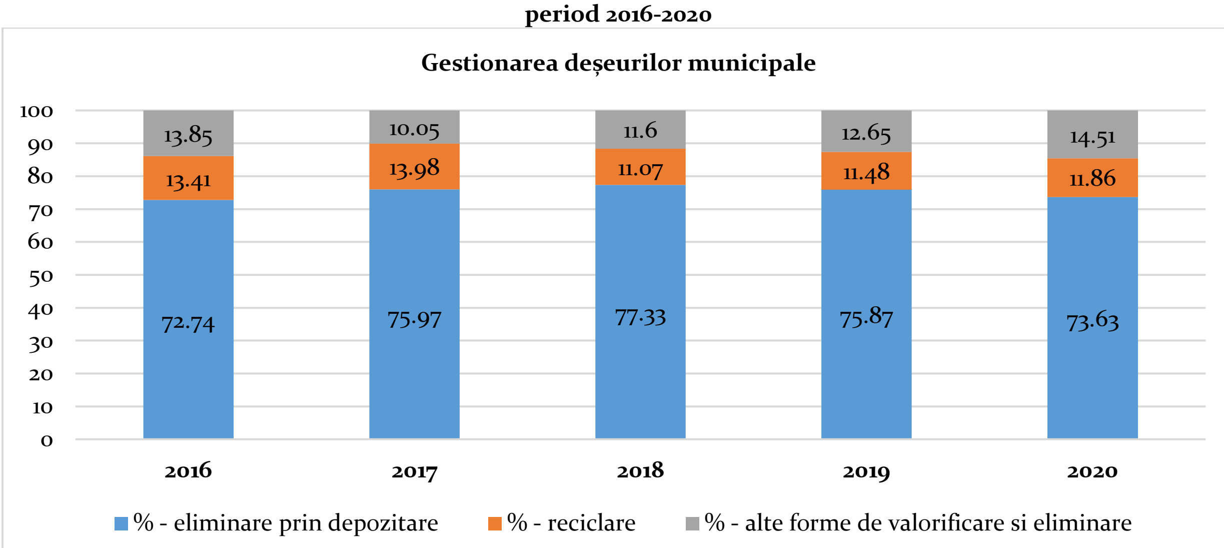


Source: National Environmental Protection Agency

Municipal waste management involves their collection, transport, recovery and disposal, including the supervision of these operations and the subsequent maintenance of disposal sites. **The responsibility for the management of municipal waste** rests with local public administrations, which, by their own means or by delegating the sanitation service to an authorized operator, must ensure the collection (including separate collection), transport and treatment of this waste. For certain waste streams falling under the category of municipal waste, collection is permitted both from households and authorized economic operators. A portion of the collected municipal waste is directly sent for final recycling (material or energy recovery) or disposal, while another portion is directed to intermediate treatment facilities (sorting stations, composting facilities).

The disposal of municipal waste that is not recovered is carried out exclusively through storage. Until now, no municipal waste incineration facilities have been put into operation in Romania. At the end of 2020, 46 compliant landfills for municipal waste were authorized and in operation.

Figure VII.7. Share of the main municipal waste management activities, in relation to the amount of waste generated, in the period 2016-2020



Source: National Environmental Protection Agency

Note: The decrease in the share of recycled waste starting from 2018 is determined by the change in the calculation methodology - starting this year, the amount of individually composted biodegradable waste was no longer considered recycled, taking into account the provisions of PNGD and European legislation

From the above, it can be seen that in 2020 there is a slight reduction in the amount of municipal waste stored. However, the amount of stored waste still remains high, which is inconsistent with the principles and objectives adopted by the EU through the circular economy legislative package.

Reducing the amount of stored biodegradable waste

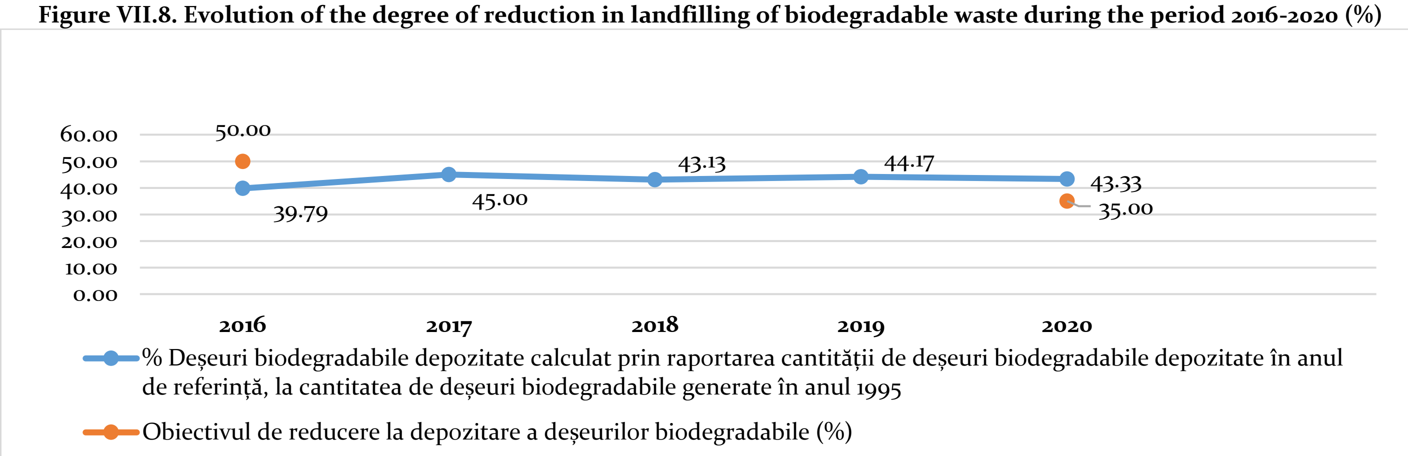
Biodegradable waste, according to the legislative provisions on waste storage, represents any waste that can undergo aerobic or anaerobic decomposition, such as food products, garden waste, paper or cardboard.
According to the provisions of GO no. 2/2021 regarding waste storage, the amount of biodegradable waste stored for the year 2020 must be a maximum of 35% of the total amount, expressed gravimetrically, produced in 1995.
The table below shows the amounts of biodegradable waste generated and stored in the period 2016-2020.

Table VII.3 – Quantities of biodegradable waste generated and stored in the period 2016-2020

Indicator name	1995	2016	2017	2018	2019	2020
Amount of biodegradable waste generated (million tons)	**4.80**	**2.64**	**2.89**	**2.81**	**2.99**	**3.00**
Amount of stored biodegradable waste (million tons)		1.91	2.16	2.07	2.12	2.08
Biodegradable waste deposited compared to 1995 (%)		39.79	45.00	43.13	44.17	43.33

Source: National Environmental Protection Agency

Figure VII.8. Evolution of the degree of reduction in landfilling of biodegradable waste during the period 2016-2020 (%)



Source: National Environmental Protection Agency

As can be seen from the graph above, the target regarding the reduction in landfill of biodegradable waste was not achieved.

GENERATION AND MANAGEMENT OF INDUSTRIAL WASTE

Generation of industrial waste

The evolution of the amounts of non-hazardous waste generated by the main economic activities, reported by economic operators generating waste, which report data through PRODDES questionnaires in the period 2016 - 2020, is presented in the table below.

Table VII.4 Non-hazardous waste generated by the main economic activities with the exception of the extractive industry in the period 2016 - 2020 (thousands of tons)

Economic activity	2016	2017	2018	2019	2020
Manufacturing industry (CAEN Sections: C10-C33)	6,743.23	6,303.41	6,767.62	6,560.92	5,496,673
Production, transport and distribution of electricity and thermal energy, gas and water (CAEN: D)	6,725.16	7,638.69	6,820.78	5,948.65	4,338,751
Water collection, treatment and distribution (CAEN Sections: E36, E37, E39), with the exception of urban wastewater treatment plants	59.52	41.02	54.31	66.54	47,214
Other activities (CAEN Sections: E38, F, GU)	817.71	774.77	940.43	1,718.09	1432,207

Source: National Environmental Protection Agency

The evolution of the quantities of hazardous waste generated by the main economic activities, reported by economic operators generating waste in the period 2016 - 2020, is presented in the table below.

Table VII.5. Hazardous waste generated by the main economic activities with the exception of the extractive industry in period2016 – 2020 (thousand tons)

Economic activity	2016	2017	2018	2019	2020
Manufacturing industry (CAEN Sections: C10-C33)	226.32	213.16	197.92	206.42	168,696
Production, transport and distribution of electricity and thermal energy, gas and water (CAEN D)	2.83	4.08	1.95	2.57	0.995
Water collection, treatment and distribution (CAEN E36, E37, E39), with the exception of urban wastewater treatment plants	2.47	2.88	5.34	4.37	1.10
Other activities (CAEN Sections: E38, F, GU and G4677)	33,36	28.33	112.95	52.76	184,054

Source: National Environmental Protection Agency

The data on waste generation, processed according to the provisions of Regulation 2150/2002 regarding waste statistics, with subsequent amendments and additions, can be found on the NEPA website, in the Waste section→General Framework→Waste Statistics.

Industrial waste management

The responsibility for industrial waste management rests with generating economic operators. They ensured the management of waste according to the provisions of the regulatory acts they hold, through recovery (recycling and co-incineration) or disposal (storage and incineration). In Romania, there are a number of 240 waste co-incineration facilities in operation, of which 233 are thermal power plants where wood waste is co-incinerated and seven industrial waste co-incineration facilities (cement factories). At the same time, there are 24 incinerators for hazardous and non-hazardous industrial waste, 18 of which were operational in 2020. The situation in 2020 is presented in the table below.

Table VII.6. Hazardous and non-hazardous industrial waste co-incineration and incineration facilities, existing in operation in 2020 (number and capacities)

	Co-incineration facilities		Incineration facilities	
	Number	Capacities (t/year)	Number	Capacities (t/year)
Romania	**240**	**7209810**	**24**	**293830**
Macroregion 1	**76**	**1898945**	**1**	**1750**
Region 6 - NORTH WEST	50	591965	1	1750
Region 7 - CENTER	26	1306980	0	0
Macroregion 2	**95**	**3805804**	**9**	**47436**
Region 1 - NORTH EAST	70	3021369	6	24980
Region 2 - SOUTH EAST	25	784435	3	22456
Macroregion 3	**32**	**780662**	**6**	**161431**
Region 3 - SOUTH MUNTENIA	32	780662	4	151026
Region 8 - BUCHAREST	0	0	2	10405
Macroregion 4	**37**	**724399**	**8**	**83213**
Region 4 - SOUTH WEST	21	331630	5	69860
Region 5 - WEST	16	392769	3	13353

Source: National Environmental Protection Agency

Hazardous and non-hazardous waste landfills currently in operation are compliant. Non-compliant warehouses for industrial waste have stopped storing waste according to the legal provisions in force. The following table presents information on hazardous and non-hazardous industrial waste landfills in operation between 2016 and 2020.

Table VII.7. Industrial landfills for hazardous and non-hazardous industrial waste in operation in the period 2016 – 2020 (no)

	2016	2017	2018	2019	2020
Compliant landfills for hazardous industrial waste	**11**	**11**	**11**	**11**	**11**
Compliant landfills for non-hazardous industrial waste	**39**	**40**	**40**	**40**	**40**

Source: National Environmental Protection Agency

SPECIAL WASTE STREAMS

Waste Electrical and Electronic Equipment (WEEE)

RO 63
Indicator code Romania: RO 63 EEA indicator code: WASTE 003
TITLE: **WASTE OF ELECTRICAL AND ELECTRONIC EQUIPMENT**
DEFINITION: The indicator presents the quantities of electrical and electronic equipment (EEE) that are placed on the market, the quantities of waste electrical and electronic equipment (WEEE) collected and the recovery objectives achieved.

The main objectives of the legislation in force regarding WEEE are:

- preventing the emergence of waste from electrical and electronic equipment and the reuse, recycling, and other forms of recovery of such waste to minimize the quantity of waste disposed of;
- improving the environmental performance of all operators involved in the life cycle of EEE (producers, distributors and consumers) and especially of the economic agents directly involved in the treatment of electrical and electronic equipment waste.

Only producers registered in the Register of Producers and Importers of EEE, set up at NEPA, can introduce electrical and electronic equipment to the market. At the beginning of 2006, the procedure for registering electrical and electronic equipment manufacturers in the Register of electrical and electronic equipment manufacturers and importers began, according to the requirements of the legislation in force.

At the end of 2020, there were 3,725 registered electrical and electronic equipment (EEE) manufacturers. The evolution of the quantities of EEE introduced on the market in the period 2015-2019 is presented in the tables below.

Table VII.8. EEE introduced on the market

Category	Amounts of EEE (tons)			
	2015	**2016**	**2017**	**2018**
1 - Large household appliances	103475.36	129548.53	140581.085	146794.551
2 - Small household appliances	14667.61	16224.62	18467.346	22675.785
3 - IT and telecommunications equipment	13469.45	13231.54	15230.911	16031.34
4 - Consumer equipment	15236.29	17594.37	27702.545	26189.225
5 - Lighting equipment	6010.49	7042.15	9084.300	13666.494
6 - Electric and electronic tools	9654.61	11108.44	18030,341	23935.021
7 - Toys, sports and leisure equipment	1616.51	2150.54	3489,874	4718,887
8 - Medical devices (except for all implanted and infected products)	673.90	564.86	889,331	1430,596
9 - Supervision and control tools	2566.35	2126.21	3343,294	4539.39
10 - Automatic dispensers	808.83	1093.56	**1225,335**	1169,184
TOTAL	**168179.40**	**200684.82**	**238044.36**	**261150.47**

Source: National Environmental Protection Agency

Table VII.9. EEE introduced on the market in 2019*

Category	Amounts of EEE (tons)
	2019* (preliminary data)
1 - Thermal transfer equipment	77574.175
2 - Screens, monitors and equipment (with a surface greater than 100 cmP)	25520.678
3 - Lamps	2132,268
4 - Large equipment, (any of the external dimensions greater than 50 cm)	117635.151
5 - Small equipment (no external dimension greater than 50 cm)	57311.506
6 - IT and telecommunications equipment of small size, (no external dimension greater than 50 cm)	9584.868
TOTAL	**289758.65**

Source: National Environmental Protection Agency

**Starting with 2019, it went from 10 categories to 6 categories according to GEO no. 5/2015 on electrical and electronic equipment waste.*

In order to achieve the annual objectives of collection, reuse, recycling and valorization of WEEE, producers can act:

- ✓ individually, using their own resources;
- ✓ by transferring these responsibilities, based on the contract, to a legally established and authorized economic operator in this sense.

Operating licenses and contact details of authorized collective organizations are published on the website of the Ministry of the Environment, Water and Forests in the Waste Management - WEEE Commission chapter (http://www.mmediu.ro/categorie/comisie-deee/213).

Minimum WEEE collection targets, provided by European and national legislation, are:
- ❖ in the period 2008 - 2015, 4 kg waste/inhabitant.year;
- ❖ for 2016, at least 40% of the average quantities of EEE introduced on the market in the previous 3 years;
- ❖ in the period 2017 – 2020, 45% of the average quantities of EEE introduced on the market in the previous 3 years.

Despite all the efforts undertaken by the authorities and responsible economic operators, up to and including the reference year 2019, the corresponding collection target was not reached in any year.

The evolution of the amounts of WEEE collected in the period 2015-2019 is presented in the tables below.

Table VII.10. WEEE collected between 2015 and 2018

Category	Amounts of WEEE (tons)			
	2015	2016	2017	2018
1 - Large household appliances	24122.22	29592.17	31175.22	35755.95
2 - Small household appliances	1218.31	1320.07	1303,18	1633.02
3 - IT and telecommunications equipment	6837.44	5645.37	6571.14	9362.28
4 - Consumer equipment	5385.17	7063.19	6545.39	9699.59
5 - Lighting equipment	1781.32	1292.77	2002,53	3171.92
6 - Electric and electronic tools	796.00	891.33	903.08	1206.34
7 - Toys, sports and leisure equipment	107.26	115.51	83.39	91.31
8 - Medical devices (except for all implanted and infected products)	48.43	83.24	67.33	114.16
9 - Supervision and control tools	383.15	411.01	700.15	2065.84
10 - Automatic dispensers	94.84	239.79	337.79	678.47
TOTAL	**40774.13**	**46654.45**	**49689.20**	**63778.88**

Source: National Environmental Protection Agency

Table VII.11. WEEE collected in 2019*

Category	Amounts of WEEE (tons)
	2019* (preliminary data)
1 - Thermal transfer equipment	19764.14
2 - Screens, monitors and equipment (with a surface greater than 100 cmP)	10283.45
3 - Lamps	399.24
4 - Large equipment (any of the external dimensions greater than 50 cm)	42292.40
5 - Small equipment (no external dimension greater than 50 cm)	6292.84
6 - IT and telecommunications equipment of small size (no external dimension greater than 50 cm)	8590.96
TOTAL	**87623.02**

Source: National Environmental Protection Agency

**Starting from 2019, the classification of EEE is carried out in 6 categories, according to GEO no. 5/2015 on electrical and electronic equipment waste*

Collected WEEE is treated both in Romania and in other EU member states. The capitalization objectives provided by the legislation, respectively achieved, are presented in the following table.

Table VII.12. Recovery objectives for WEEE period 2015-2018

Category	Capitalization objective provided by the legislation (%) for the year 2015	Capitalization objective provided by the legislation (%) for years 2016-2018	Capitalization objectives achieved (%)			
			2015	2016	2017	2018
1 - Large household appliances	80	85	70	84	88	92
2 - Small household appliances	70	75	93	75	91	91

3 - IT and telecommunications equipment	75	80	78	99	91	79
4 - Consumer equipment	75	80	83	87	91	83
5 - Lighting equipment	80	75	54	80	83	83
6 - Electric and electronic tools	70	75	95	71	91	89
7 - Toys, sports and leisure equipment	70	75	65	82	91	94
8 - Medical devices (except for all implanted and infected products)	not applicable	not applicable	not applicable	not applicable	not applicable	not applicable
9 - Supervision and control tools	70	75	88	71	95	95
10 - Automatic dispensers	80	85	93	83	86	89

Source: National Environmental Protection Agency

Table VII.13. Recovery objectives for WEEE for 2019

Category	Capitalization objective provided by legislation for 2019 (%)	Capitalization objective achieved (%) in 2019* (preliminary data)
1 - Thermal transfer equipment	85	95
2 - Screens, monitors and equipment (with an area greater than 100 cmP)	80	98
3 - Lamps	80	80
4 - Large equipment, (any of the external dimensions greater than 50 cm)	85	94
5 - Small equipment (no external dimension greater than 50 cm)	75	90
6 - Small IT and telecommunications equipment, (no external dimension greater than 50 cm)	75	94
TOTAL	85	95

Source: National Environmental Protection Agency

**Starting from 2019, WEEE is classified into 6 categories, according to GEO no. 5/2015 on electrical and electronic equipment waste*

Packaging waste

RO 17

Indicator code Romania: RO 17
EEA indicator code: CSI 17

TITLE: **GENERATION AND RECYCLING OF PACKAGING WASTE**

DEFINITION: The indicator represents the total amount of packaging used in Romania, expressed in kg per capita and year.

Based on the legislation in force, the economic operators with responsibilities report the data on the packaging introduced on the market and the packaging waste managed. Data analysis and interpretation was performed by NEPA. Next, the obtained results are presented.

The annual objectives regarding recovery or incineration in incineration plants with energy recovery and, respectively, the recycling of packaging waste, which must be achieved by the end of 2022, at national level, are the following:
a) recovery or incineration in incineration plants with energy recovery of at least 60% of the weight of packaging waste;
b) the recycling of at least 55% of the total weight of the packaging materials contained in the packaging waste, with the achievement of the minimum values for the recycling of each type of material contained in the packaging waste.

The values of the recycling objectives for each type of material are the following:
a) 60% of the weight for glass;
b) 60% of the weight for paper/cardboard;
c) 50% of the weight for metal;
d) 20% of the weight for aluminum
e) 15% of the weight for wood;
f) 22.5% of the weight for plastic, considering only recycled material in the form of plastic.

Table VII.14. Packaging introduced on the market (tons), by types of material, 2015-2019

Material type	2015	2016	2017	2018	2019
	tons	tons	tons	tons	tons
glass	194347	210027	237590	272123	367086
plastic	359036	348794	360463	391376	481857
paper/cardboard	441764	427434	437955	482540	641073
metal	66830	64006	67476	77913	95980
wood	334573	299876	305316	343156	424450
other	11	31	10	0	550
TOTAL	1396561	1350168	1408810	1567108	2010996

Source: National Environmental Protection Agency

Table VII.15. Recycled packaging waste, by types of material, 2015-2019

Tip materiale	2015		2016		2017		2018		2019	
	tone	%	tone	%	tone	%	tone	%	tone	%
sticla	79874	41,1	134646	64,11	149608	62,97	166377	61,14	157619	42,94
plastic	170596	47,51	173972	49,88	186375	51,7	178551	45,62	176667	36,66
hârtie/carton	395861	89,61	398322	93,19	407495	93,04	441594	91,51	447449	69,8
metal	42845	64,11	39767	62,13	40723	60,35	45723	58,68	47648	49,64
lemn	105520	31,54	94465	31,5	101642	33,29	108030	31,48	119655	28,19
altele	0	0	12	38,71	3	30	0	0	242	44
TOTAL	794696	56,9	841184	62,3	885846	62,89	940275	60	949280	47,2

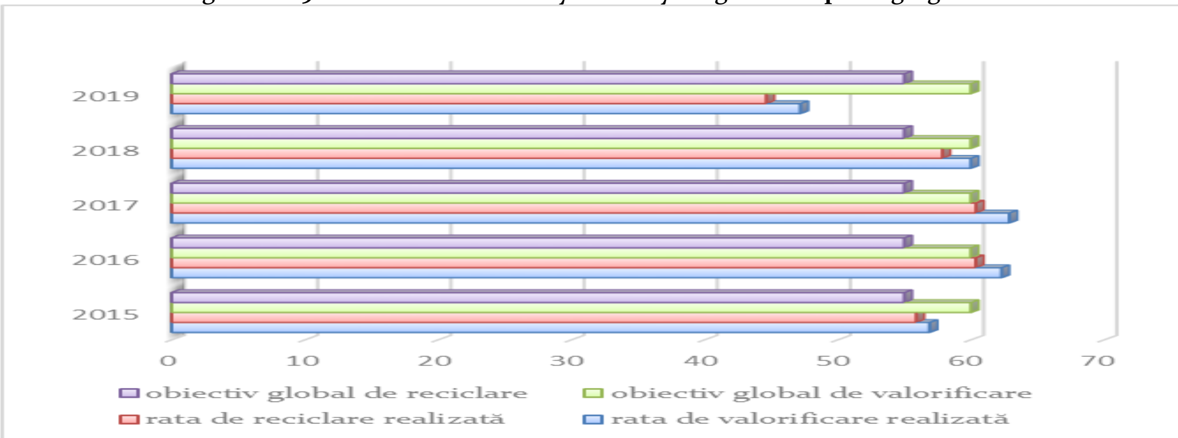
Source: National Environmental Protection Agency

Table VII.16. Recycled packaging waste, by types of material, 2015 -2019

Tip materiale	2015		2016		2017		2018		2019	
	tone	%	tone	%	tone	%	tone	%	tone	%
sticla	79874	41,1	134646	64,11	149608	62,97	166377	61,14	157619	42,94
plastic	167554	46,67	162351	46,55	171603	47,61	168270	42,99	149867	31,1
hârtie/carton	394300	89,26	395378	92,5	396947	90,64	429037	88,91	437703	68,28
metal	42845	64,11	39767	62,13	40723	60,35	45723	58,68	47648	49,64
lemn	96203	28,75	82891	27,64	91739	30,05	97420	28,39	105069	24,75
altele	0	0	0	0	0	0	0	0	0	0
TOTAL	780776	55,91	815033	60,37	850620	60,38	906827	57,87	897906	44,65

Source: National Environmental Protection Agency

Figure VII.9. The trend of recovery and recycling rates of packaging waste



Source: National Environmental Protection Agency

End-of-life vehicles (VSU/ELV)

RO 69

Indicator code Romania: RO 69
EEA indicator code: : TERM 11

TITLE: **END-OF-LIFE VEHICLES**

DEFINITION: The indicator shows the number of end-of-life vehicles and tracks whether the objective of reuse and recovery and the objective of reuse and recycling have been met in relation to the average empty weight of the end-of-use vehicles treated. The indicator is expressed in units collected/year and percentage.

The economic operators involved in the management of end-of-life vehicles are: manufacturers, distributors, collectors, insurance companies, as well as operators whose business is: treatment, recovery, recycling of end-of-life vehicles, including their components and materials.

Starting with 1ST of January 2015, economic operators authorized to carry out activities of treatment of end-of-life vehicles are obliged to ensure the achievement of the following objectives, taking into account average empty mass:

- ⇨ reuse and recovery of at least 95% of the average mass per vehicle and year, for all end-of-life vehicles;
- ⇨ reuse and recycling of at least 85% of the average mass per vehicle per year for all end-of-life vehicles.

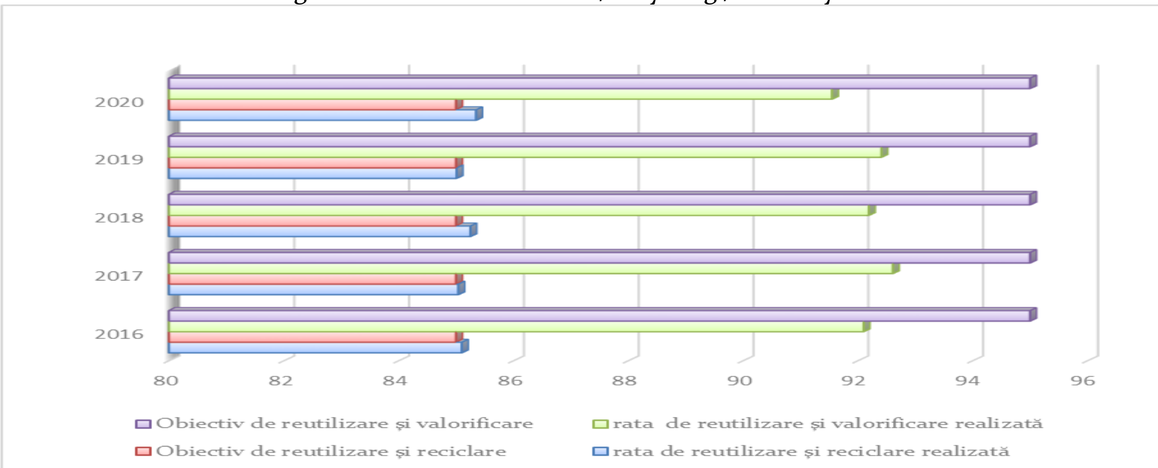
In order to monitor the achievement of the objectives set out above, economic operators who carry out collection and treatment operations of end-of-life vehicles are required to report specific information. Data centralized at national level are presented below.

Table VII.17. ELV collected and treated in the period 2016 -2020

	2016	2017	2018	2019	2020
VSU colectate	44762	49073	72213	84056	79743
VSU tratate	46572	49830	67344	84621	79360

Source: National Environmental Protection Agency

Figure VII.10. Trend of reuse / recycling / recovery rates



Source: National Environmental Protection Agency

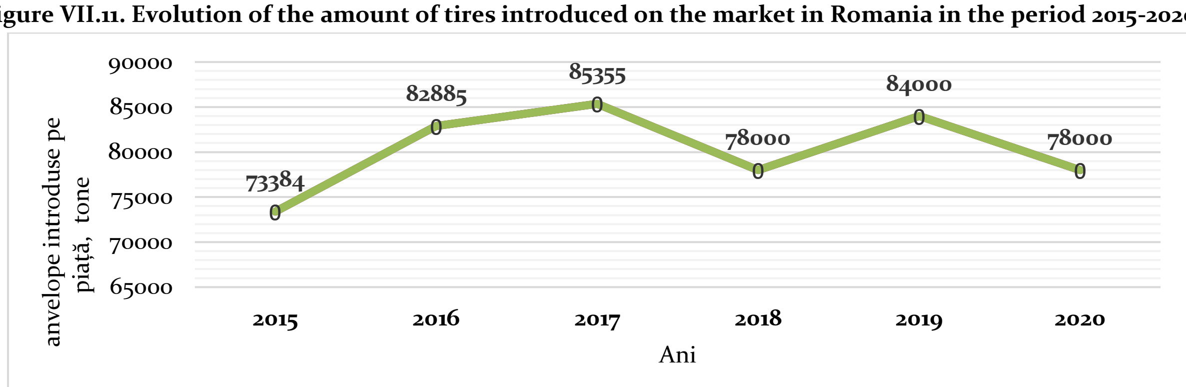
Used tires*

Source: Ministry of Economy

The entities involved in the activity of managing the flow of used tires are the economic operators who introduce new tires and/or used tires intended for reuse on the market, these being called "generators", the economic operators who sell tires, natural and legal persons who own used tires, referred to as "holders", the legal entities authorized to carry out collection and transport activities of used tires and, finally, but not least, the economic operators who ensure the recovery/recycling of used tires. According to Government Decision no. 170/2004 on the management of used tires, legal entities that introduce new tires and/or used tires intended for reuse on the market are obliged to collect used tires in proportion to 80% of the quantity introduced on the market in the previous year and to capitalize the entire amount of used tires collected. Valorization consists of reuse, direct reuse, retreading, recycling, and energy recovery. These obligations can be individually fulfilled by producers and/or importers falling under Government Decision no. 170/2004, or by transferring the responsibility to legally established entities for this purpose. Up until this date, only one commercial company, S.C. ECO ANVELOPE S.A. Bucharest, has been authorized to assume the responsibility for achieving the objective of collecting and valorizing used tires.

In the period 2015 - 2020, the evolution of the quantities of tires introduced on the market, as well as of the used tires collected and recovered (the data held by the Ministry of Economy, based on GD no. 170/2004, refer only to the used tires collected in order to fulfill the collection obligation in proportion to 80% of the quantity introduced on the market in the previous year by manufacturers and importers of new tires and/or used tires intended for reuse and do not include used tires resulting from the dismantling of end-of-life vehicles (VSU)) are presented as follows:

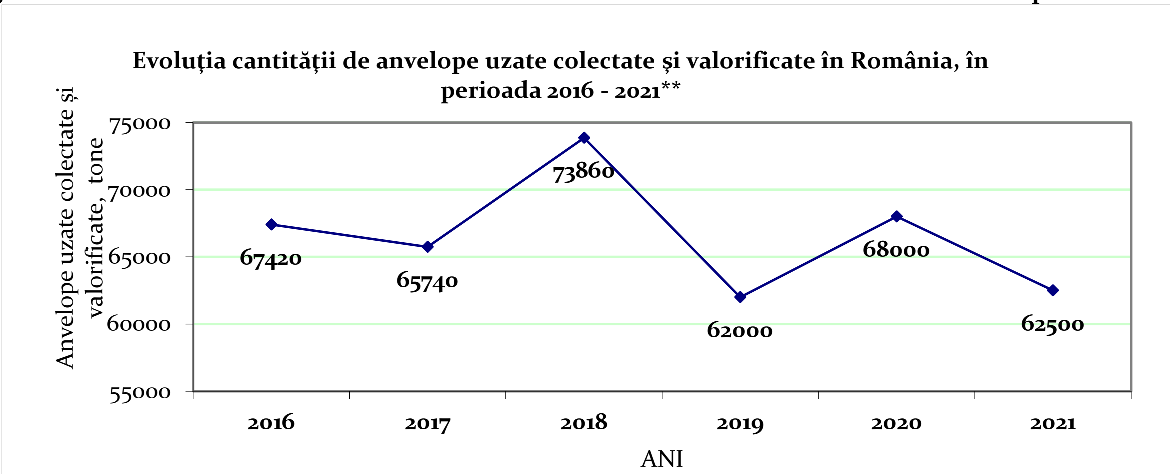
Figure VII.11. Evolution of the amount of tires introduced on the market in Romania in the period 2015-2020**



Source: Ministry of Economy

Note: The data for 2020 are estimates

FigureVII.12. Evolution of the amount of used tires collected and recovered in Romania in the period 2016-2021



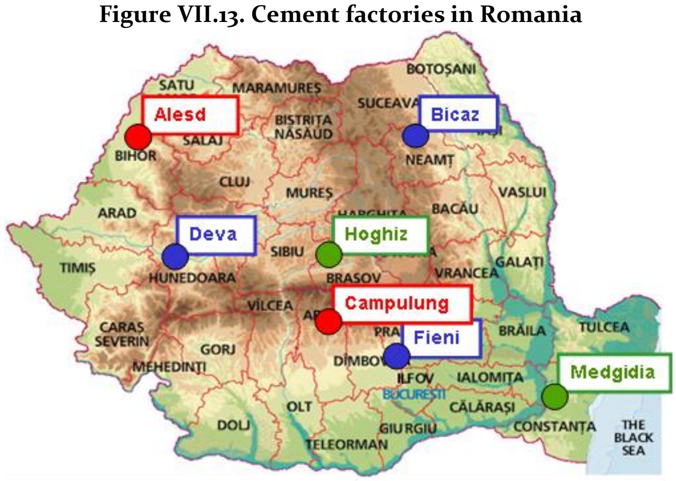
Source: Ministry of Economy

Note: The data for 2021 are estimates

*** - There is a margin of error in the data because the Ministry of Economy has no control over the reports received, in terms of the correctness of the data and the total number of economic operators that must report.*

Over 90% of the collected quantity of used tires is valorized through the co-processing method, while the remainder is recycled to obtain powder for various purposes. The rubber powder obtained is further used in the production of technical rubber articles. Occasionally, used tires are directly utilized for protecting race tracks, stabilizing household waste landfills, and reinforcing embankments, among other purposes. Through the **co-processing of used tires** in cement factories' kilns, the waste is transformed into alternative resources, simultaneously achieving both **energy recovery** (R1) and the **recycling of their mineral content** (R4 / R5). This method is recognized at the European level as a good practice in resource efficiency and serves as an example to follow in the fight against climate change. The total capacity for co-processing used tires in the seven cement factories is approximately 110,000 tons per year. These factories belong to three international producers: **CRH Romania (formerly Lafarge)**, **HeidelbergCement (Romania) (formerly Carpatcement)**, and **Holcim (Romania)**

Figure VII.13. Cement factories in Romania



Source: Ministry of Economy

According to the current legislation, no type of used tires, whole or shredded, is allowed to be disposed of in a landfill (*a location for the final disposal of waste through storage on land or underground, including*). The only exception is for tires used as construction materials in a landfill.

Construction and demolition waste

Construction and demolition waste is the waste corresponding to the waste codes appearing in chapter 17 of the annex to Decision 2000/532/EC, with subsequent amendments and additions, excluding hazardous waste and natural geological *materials in accordance with the definition of category 17 05 04, according to the provisions of the Decision 2011/753/EU establishing the rules and calculation methods for verifying compliance with the objectives set in art. 11, paragraph (2) of Directive 2008/98/EC"".*

According to the provisions of **Article 17, paragraph (7) of Government Emergency Ordinance no. 92/2021 on waste management**, *holders for whom construction and/or demolition permits have been issued according to the provisions of Law no. 50/1991 on the authorization of construction works, republished, with subsequent modifications and completions, have the obligation to manage construction and demolition waste in such a way as to achieve a level of preparation for reuse, recycling, and other material recovery operations, including operations using waste for backfilling to replace other materials, of at least 70% of the mass of non-hazardous waste from construction and demolition activities, except for naturally occurring geological materials defined under category 17 05 04 of the Annex to Commission Decision of 18 December 2014 amending Decision 2000/532/EC establishing a list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council*.
The calculation for verifying compliance with the objectives set out in the above-mentioned article is made in accordance with Decision 2011/753/EU establishing rules and calculation methods for verifying compliance with the objectives set out in Article 11(2) of Directive 2008/98/EC of the European Parliament and of the Council."

From the data reported by economic operators generating waste, administrators of waste crushing stations from construction and demolition, the situation for the years 2016-2020 is as follows:

Table VII.18. Construction and demolition waste 2016-2020

Indicator name	2016	2017	2018	2019	2020
Amount of construction and demolition waste generated (tons)	1294665	703277	735684	981080	1172913
Amount of construction and demolition waste recycled (tons)	737100	408919	360888	594575	622756
Amount of construction and demolition waste used for backfilling (tons)	220686	116055	129992	132247	223193
% recycling + backfilling	73.97	74.65	66.72	74.08	72.12

Source: National Environmental Protection Agency

WASTE IMPACTS AND PRESSURES

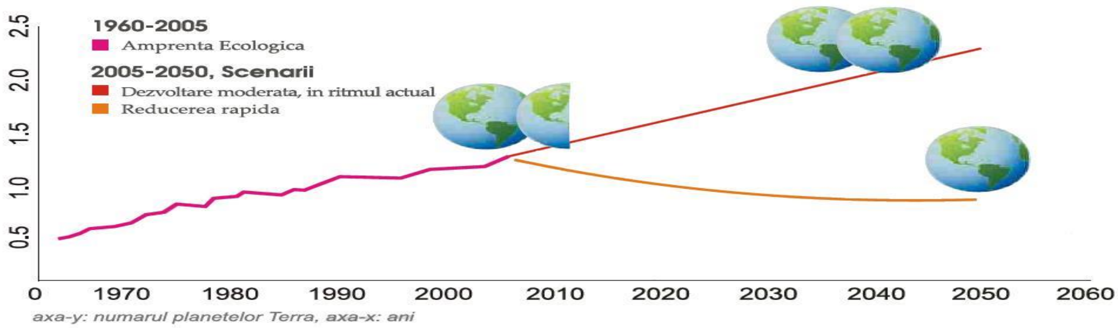
The European economy is based on a high level of consumption of resources - raw materials, energy and soil[1]. The main driving forces of resource consumption in Europe are economic growth, technological developments and changing patterns of production and consumption. Approximately one third of the resources used are transformed into waste and emissions. *According to information provided by the European Environment Agency, approximately four tons of waste per capita are generated each year in EEA member countries, and each European citizen throws away an average of 520 kg of household waste per year*.
The high consumption of resources in Europe creates pressure on the environment not only in Europe, but also in other regions of the world. These pressures include depletion of non-renewable resources, intensive use of renewable resources, transport, high emissions in water, air and soil from socio-economic activities. Waste management activities, mainly disposal, can cause a range of health and environmental impacts, including emissions to air, surface water and groundwater. Discarded waste also represents a loss of material or energetic natural resources. Therefore, good waste management can protect public health and environmental quality, while supporting the conservation of natural resources.

In the year 1992, William Rees, professor emeritus at the University of British Columbia, introduced the concept of the **(*Ecological Footprint*),**in order to synthetically express the pressure that humanity exerts on the biosphere, depending on the productive surface (land and water surface) of the planet, necessary to supply the natural resources that it consumes and to neutralize the waste generated by the inhabitants of the planet. The ecological footprint of a country includes the area of cultivated land, pastures, forests and fish areas necessary for the production of fibres, wood material and food intended for consumption and the areas occupied for the neutralization of generated waste.
The ecological footprint is calculated by relating the human consumption of natural resources to the earth's ability to regenerate them and is expressed in *global hectares (hag)*. The dynamic over time of the global ecological footprint expresses the exploitation by people of all categories of natural resources, in the general effort to satisfy the needs of development at an increasingly high level. *Currently, 1.8 hag/person are available in the world. However, each European uses 4.9 ha, and a North American, twice as much as a European, thus reducing the amount available for consumption by residents of other continents.*

[1]Source: European Environment Agency - https://www.eea.europa.eu/ro/themes/waste/about-waste-and-material-resources

Today, humanity uses the equivalent of more than 1.5 planets to provide the resources we need and absorb the waste we produce. The moderate scenarios of the United Nations show that if we keep the same rate of consumption and population growth, by 2035 we will need 2 planets to cope!

Figure VII.14. Ecological footprint - scenarios



Source: https://www.viitorplus.ro/Sustenabilitȧ-noastr-71

According to data published by the Global Footprint Network, in 2016 Romania had a carbon footprint of 1.9 (expressed as "number of planets"), on a scale between 0.3 and 8.84 and a European average of 2.8 . Practically, in our country, nature still has a good capacity to provide resources and absorb emissions and waste, but we must take into account the fact that the relatively low industrial activity contributes to this to a large extent.

TRENDS AND FORECASTS REGARDING WASTE GENERATION

In accordance with the legislative provisions in force, the National Waste Management Plan (NWMP) was developed, through which measures and actions were established for the implementation of the objectives set out in ***National Waste Management Strategy 2014-2020***. The NWMP ncludes projections for the generation of municipal waste and packaging waste for the period 2015 – 2025, based on the existing situation at the time of plan development and relevant socio-economic projections. As for industrial waste, it is not possible to make a generation forecast as these quantities depend entirely on the quantitative and qualitative evolution of the generating activities.

POLICIES AND ACTIONS REGARDING THE USE OF MATERIAL RESOURCES AND WASTE

EU policies on waste management aim to reduce the impact of waste on the environment and health and improve the EU's energy efficiency. For these actions to be effective, they need to address every stage throughout the resource's lifecycle. Applying the tools established in existing community legislation, such as disseminating the best available techniques or adopting ecodesign of products, therefore, plays a significant role in achieving this goal. The long-term objective of EU policies is to reduce the quantity of waste generated and, when waste generation cannot be avoided, to promote their use as a resource and achieve higher levels of recycling and safe disposal. European waste legislation has already set the main directions, taking into account extended producer responsibility and the product lifecycle. Member States are encouraged to adopt legislative and non-legislative measures to strengthen waste reuse and prevention, recycling, and other waste recovery operations. These measures can encourage the development, production, and commercialization of multi-use products that are technically durable and allow for eco-friendly end-of-life management.

At national level, in 2017, the ***National Waste Management Plan (NWMP) and the National Waste Generation Prevention Program*** were developed and approved by Government Decision no. 942/2017. This document aims to establish a conducive framework for waste management at the national level with minimal adverse effects on the environment. The main objectives of PNGD are to characterize the current situation in the field (quantities of waste generated and managed, existing facilities), identify problems causing inefficient waste management, set objectives and targets based on legal provisions and strategic objectives established through SNGD, and identify investment needs.
To characterize the existing situation, data on quantities of waste generated and managed during the period 2010 – 2014 were used, along with data and information regarding waste management facilities for the year 2016.

Projections for waste quantities were made for the period 2015 – 2025, and the action plan covers the period 2018 – 2025.

The implementation of measures outlined in the mentioned documents will also take into account legislative changes at the European level introduced through the so-called ***Circular Economy*** package, which sets more ambitious targets for waste recycling/recovery and reducing the quantities of waste deposited.

VIII. CLIMATE CHANGES

THE IMPACT OF CLIMATE CHANGE ON NATURAL AND ANTHROPICAL SYSTEMS

CHANGES OBSERVED ON THE CLIMATE REGIME IN ROMANIA

Climatic characterization of the year 2021

RO 12
Indicator code Romania: RO 12 EEA indicator code: CSI 012
TITLE: **TEMPERATURE AT NATIONAL LEVEL**
DEFINITION: This indicator shows the absolute changes and rates of change of the national average temperature.

"In 2021, the national average temperature was 9.8°C, which was 0.2°C higher than the climatological normal (1991-2020). The year 2021 ranks ninth in the list of the warmest years in Romania for the period from 1961 to 2021.

Positive anomalies were recorded in seven months of the year, with the monthly average temperature in the country being higher than the climatological normal (1991-2020) by values ranging from 0.1°C (June) to 2.2°C (January). In the remaining months, the anomaly was negative and ranged from 0.2°C in September to 2.5°C in April.

The annual average temperature had values ranging from -1.7°C at the Vf. Omu weather station to 13.2°C in Constanța and Drobeta-Turnu Severin. The highest values, above 12°C, were recorded in the southern and southeastern parts of Muntenia, the central and southern parts of Oltenia, the western and central parts of Banat, the southernmost part of Moldova, the central and eastern parts of Dobrogea, and the Danube Delta. Values above 10°C were recorded in most of Oltenia, Muntenia, Banat, and Crișana, the western part of Maramureș, the southern and eastern parts of Moldova, extensive areas in Dobrogea, and the lowland areas of Transylvania.

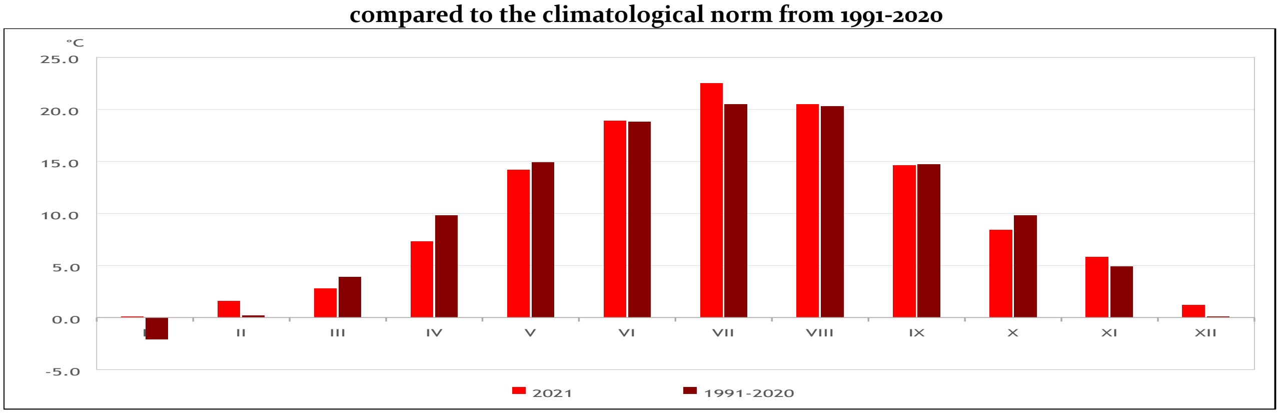
Annual temperature averages ranged between 8 and 10°C in most of Moldova and Transylvania, in the submontane areas, and in the intramontane depressions. In mountainous areas, the annual average temperature varied between 2 and 6°C, and at altitudes above 2000 m, it dropped below 2°C, reaching -1.7°C at the Vf. Omu weather station.

Table VIII.1 Average annual temperatures and average annual amounts of precipitation at the level of Romania, in the last 5 years

Year	2015	2016	2017	2018	2019	2020	2021
Temperature (in ºC)	10.5	10.4	9.9	10.4	10.9	10.8	9.8
Precipitation (in mm)	630.1	791.5	673.5	698.8	614.2	653.2	695.3

Source: National Meteorological Administration

Figure VIII.1. Average monthly temperature in Romania in 2021, compared to the climatological norm from 1991-2020



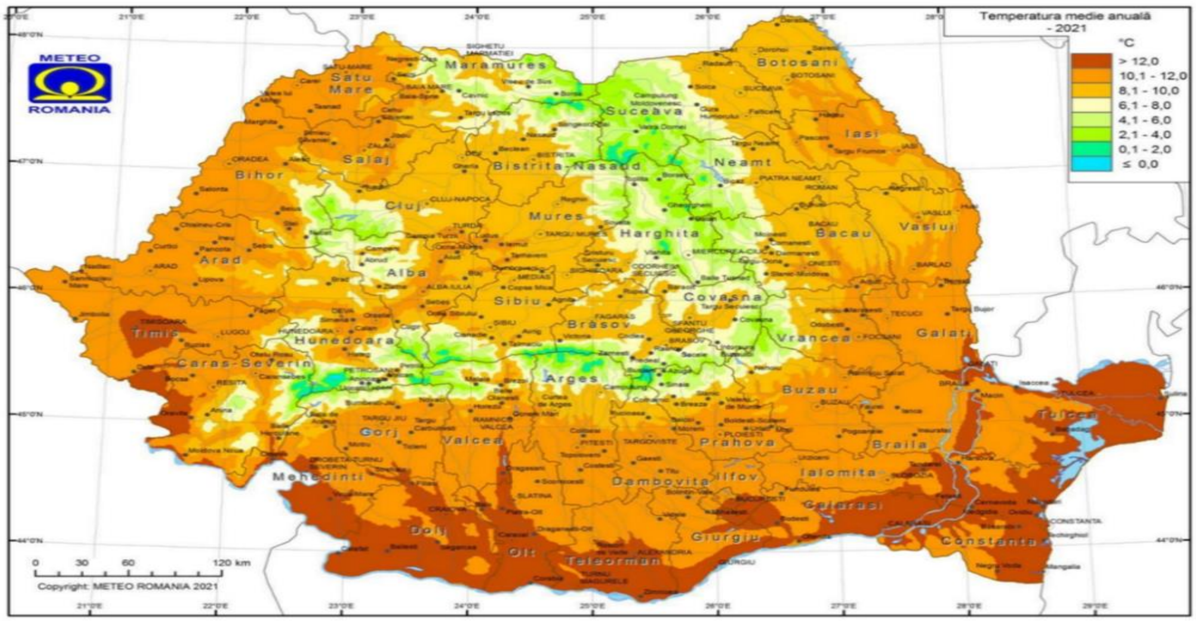
Source: National Meteorological Administration

The deviation of the average air temperature in 2021 from the standard reference interval median (1991-2020) was positive throughout the country. Deviations of over 1°C were recorded in the mountainous region, on the coast, in parts of Oltenia and Banat, and locally in Transylvania and Crișana. The highest deviation value was 1.3°C, recorded at the Târgu Jiu weather station.

Analyzing the categorization of temperature anomalies in 2021 in terms of severity classes, it can be observed that the thermal regime was warm in almost the entire country.

It was very warm or extremely warm, isolated, in Oltenia and southern Dobrogea. Otherwise, the thermal regime fell within normal limits.

Figure VIII.2. Average annual temperatures in 2021 (in ºC)



Source: National Meteorological Administration

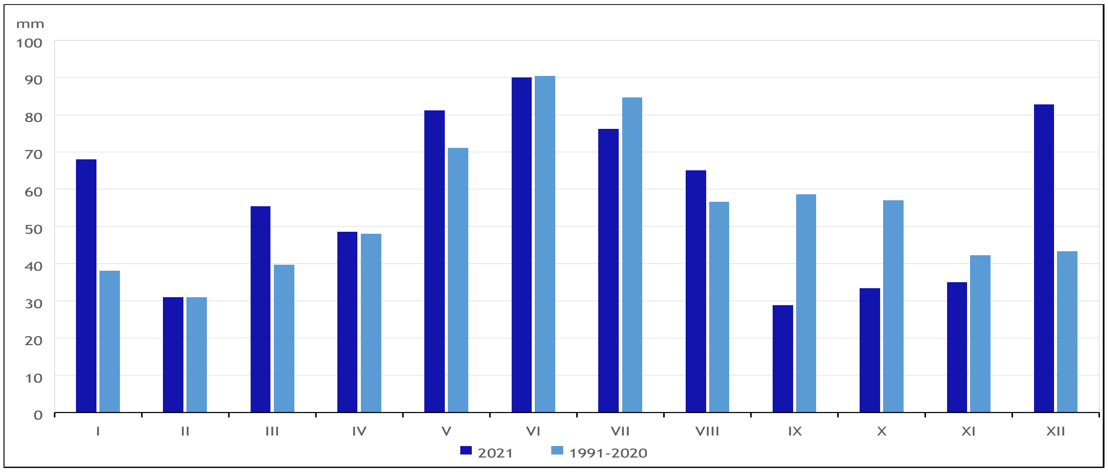
RO 47
Indicator code Romania: RO 47 EEA indicator code: CLIM 002
TITLE: **PRECIPITATION AVERAGE**
DEFINITION: This indicator is defined by: • Annual rainfall trends recorded at national level • The forecasted changes regarding annual and summer rainfall, at national level

The total precipitation in 2021, averaged across the country, was 695.3 mm, which was 4% higher than the annual climatological normal (1991-2020).

Deviation from the average annual precipitation in 2021 was positive in six months, ranging from 1% (April) to 91% (December), negative in four months, ranging from 10% (July) to 51% (September), and in February and June, the precipitation was equal to the climatological normal. The total annual precipitation in 2021 had values over 500 mm in most of the country. Values between 500 and 700 mm were recorded in most of Moldova, Muntenia, Oltenia, Transylvania, Banat, Crișana, the western part of Maramureș, and extensive areas in Dobrogea. In submontane areas, in parts of central and southeastern Muntenia, in southern Dobrogea, and sporadically in eastern Moldova, annual precipitation amounts ranged between 700 and 1000 mm. In mountainous regions, the precipitation exceeded 1000 mm and, in isolated cases, 2000 mm. Precipitation amounts below 500 mm were recorded in central Dobrogea, the Danube Delta, some areas in northern and southern Moldova, and locally in Crișana. The highest recorded precipitation amount this year was 2165 mm, registered in Stâna de Vale, while the lowest was 355 mm, at the Sulina weather station.

The deviation of the precipitation amount in 2021 from the median of the standard reference interval (1991-2020), calculated in percentages, was positive in most of the country, with values below 65%. The negative deviation values were less than 26%.

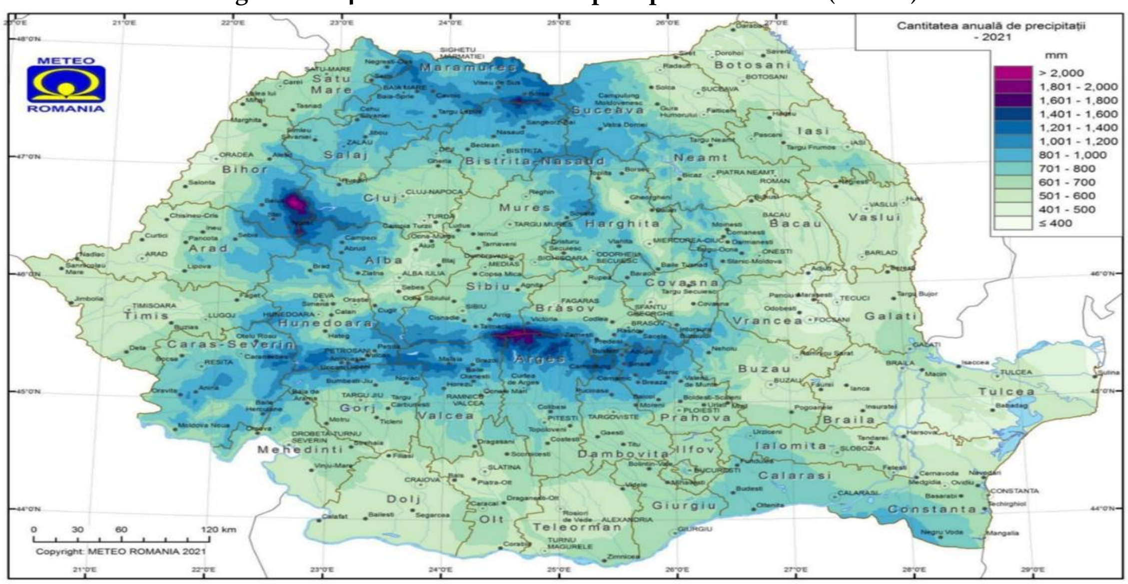
Figure VIII.3. The average monthly amount of precipitation in Romania in 2021, compared to the climatological norm from the period 1991-2020



2

Source: National Meteorological Administration

Figure VIII.4. Annual amounts of precipitation in 2021 (in mm)

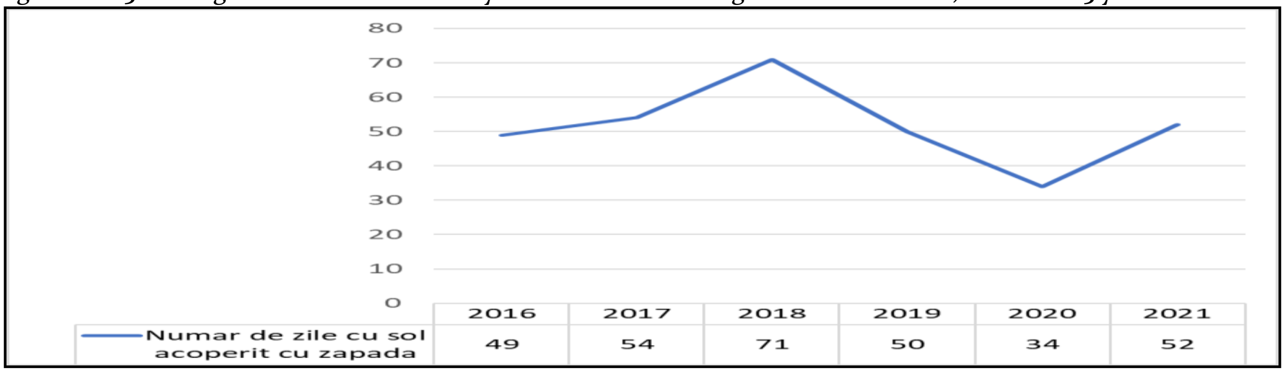


Source: National Meteorological Administration

RO 49
Indicator code Romania: RO 49 EEA indicator code: CLIM 08
TITLE: **THE SNOW COVER EXTENT**
DEFINITION: This indicator is defined by: • The evolution of the snow cover extent at the national level • The trend of the amount of snow recorded in March (except for mountain areas) • Forecasted changes in the annual number of snow days

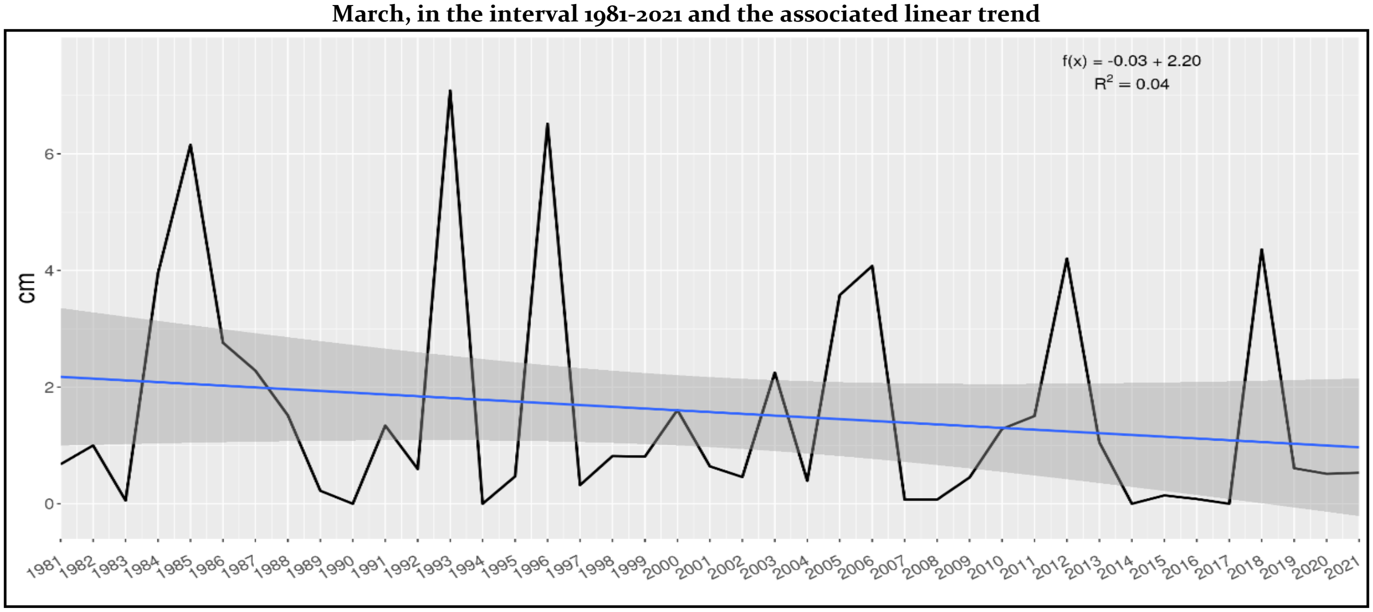
In 2021, there was a decrease in the number of days with snow cover compared to 2019. This marks the lowest value in the last 6 years. The trend in snow depth (excluding mountain stations) observed in March, for the period 1981-2021, indicates a significant reduction, consistent with trends recorded in both Europe and Asia, and in line with the signal of global warming.

Figure VIII.5. Average annual number of days with snow-covered ground in Romania, in the last 5 years and in 2021



Source: National Meteorological Administration

Figure VIII.6. The evolution of the average thickness of the snow layer (in cm) in Romania (excluding mountain stations) in March, in the interval 1981-2021 and the associated linear trend



Source: National Meteorological Administration

RO 48

Indicator code Romania: RO 48
EEA indicator code: CLIM 04

TITLE: **EXTREME PRECIPITATION**

DEFINITION: This indicator is defined by:

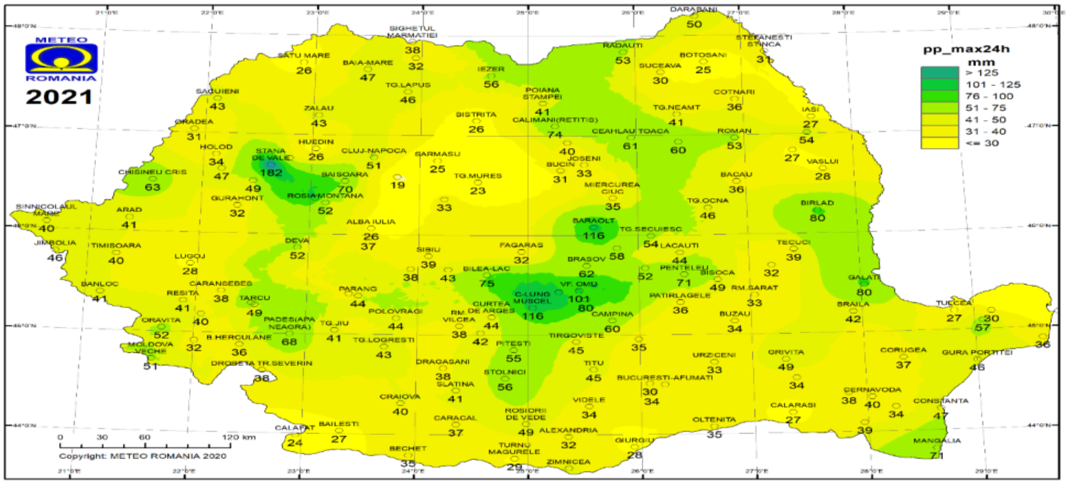
- Evolution of the number of consecutive days with precipitation (wet periods) and without precipitation (dry periods)
- Changes predicted for the next 20 years regarding maximum precipitation in summer and winter

Analyzing the severity classes of rainfall anomalies from the year 2021, it is found that the rainfall regime was normal in most areas of the country.

It was also excedentary in most of Muntenia and Dobrogea, in the south and east of Oltenia, on extensive areas in the Carpathians and locally in the other regions. The rainfall regime was very excessive or extremely excessive on the coast, in the Danube Delta and locally or isolated, in the mountainous area and in Muntenia. Deficient precipitation was local, in Banat and Crișana, and isolated, in Oltenia, Transylvania and southern Moldova. The rainfall regime was very deficient, isolated, in Crișana.

In 2021, high values of the maximum amount of accumulated precipitation in 24 hours were recorded especially at the weather stations Stâna de Vale, Cîmpulung Muscel and Baraolt.

Figure VIII.7. The maximum amount of accumulated precipitation in 24 hours, recorded in 2021, at the meteorological stations covering the territory of Romania (in mm)



Source: National Meteorological Administration

THE CONCENTRATION OF GREENHOUSE GASES IN THE ATMOSPHERE

RO 13

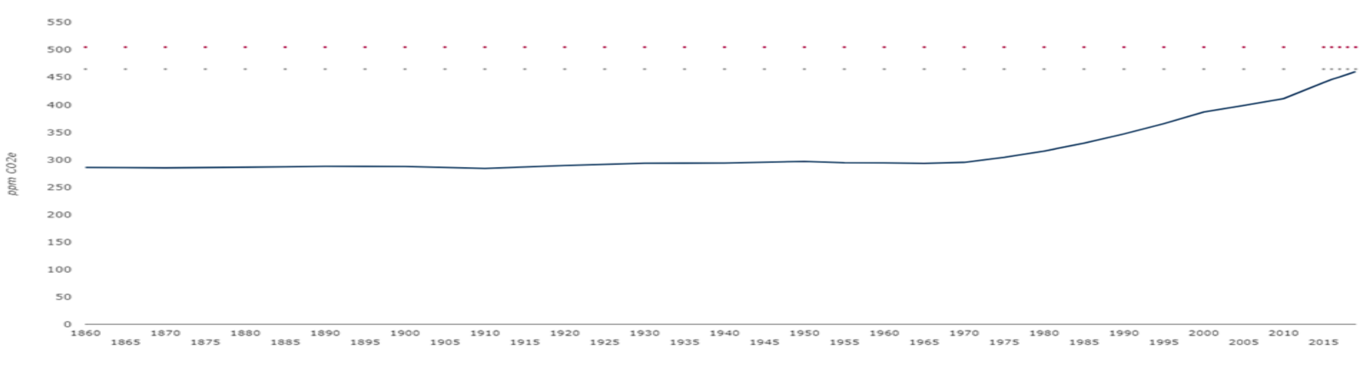
Indicator code Romania: RO 13
EEA indicator code: CSI 013

TITLE: **ATMOSPHERIC CONCENTRATIONS OF GREENHOUSE GASES**

DEFINITION: The indicator presents measured trends and forecasts for greenhouse gas (GHG) concentrations. The GHG concentrations included in the Kyoto protocol (CO_2, CH_4, N_2O, SF_6, HFCs, PFCs and NF_3) are included.

The total concentration of all greenhouse gases and other forcing agents, including cooling aerosols, reached 460 parts per million of CO_2 equivalent in 2019. This is already within the upper range that the Intergovernmental Panel on Climate Change (IPCC) states should not be exceeded if, with a 67% probability, global temperature rise is to be limited to 1.5°C above pre-industrial levels by 2100. The maximum concentrations corresponding to a 2°C temperature increase by 2100 could be exceeded around the year 2030.

Figure VIII.8. Observed trends in total greenhouse gas concentrations between 1860 and 2019, considering all greenhouse gases and other forcing agents (including aerosols)



Source: https://www.eea.europa.eu/ims/atmospheric-greenhouse-gas-concentrations

This indicator assesses the global atmospheric concentration of all greenhouse gases and forcing agents and examines how the state and trend of that concentration are linked to scientific knowledge and political ambitions to limit the rise in global temperatures at the end of the century. The objective of the 2015 Paris Climate Agreement is 'to keep the increase in global average temperature well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.' One outcome of the recent agreement in Glasgow was to 'drive efforts to limit temperature increase to 1.5°C even further.' It is important to consider all gases and other forcing agents using the so-called 'CO_2 equivalent' (CO_2e); (see supporting material for details). Note that some gases, such as sulfate aerosols, have a negative forcing (i.e., a cooling effect).

Considering all greenhouse gases and other forcing agents, including aerosols, the total CO_2 equivalent (CO_2e) reached 460 ppm in 2019, which is approximately 52 ppm higher than a decade ago and about 180 ppm higher than pre-industrial times. The assessment of the contributions of different groups of greenhouse gases showed that by far the most significant forcing is caused by gases covered by the Kyoto Protocol (KP), especially CO_2, with its annual concentration reaching 410 and 412 ppm in 2019 and 2020, respectively, which is more than 130 ppm (+147%) above pre-industrial levels. As a group, gases covered by the Montreal Protocol (MP) contributed around 31 ppm to climate forcing in 2019. Non-protocol gases (NPG) generally have a net cooling effect. In 2019, this effect amounted to nearly 55 ppm CO_2e and, therefore, offset approximately 23% of the forcing induced by other greenhouse gases. The trend in forcing (cooling) from NPGs is decreasing, mainly due to the indirect sulfate aerosol reduction effect (through its interaction with cloud).

THE IMPACT OF CLIMATE CHANGES ON NATURAL SYSTEMS

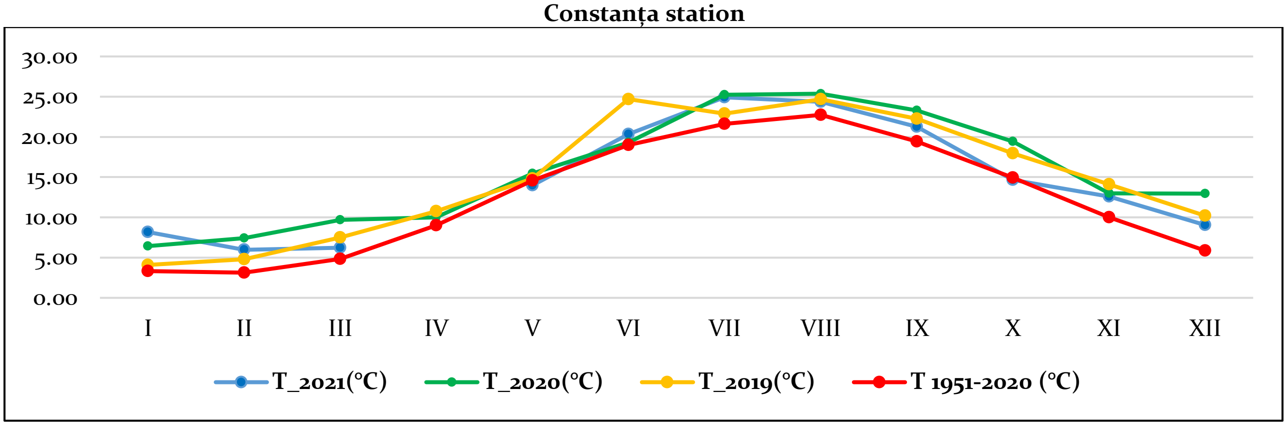
Impact on the marine and coastal environment

In 2021, the global average surface temperature was equal to the average temperature of 2018, ranking as the sixth warmest year according to independent analyses conducted by NASA and NOAA. According to annual temperature data, the last eight years have been the warmest eight years since NASA and NOAA began modern record-keeping in 1880. The data is provided annually by NASA's GISS laboratory, managed by the Earth Science Division of NASA's Goddard Space Flight Center in Maryland, USA. According to these records, global temperatures in 2021 were 0.85 degrees Celsius above the 1880-2020 reference period average.

The sixth assessment report of the IPCC (Intergovernmental Panel on Climate Change), published in August 2021, indicates that greenhouse gas emissions resulting from human activities are causing global temperatures to rise by 0.8°C-1.3°C, with an optimal estimate of 1.07°C, leading to rapid changes in the global ocean and atmosphere.

In Romania, according to the country's fourth biennial report prepared by the Ministry of Environment, Waters, and Forests for the year 2020, carbon dioxide accounts for the largest percentage of total greenhouse gas emissions, contributing 0.3% to global emissions and less than 3% to the total emissions of EU countries. Although these contributions are insignificant, in the context of global warming, there is a progressively increasing trend in the average air and sea temperatures, reflected in the monthly average temperatures recorded over the last decades, becoming increasingly evident in both summer and winter seasons in recent years, with the average sea temperature recorded in Constanța in 2021 being 1.91°C higher compared to the average temperatures of the past 67 years.

Figure VIII.9. Monthly average temperatures (2019, 2020, 2021)/multiannual monthly averages (1953-2020) at Mamaia - Constanța station



Source: Institute of Marine Research and Development "Grigore Antipa" Constanța

The impact of climate change on watercourses

RO 53
Indicator code Romania: RO 53 EEA indicator code: CLIM 017
TITLE: **FLOODS**
DEFINITION: This indicator highlights the trend of producing major floods in Europe, as well as the expected changes in the variation of floods with a return period of 100 years.

Table VIII.2. Synthetic table regarding the floods in Romania

No. Crt.	Year	No. events	No. significant events	Affected urban areas
1	2010	94	9	117
2	2011	45	1	19
3	2012	39	6	39
4	2013	74	4	47
5	2014	151	14	72
6	2015	49	2	20
7	2016	171	18	93
8	2017	137	***	68
9	2018	164	***	138
10	2019	154	***	131
11	2020	158	***	111
12	2021	207	***	122

Source: "Romanian Waters" National Administration and the National Institute of Hydrology and Water Management
*Note: ***significant historical events are established within the 3rd implementation cycle of the Floods Directive 2007/60/EC*

During 2021, a number of 207 extreme weather phenomena were recorded, of which:

- 205 extreme events caused by flooding through overflowing rivers or runoff from slopes;
- 2 extreme events caused by wind, the first recorded during the period of May 17-20, 2021, when wind gusts affected the Igniș meteorological radar dome owned by ANAR-ABAST-SGA Maramureș, and the second event occurred in Zorlențu Mare, Caraș-Severin County, during the period of August 1-2, 2021.

The following events accompanied the phenomena of river overflow and runoff from slopes.

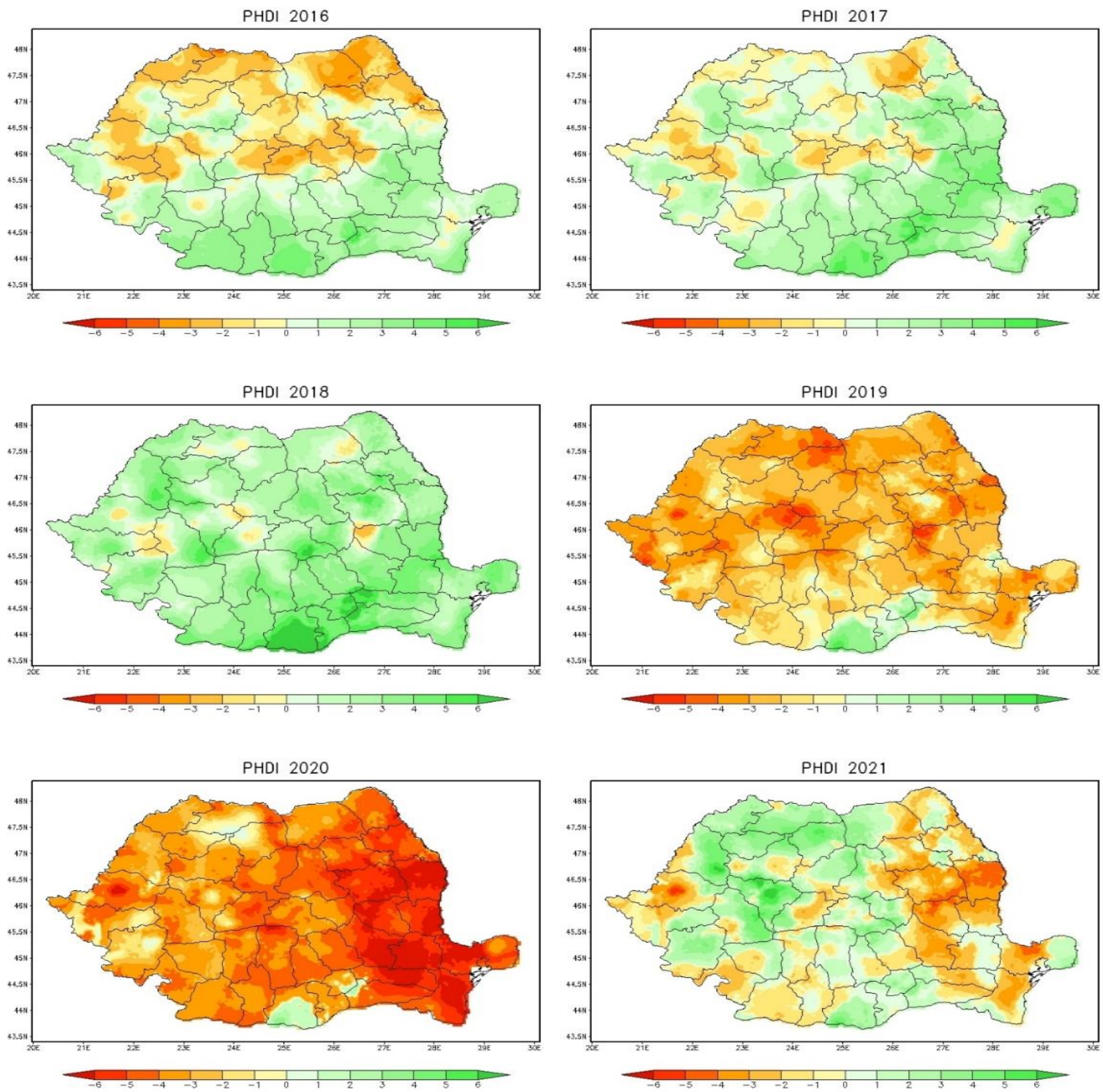
- 5 events caused by snowmelt or due to the freeze-thaw phenomenon;
- 23 extreme events caused by heavy rainfall and puddles;
- 10 extreme events caused by heavy rainfall and hail;
- 11 extreme events caused by heavy rainfall and wind;
- 29 events caused by the incapacity of the sewage system to handle rainwater;
- 15 events were accompanied by landslides.

During the floods in 2021, there was one casualty who was caught in the flash flood on the Provița River in the Adâncata locality, Prahova County. Flooding affected at least 1043 administrative-territorial units (UATs) and a total of 2912 localities at least once.

The values of the Palmer self-calibrating drought index (Palmer, 1965; Wells et al., 2004) for the year 2021, as illustrated in Figure VIII.10, suggest the presence of ***regions experiencing extreme hydrological drought (depicted by dark ochre and red shades***), especially in the eastern, southeastern, and western parts of Romania. However, the extent and magnitude of the hydrological drought in 2021 are less pronounced compared to the hydrological droughts of 2020 and 2019..

Figure VIII.10. The annual average of the monthly Palmer hydrological drought index, calculated at meteorological stations covering the territory of Romania, for the years 2016-2020 and in 2021

Source: National Meteorological Administration
Note: Values lower (higher) than -4 (4) illustrate extreme (extreme) drought (excess moisture).



THE IMPACT OF CLIMATE CHANGE ON SOCIO-ECONOMIC SYSTEMS AND SECTORS

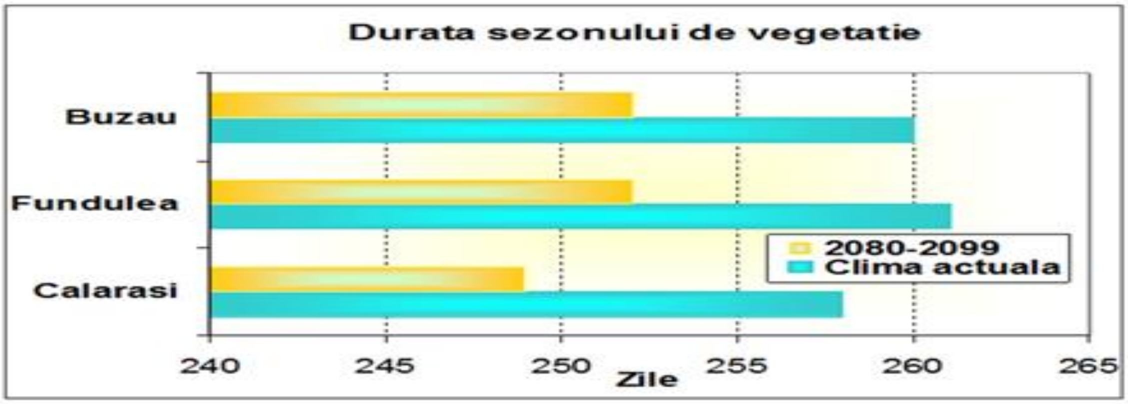
Agriculture

The growing season of agricultural crops

RO 56
Indicator code Romania: RO 56 EEA indicator code: CLIM 030
TITLE: **THE GROWING SEASON OF AGRICULTURAL CROPS**
DEFINITION: This indicator is defined by the number of days with positive temperatures in a year.

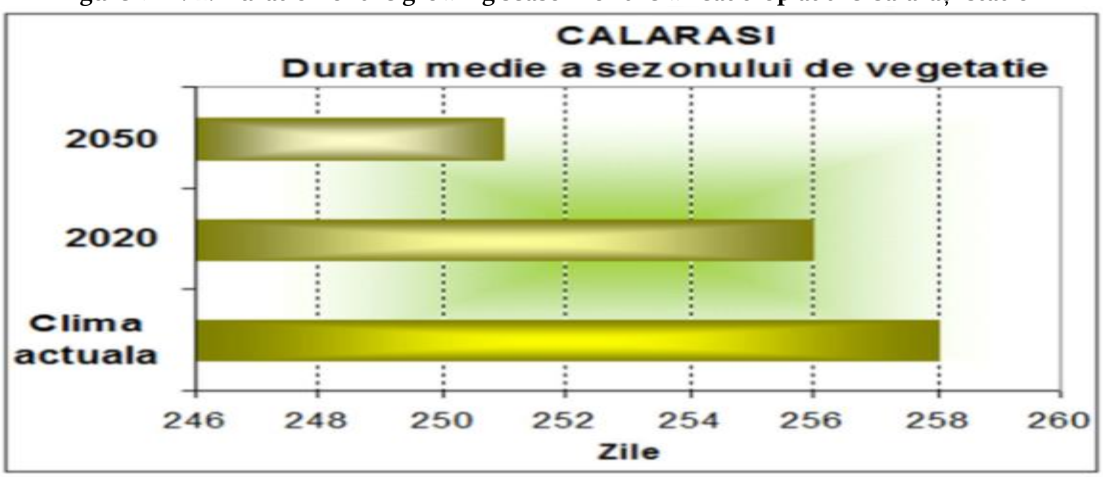
The vegetation season represents that period of the year, also called the frost-free season, in which the most favorable conditions for plant development are recorded.
In the figure below, the duration of the growing season for the wheat crop is represented both for the present period and for the period between the years 2080-2099.
The projections were made using the RegCM3 climate model, developed at ICTP, Trieste, under the conditions of the IPCC emission scenario, A1B.
For all three stations analyzed, significant decreases (number of days) in the duration of the vegetation season are observed.
For example, in Călărași, one can observe a decrease in the vegetation season by 2-14 days, due to the increase in temperature.
For the average duration of the growing season, the simulations of the HadCM3 climate model were used, for the time period 2020-2050, under the conditions of the IPCC A2 emission scenario.

Figure VIII.11. Length of the growing season for the wheat crop for the current climate and for the period 2080-2099



Source National Meteorological Administration, Extreme meteorological phenomena in Romania – the implications on agriculture, 5th edition ICAR Forum

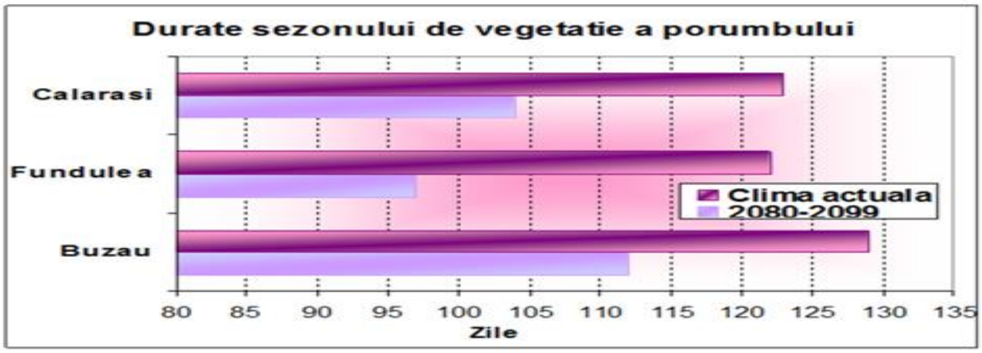
Figure VIII.12. Duration of the growing season for the wheat crop at the Călărași station



Source National Meteorological Administration, Extreme meteorological phenomena in Romania – the implications on agriculture, 5th edition ICAR Forum

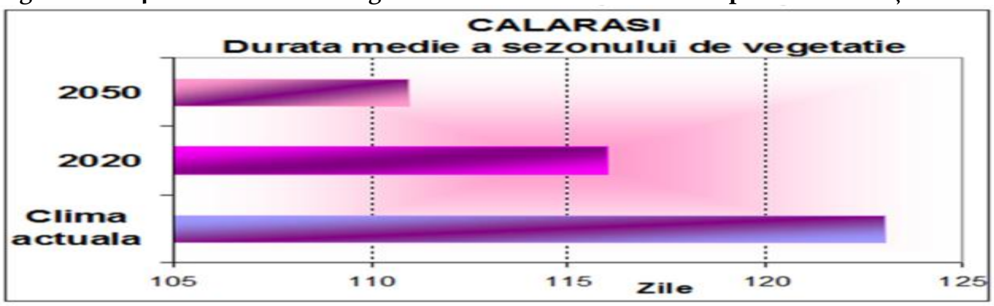
As far as the corn crop is concerned, a decrease in production is noted as a result of the increase in water deficits in the soil, especially in the grain filling phase. For the Călărași station, the shortening of the vegetation season by 7 days in 2020 and 12 days in 2050, respectively, is noted, as a result of the increase in air temperature.

Figure VIII.13. Maize growing season length for the current climate and 2080-2099



Source National Meteorological Administration, Extreme meteorological phenomena in Romania – the implications on agriculture, 5th edition ICAR Forum

Figure VIII.14. Duration of the vegetation season for the corn crop at the Călărași station



Source National Meteorological Administration, Extreme meteorological phenomena in Romania – the implications on agriculture, 5th edition ICAR Forum

RO 57
Indicator code Romania: RO 57 EEA indicator code: CLIM 32
TITLE: **THE PRODUCTIVITY OF AGRICULTURAL CROPS DETERMINED BY THE LACK OF WATER RESOURCES**
DEFINITION:This indicator can be mainly defined by the yield of agricultural crops determined by the lack of water resources.

Forecasts of climate changes (air temperature and precipitation) in Romania for the period 2001 – 2030 were constructed by applying two extrapolation methods (dynamic and static) recommended by the IPCC and applied to some global models (AOGCM) or regional models (RegCM) and applied to the IPCC A1B forecast (small increases in atmospheric GHG concentrations in the century 21).

Statistical results of forecasts for the period 2001-2030 compared to the period 1960-1990 shows the following:
- the air temperature will increase by 0.7 to 1.1°C;
- average values of precipitation in the months of December and February will decrease, while in the months of October and June they will increase, and for the other months the average values will not have significant changes.

The results of dynamic modeling for the period 2001-2030 compared to the period 1960-1990 indicate:
- the average temperature will increase more in the eastern part of Romania;
- the winter air temperature outside the Carpathians it is expected to decrease by 1.5°C, and during the summer to increase by 0.2°C;
- spring - the temperature will increase by 1.8°C;
- autumn - the temperature is expected to increase;
- summer -precipitation will increase especially in the western part;
- the increase in precipitation in the autumn season;
- the decrease in precipitation in the winter season.

Source: 5th National Communication of Romania, Bucharest January 2010

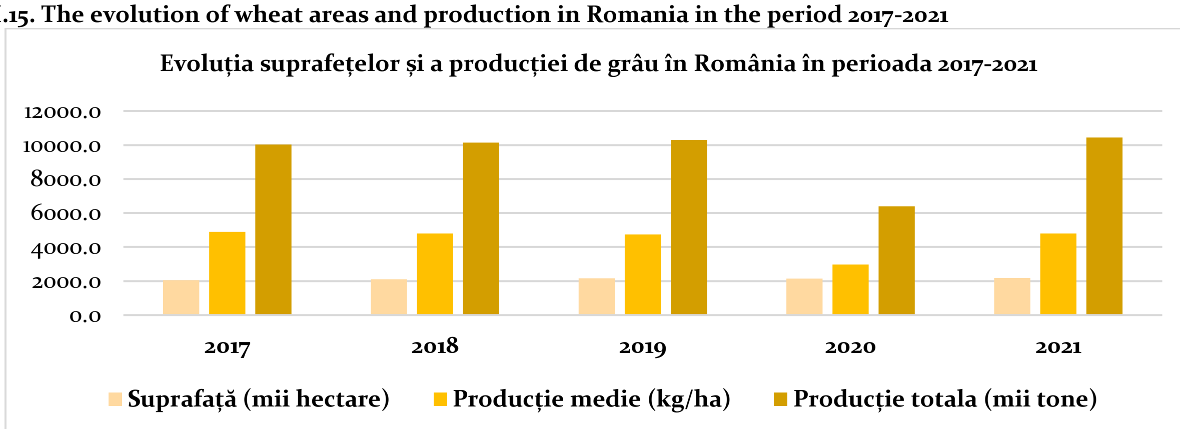
Table VIII.3. Cultivated area and production of the wheat crop in Romania, period 2017-2021

Year	Cultivated area (thousands of hectares)	Production (thousand tons)	Yield (kg/ha)
2017	2052.9	10035.0	4888
2018	2116.2	10143.7	4793
2019	2168.4	10297.1	4749
2020	2155.3	6392.4	2966
2021	2175.1	10433.8	4797

Data source NIS, TEMPO database

The evolution of the wheat crop yield in Romania (kg/ha), period 2017-2021, is illustrated in the figure below.

Figure VIII.15. The evolution of wheat areas and production in Romania in the period 2017-2021



Data source NIS, TEMPO-Online database

Forests and forestry

RO 58

Indicator code Romania: RO 58
EEA indicator code: CLIM 34

TITLE: **AREAS OCCUPIED BY FORESTS**

DEFINITION: This indicator is defined by:
- The forest area;
- The volume of forest biomass.

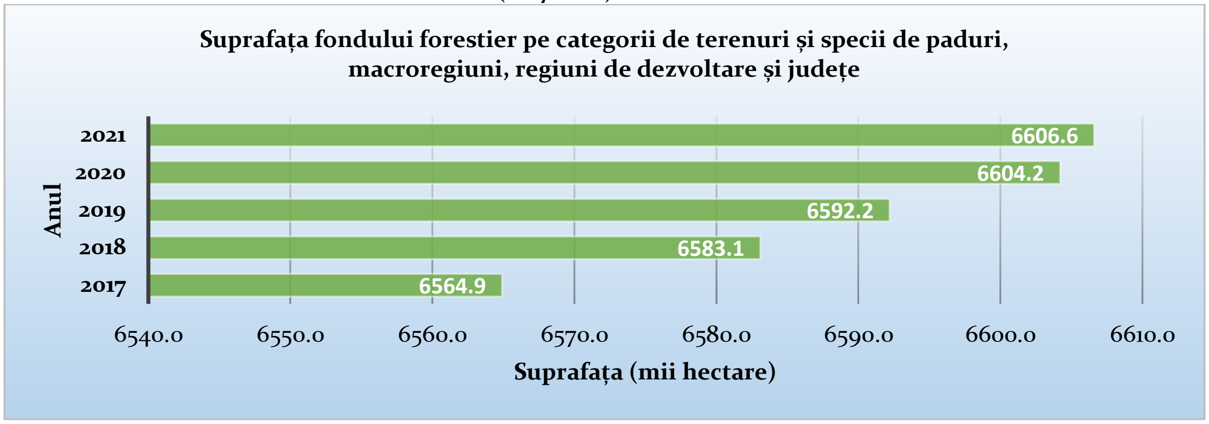
The area of the forest fund by categories of land and species of forests, macro-regions, development regions and counties, was in 2021 of 6606.6 thousand hectares, maintaining the growth trend of recent years.
The evolution of the area of the forest fund in the period 2017-2021, by categories of land and species of forests, macro-regions, development regions and counties, is represented in the table and figure below.

Table VIII.4. Area of forest fund (2017-2021)

Year	Area (thousands of hectares)
2017	6564.9
2018	6583.1
2019	6592.2
2020	6604.2
2021	6606.6

Data source NIS, TEMPO database

Figure VIII.16. Evolution of the area of the forest fund (2017-2021)



Data source NIS, TEMPO database

The harvesting of wood mass from the forest fund, the public property of the state, administered by the National Forestry Authority - Romsilva

A. Volume of wood mass harvested

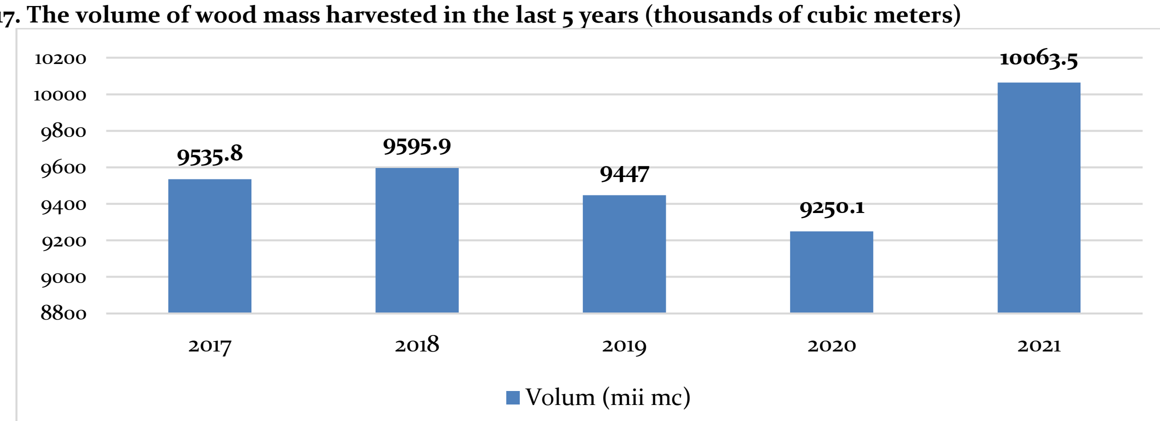
In 2021, a total volume of 10,063.5 thousand cubic meters of wood mass was harvested from the state's public forest fund. The situation of wood mass harvesting by ways of capitalization is presented in the table below.

Table VIII.5. The situation of the wood mass harvesting by ways of capitalization (thousands of cubic meters)

YEAR	The total volume of wood harvested	from which:		
		utilized as standing woody biomass	exploited through the provision of services	operated by own forces
2017	9,535.8	7,556.2	441.9	1,537.7
2018	9,595.9	5,622.2	2,005.3	1,968.4
2019	9,447.0	6,497.6	1,048.6	1,900.8
2020	9,250.1	6,469.1	892.0	1,889.0
2021	10,063.5	7,456.9	793.7	1,812.9

Source: National Directorate of Forests - Romsilva

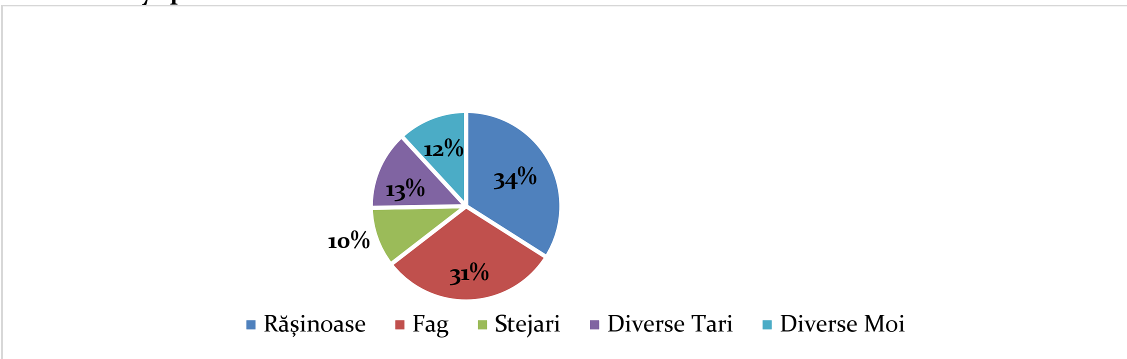
Figure VIII.17. The volume of wood mass harvested in the last 5 years (thousands of cubic meters)



Source: National Directorate of Forests - Romsilva

The structure by species of the volume harvested in 2021 is, in general, similar to that of previous years, being represented as follows:

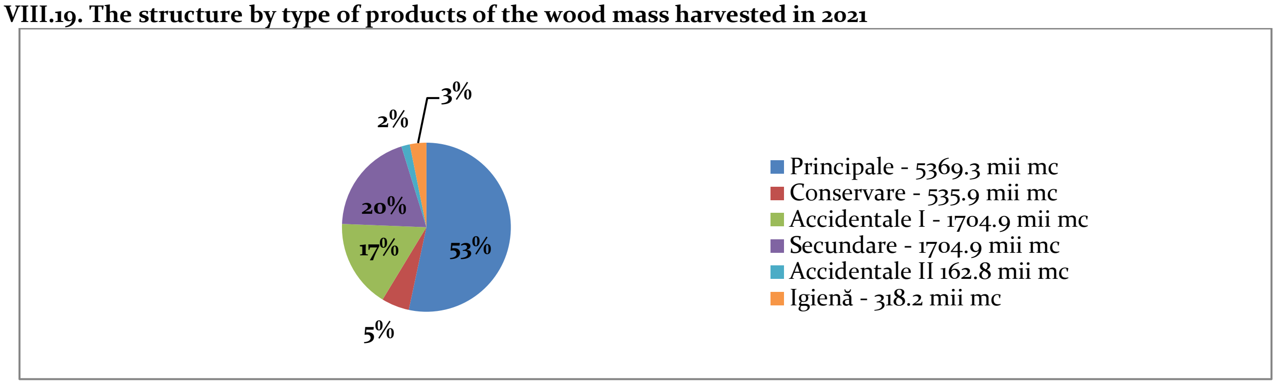
Figure VIII.18. Structure by species of the volume of timber harvested in 2021



Source: National Directorate of Forests - Romsilva

By type of products, 7,610.1 thousand cubic meters represent the main products and those assimilated to them (preservation cuts and accidental products I), 2,135.2 thousand cubic meters are secondary products (including the volume of accidental products II) and 318.2 thousand cubic meters used for hygiene products.

Figure VIII.19. The structure by type of products of the wood mass harvested in 2021

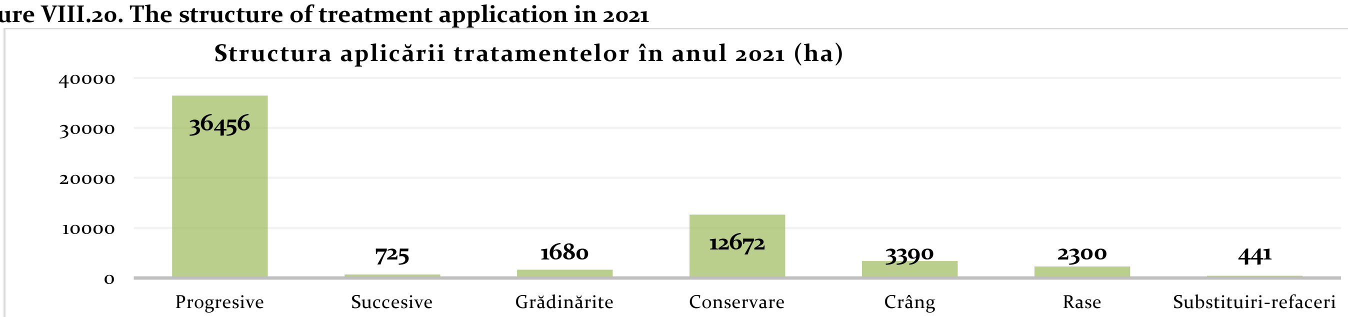


Source: National Directorate of Forests - Romsilva

Due to the action of some destabilizing factors, biotic and/or abiotic, accidental products were harvested during 2021 that accumulated a volume of 1,867.7 thousand cubic meters (19% of the total volume of wood mass harvested in 2021), from which 1,704.9 thousand cubic meters of accidental products I and 162.8 thousand cubic meters of accidental products II.

The proportion of treatment applications (forest regeneration methods) as an area covered is presented in the graph below.

Figure VIII.20. The structure of treatment application in 2021



Source: National Directorate of Forests - Romsilva

B. Care work for young trees

In 2021, maintenance works were carried out on a total area of 102,619 ha in the state-owned forestry fund managed by RNP – Romsilva, in accordance with the provisions of the forest management.

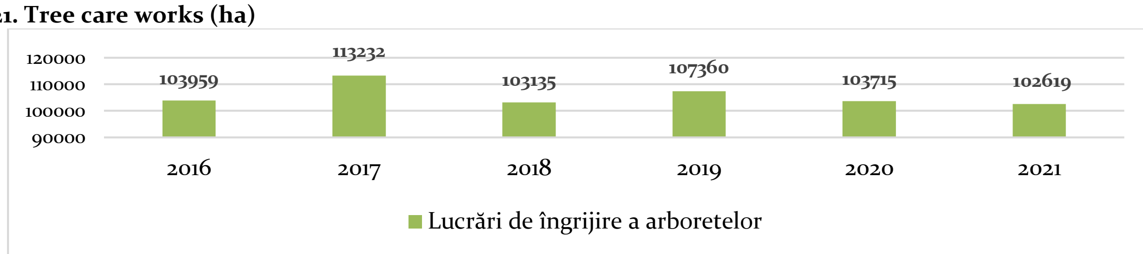
By nature of works, the situation of the maintenance works is presented as follows:

Table VIII.6. The status of maintenance works by nature of works (ha)

Nature of works	2016	2017	2018	2019	2020	2021
Clearcuts	10,220	10,614	12,797	11,334	10,776	9,400
Cleanings	16,388	17,040	18,723	17,533	17,711	16,679
Thinnings	75,814	83,067	69,978	76,430	73,506	74,955
Artificial pruning	1,537	2,511	1,637	2,063	1,722	1,585
TOTAL	**103,959**	**113,232**	**103,135**	**107,360**	**103,715**	**102,619**

Source: National Directorate of Forests - Romsilva

Figure VIII.21. Tree care works (ha)



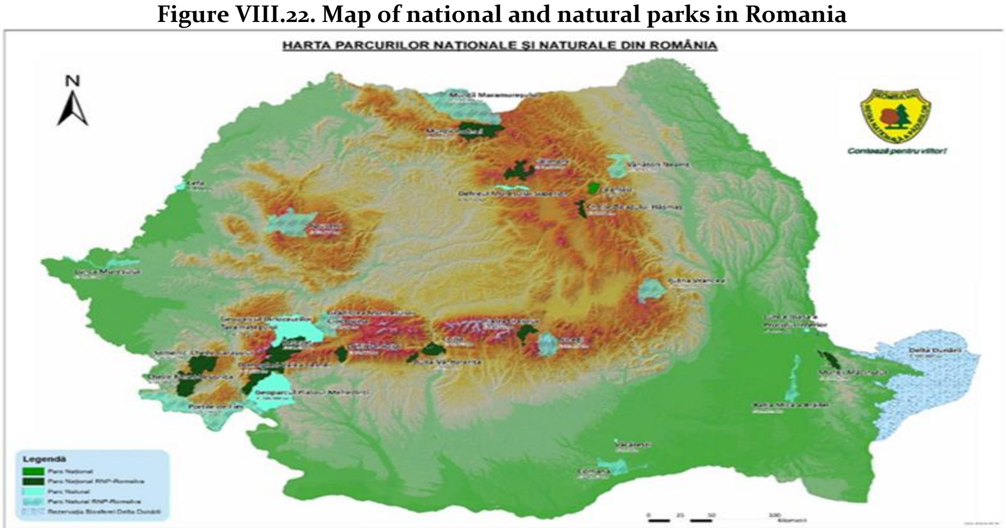
Source: National Directorate of Forests - Romsilva

In the forest resources owned by other proprietors, based on the management/service contracts concluded with the National Forest Administration - Romsilva, the forest directorates aimed to carry out the care work for young stands and in the forest resources owned by other proprietors, in accordance with the provisions of the forest management plans and the condition of the stands. In 2021, care work for young stands was carried out on a total area of 13,798 hectares in the respective forests, of which: Clearances: 524 ha; Cleanings: 981 ha; Thinnings: 12,293 ha.

C. Protected areas

In 2021, from the total of 30 major protected natural areas designated at national level, whose total area represents approx. 1.67 million ha, the National Forestry Authority – Romsilva continued to administer 22 national and natural parks, through the 22 administrative structures with legal personality in its structure. The total area of the 22 parks in the management structure, according to the GIS measurement made by the staff of the park administrations, is approx. 853 thousand ha, with a total area of forest land of approx. 599 thousand ha, of which approx. 373 thousand ha of forest fund public property of the state.

Figure VIII.22. Map of national and natural parks in Romania



Source: National Directorate of Forests - Romsilva

Taking into account the internal zoning of the parks, it should be mentioned in particular that, from the total area of the forest fund publicly owned by the state in the parks managed by the directorate, approx. 109 thousand ha are found in the strict protection zone - (ZPS) and the integral protection zone - (ZPI) (areas where the exploitation of natural resources is prohibited). The situation of the areas in the national and natural parks administered by RNP-Romsilva is detailed in the following table:

Table VIII.7. The situation of the areas in the national and natural parks administered by RNP-Romsilva

No. crt.	NAME OF THE PARK	County	Park area (cf. GIS) (ha)	from which:			
				Forest Fund		from which: forest fund the property of the state	
				total	of which: ZPI+ZPS	total	of which: ZPI+ZPS
	NATIONAL PARKS						
1	Buila - Vânturarița	VL	4,465	3,873	1,459	2,087	532
2	Călimani	BN, SV, MS, HR	24,556	17,933	10,601	10,190	5,462
3	Cheile Bicazului - Hășmaș	NT, HR	7,072	6,644	4,889	2,081	1,878
4	Cheile Nerei-Beușnița	CS	36,661	30,982	13,951	29,372	13,947
5	Cozia	VL	16,813	16,072	8,134	8,661	5,184
6	Defileul Jiului	GJ, HD	10,941	9,443	8,930	1,993	1,970
7	Domogled - Valea Cernei	CS, MH, GJ	61,211	46,544	20,135	44,278	19,854
8	Munții Măcinului	TL	11,200	11,158	3,839	11,148	3,839
9	Munții Rodnei	BN, MM	47,202	29,116	14,322	2,497	2,198
10	Piatra Craiului	AG, BV	14,766	10,880	6,223	3,771	2,490
11	Retezat	HD	38,259	20,494	11,143	6,989	2,787
12	Semenic – Cheile Carașului	CS	36,052	30,775	11,187	30,091	11,179
	TOTAL NATIONAL PARKS		**309,198**	**233,914**	**114,813**	**153,158**	**71,320**
	NATURAL PARKS						
13	Apuseni	AB, BH, CJ	76,067	60,447	13,978	26,275	8,434
14	Balta Mică a Brăilei	BR	24,123	13,446	3,453	11,799	1,947
15	Bucegi	BV, DB, PH	32,497	21,411	6,643	10,862	4446
16	Comana	GR	25,107	8,024	870	7,423	856
17	Grădiștea Muncelului - Cioclovina	HD	38,116	26,698	4,672	17,655	2,092
18	Lunca Mureșului	AR, TM	17,420	6,468	811	5,821	528
19	Munții Maramureșului	MM	133,484	86,968	12,638	48,318	7,290
20	Porțile de Fier	CS, MH	128,196	82,089	9,526	73,471	9,497
21	Putna Vrancea	GR	38,116	33,618	7,617	2,710	2,523
22	Vânători Neamț	AR, TM	30,631	26,204	616	15,268	243
	TOTAL NATURAL PARKS		**543,757**	365,373	**60,824**	**219,602**	**37,856**
	GRAND TOTAL		**852,955**	**599,287**	**175,637**	**372,760**	**109,176**

Source: National Directorate of Forests - Romsilva

Regarding the ownership structure of the forest fund in the national and natural parks administered by RNP-Romsilva, we can specify that, at this time, the Romanian state predominates as owner with approx. 65%. The decrease in the area of the state-owned forest fund represents a challenge for the park administrations, which must put more effort into the activity of raising the awareness of the local population regarding conservation measures, in the conditions of non-granting or late granting of compensations for the loss of income recorded by private forest owners.

The parks in which the private forest fund represents more than 50% are: Munții Rodnei, Piatra Craiului, Retezat, Cheile Bicazului, Defileul Jiului national parks and Putna Vrancea and Bucegi natural parks.
The administration of the 22 national and natural parks, together with the Natura 2000 sites and the protected natural areas of national interest that overlap with them, is carried out on the basis of the management contracts concluded with the central public authority for environmental protection and additional documents concluded with the National Agency for Natural Protected Areas. The number of protected natural areas, which are the subject of these management contracts, is 271.
Regarding the composition of the park administration structures (according to the specific legislation), this includes: park director, security chief, economist, legal advisor, responsible for public awareness and ecological education, specialist in information technology, biologist, as well as between 6 and 20 agents of land, depending on the surface and the specifics of the protected natural area.
The main objectives of national and natural parks are the preservation of biodiversity, the landscape, cultural identity, as well as the promotion of tourism, traditions, etc. The way to achieve the objectives is established by the management plans developed by the park administration.
From those 22 of national and natural parks administered by the National Forestry Authority - Romsilva:

- 13 parks have an approved management plan, as follows:
    1. Balta Mică a Brăilei Natural Park: GD no. 538/2011 for the approval of the Management Plan of the Balta Mică a Brăilei Natural Park;
    2. Porţile de Fier Natural Park: GD no. 1048/2013 for the approval of the Management Plan and the Regulations of the Porţile de Fier Natural Park;
    3. Macin Mountains National Park: GD no. 1074/2013 for the approval of the Management Plan of the Măcin Mountains National Park;
    4. Buila-Vânturarița National Park: Order of the Minister of Environment, Water and Forests no. 1151/2016 regarding the approval of the Management Plan and the Regulations of the Buila-Vânturarița National Park, of the Natura 2000 sites ROSCI0015 Buila – Vânturarița, ROSPA0025 Cozia-Buila-Vânturarița and of the protected natural areas included therein;
    5. Cheile Bicazului – Hăşmaş National Park: Order of the Minister of Environment, Water and Forests no. 1523/2016 regarding the approval of the Management Plan and the Regulations of the Cheile Bicazului - Hăşmaş National Park and the Natura 2000 sites ROSCI0027 and ROSPA0018 Cheile Bicazului - Hăşmaş (without the overlap area with ROSCI0033 Cheile Şugaului - Munticelu);
    6. Cheile Nerei-Beuşniţa National Park: Order of the Minister of Environment, Water and Forests no. 1642/2016 regarding the approval of the Management Plan and the Regulations of the Cheile Nerei - Beusniţa National Park and the Natura 2000 sites ROSCI0031 Cheile Nerei - Beusniţa and ROSPA0020 Cheile Nerei - Beusniţa;
    7. Cozia National Park: Order of the Minister of Environment, Water and Forests no. 1060/2016 regarding the approval of the Management Plan and Regulations of the Cozia National Park and the Natura 2000 sites in its area ROSCI0046 Cozia and ROSPA0025 Cozia – Buila - Vânturarița;
    8. Domogled - Valea Cernei National Park: Order of the Minister of Environment, Water and Forests no. 1121/2016 regarding the approval of the Management Plan and the Regulations of the Domogled - Valea Cernei National Park and the Natura 2000 sites ROSCI0069 and ROSPA0035;
    9. Lunca Mureșului Natural Park: Order of the Minister of Environment, Water and Forests no. 1224/2016 regarding the approval of the Management Plan and the Regulation of the Lunca Mureşului Natural Park;
    10. Maramureş Mountains Natural Park: Order of the Minister of Environment, Water and Forests no. 1157/2016 regarding the approval of the Management Plan and the Regulations of the Maramureş Mountains Natural Park, of the site of community importance ROSCI0124 Maramureș Mountains, of the avifaunistic special protection area ROSPA0131 Maramureş Mountains and of the overlapping protected natural areas of national interest;
    11. Vânători – Neamţ Natural Park: Order of the Minister of the Environment, Waters and Forests no. 1246/2016 regarding the approval of the Management Plan and the Regulations of the Vânători Neamţ Natural Park and the Natura 2000 sites ROSCI0270 Vânători Neamţ and ROSPA0107 Vânători Neamţ;
    12. Rodnei Mountains National Park: Order of the Minister of the Environment no. 307/2019 regarding the approval of the Management Plan and the Regulations of the Rodnei Mountains National Park, of the ROSCI0125 of the Rodnei Mountains, of the ROSPA0085 of the Rodnei Mountains and of the other protected natural areas of national interest included;

13. Piatra Craiului National Park: Order of the Minister of Environment, Water and Forests no. 296/21 February 2020 regarding the approval of the Management Plan and the Regulations of the Piatra Craiului National Park and the Natura 2000 site ROSCI0194 Piatra Craiului.

- In the case of 4 parks, Putna Natural Park – Vrancea, Comana Natural Park, Călimani National Park, Grădiștea Muncelului Natural Park – Cioclovina, the management plans are in the final stage of approval by the relevant ministry;
- 1 management plan, of the Bucegi Natural Park, is currently in the approval stage, at the National Agency for Natural Protected Areas;
- 2 management plans, of the Apuseni Natural Park and the Retezat National Park, are drawn up through POIM projects;
- In the case of 2 parks, Defileul Jiului National Park and Semenic - Cheile Carașului National Park, the management plans are in the regulatory procedure with the competent environmental authorities.

In terms of biodiversity management, in 2021, 896 inventory actions of flora/fauna species and natural habitats were carried out, mapping was updated for 460 flora/fauna species and 47 natural habitats, and also carried out monitoring activities of species and natural habitats within the protected natural areas under administration.

The park administrations carried out actions to raise awareness and inform the local population about the need to protect nature, the importance of promoting ecotourism, for the purpose of the sustainable development of the area. In this sense, in 2021, the park administrations carried out a number of 550 awareness actions and a number of 403 ecological education actions, greatly reduced in number compared to the previous year. For a minimal negative impact of tourist activities on the park, the park administrations have created over time, but also in 2021, a series of tourist facilities, both from their own funds and especially from projects. Among these we list: visitor centers, information points, camping sites, resting places with benches, tables, educational information boards, themed trails, places to light fires, the installation of barriers on forest roads that penetrate into protected natural areas. At the same time, an important part of the activity is the maintenance of the visiting infrastructure, an activity financed from the revenues obtained by the park administrations from visiting the protected natural area.

In order to prevent illegal activities, 10,873 patrol actions were carried out, some of which were carried out with the support of the Gendarmerie, the Romanian Police, the Environmental Guard, the Forest Guard and other institutions.

The basic financing of the 22 parks is provided by the National Directorate of Forests-Romsilva on the basis of management contracts concluded for a period of 10 years. In 2021, RNP-Romsilva ensured for the 22 administrations a total budget of approx. 31.2 million lei (without the sums related to external funds). A major concern is attracting funds through projects to achieve management objectives. The amount attracted by the park administrations during 2021, from various funding sources, is 32.35 million lei, most of the amounts being attracted through the Large Infrastructure Operational Program, followed by the LIFE program, Interreg, etc.

Human health

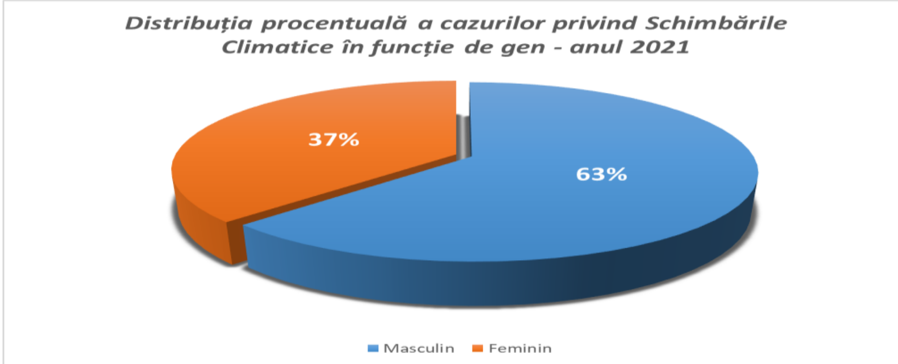
RO 60
Indicator code Romania: RO 60 EEA indicator code: CLIM 36
TITLE: **EXTREME TEMPERATURES AND HEALTH**
DEFINITION: This indicator is defined by the annual mortality rate at national level caused by extreme temperatures during the summer period.

The National Institute of Public Health, through the National Center for Monitoring Community Environmental Risks (CNMRMC), manages the National Electronic Environmental Risks Register (ReSanMed), representing a specific national-level tool for managing information related to the impact of environmental factors on the health of the population.

From the data recorded in the ReSanMed electronic platform, corresponding to the "Climate Change" module, where cases of illness that can be attributed to extreme weather conditions (frostbite, heatstroke, hypothermia, etc.) have been registered, the following results for the year 2021 are obtained:

- distribution of cases of disease that can be determined by extreme phenomena according to gender:
  - Male, with a percentage of 63% (901 cases)
  - Female, with a percentage of 37% (533 cases)

Figure VIII.23. Distribution of disease cases by gender in 2021



Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

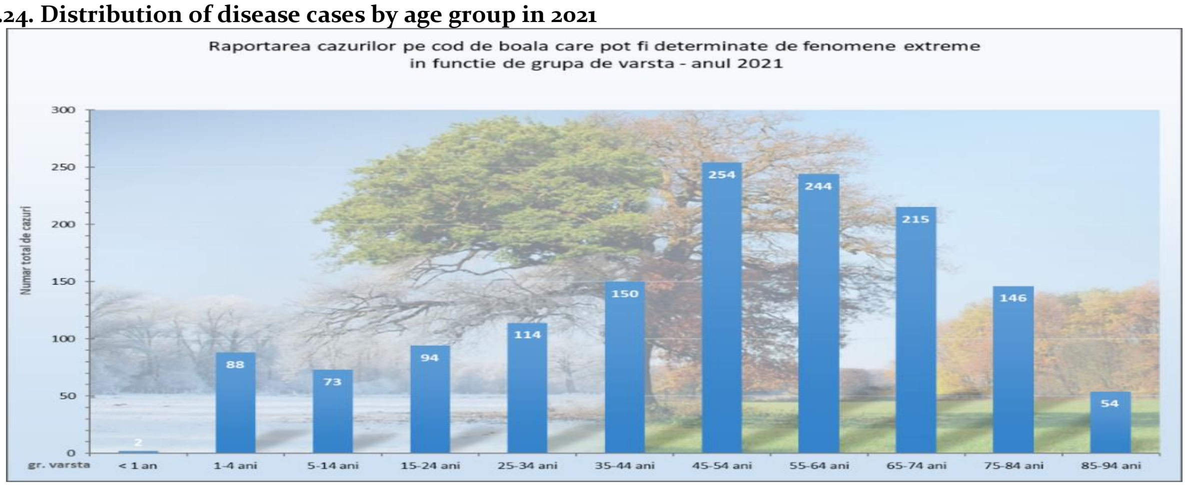
- according to the records in the ReSanMed platform, related to the Climate Change module, for the distribution of cases according to age, 11 age groups were structured as follows:

Table VIII.8. Disease cases reported by age group in 2021

No.	Age group	Cases reported
1	under 1 year	2
2	1-4 years	88
3	5-14 years	73
4	15-24 years	94
5	25-34 years old	114
6	35-44 years old	150
7	45-54 years old	254
8	55-64 years	244
9	65-74 years old	215
10	75-84 years	146
11	>85 years	54

Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

Figure VIII.24. Distribution of disease cases by age group in 2021



Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

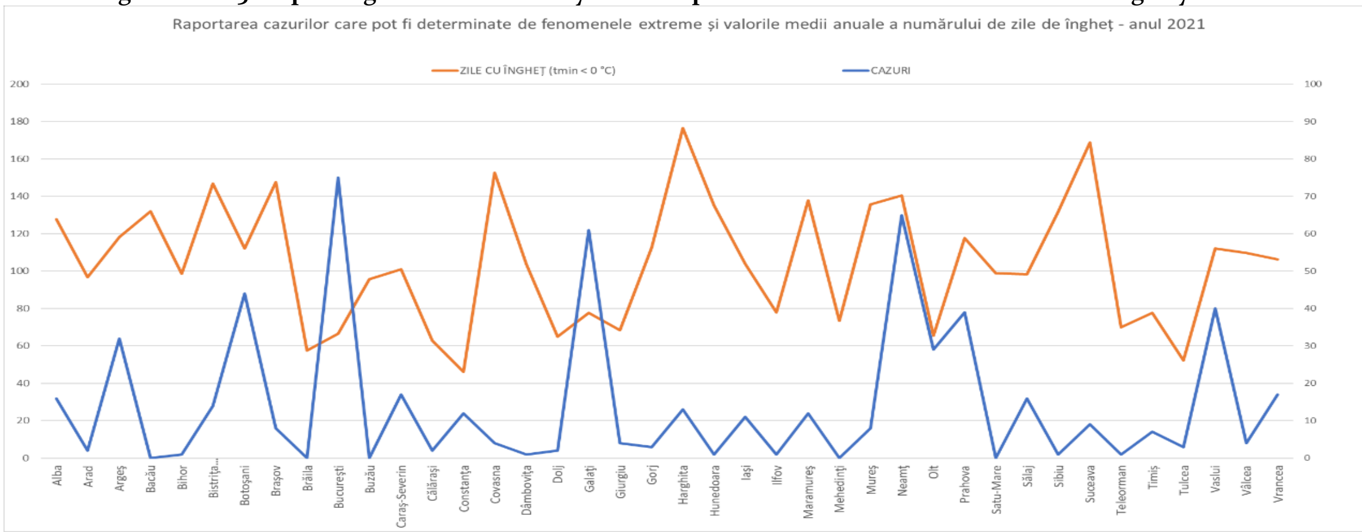
There is an increase in the number of cases correlated with age, the most affected age groups are those over the age of 45, with a maximum in the age range of 45-54 years.
The distribution of reported cases, according to the months of the year (December, January, February and March) and the annual average values of the number of freezing days (air temperature tmin < 0°C), data provided by the National Meteorological Administration is presented in the table and the following figure.

Table VIII.9. Reporting of cases caused by extreme weather events and the number of frost days in the year 2021

COUNTY	CASES	FREEZING DAYS (tmin < 0 °C)
Alba	16	127.8
Arad	2	96.7
Argeş	32	118.1
Bacău	0	132.1
Bihor	1	98.7
Bistriţa Năsăud	14	146.7
Botoşani	44	112.0
Braşov	8	147.5
Brăila	0	57.6
Bucureşti	75	66.6
Buzău	0	95.8
Caraş-Severin	17	101.0
Călăraşi	2	62.8
Constanţa	12	46.2
Covasna	4	152.6
Dâmboviţa	1	103.6
Dolj	2	65.1
Galaţi	61	77.7
Giurgiu	4	68.5
Gorj	3	112.7
Harghita	13	176.4
Hunedoara	1	135.2
Iaşi	11	104.0
Ilfov	1	77.9
Maramureş	12	137.9
Mehedinţi	0	73.5
Mureş	8	135.7
Neamţ	65	140.4
Olt	29	65.6
Prahova	39	117.8
Satu-Mare	0	98.8
Sălaj	16	98.4
Sibiu	1	131.8
Suceava	9	168.8
Teleorman	1	70.1
Timiş	7	77.7
Tulcea	3	52.2
Vaslui	40	112.0
Vâlcea	4	109.8
Vrancea	17	106.2

Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

Figure VIII.25. Reporting of cases caused by extreme phenomena and the number of freezing days in 2021



Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

The reporting of cases by age group in the summer period (June, July, August) and the annual average values of the number of days with heatwave (air temperature (tmax >35 °C) data provided by the National Meteorological Administration are represented subsequently.

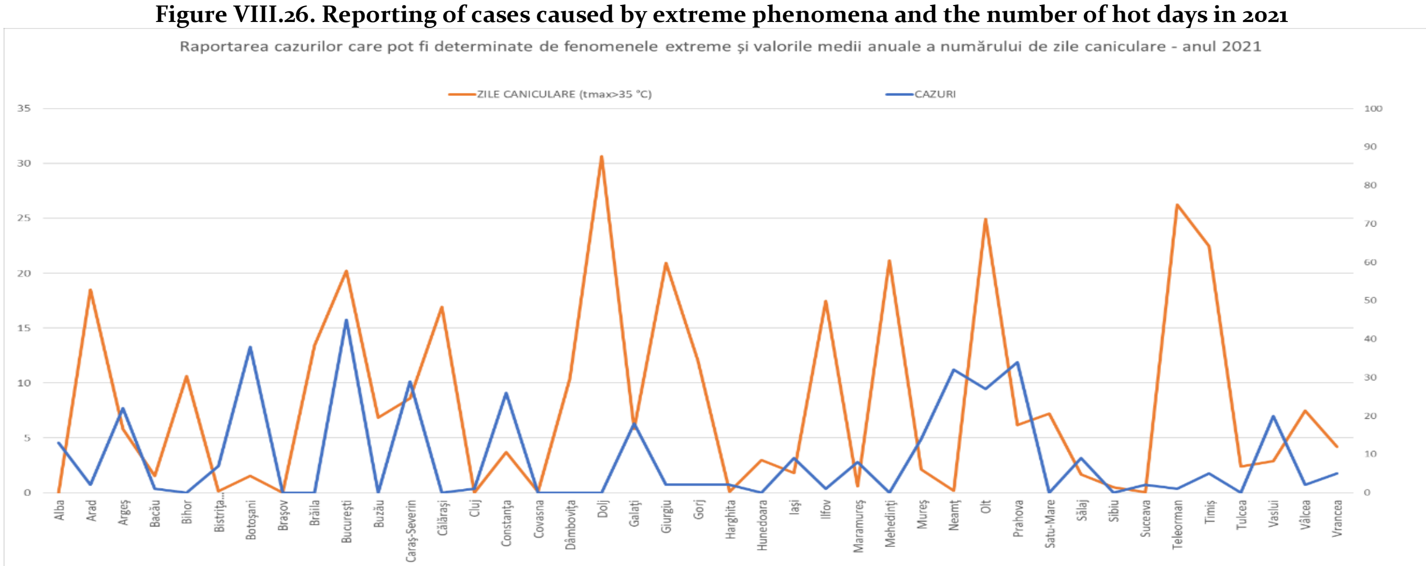
Table VIII.10. Reporting of cases caused by extreme phenomena and the number of hot days in 2021

COUNTY	CASES	HOT DAYS (tmax>35 °C)
Alba	13	0
Arad	2	18.5
Argeş	22	5.8
Bacău	1	1.5
Bihor	0	10.6
Bistriţa Năsăud	7	0.1
Botoşani	38	1.5
Braşov	0	0.0
Brăila	0	13.4
Bucureşti	45	20.2
Buzău	0	6.9
Caraş-Severin	29	8.6
Călăraşi	0	16.9
Cluj	1	0.5
Constanţa	26	3.7
Covasna	0	0.1
Dâmboviţa	0	10.4
Dolj	0	30.7
Galaţi	18	5.8
Giurgiu	2	20.9
Gorj	2	12.1
Harghita	2	0.1
Hunedoara	0	3.0
Iaşi	9	1.8
Ilfov	1	17.5
Maramureş	8	0.6
Mehedinţi	0	21.2
Mureş	14	2.1
Neamţ	32	0.2
Olt	27	25.0

Prahova	34	6.1
Satu-Mare	0	7.2
Sălaj	9	1.7
Sibiu	0	0.5
Suceava	2	0.0
Teleorman	1	26.2
Timiș	5	22.5
Tulcea	0	2.4
Vaslui	20	2.9
Vâlcea	2	7.5
Vrancea	5	4.2

Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

Figure VIII.26. Reporting of cases caused by extreme phenomena and the number of hot days in 2021



Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

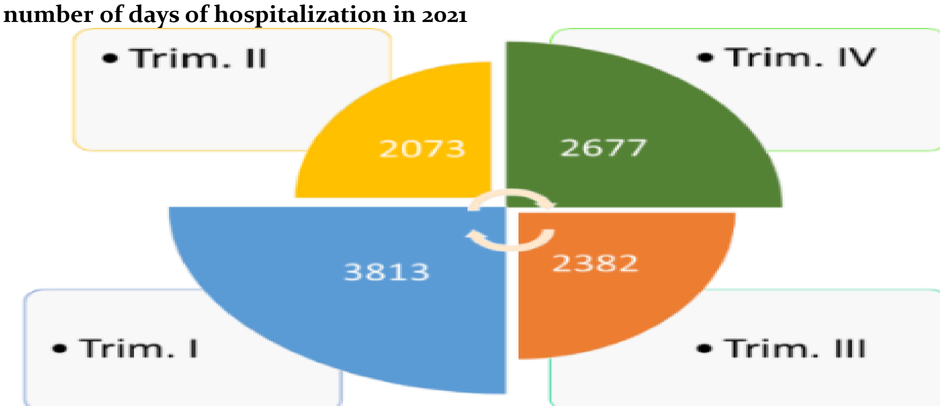
For the cases regarding Climate Change, registered in the ReSanMed electronic platform, in the year 2021, the most days of hospitalization were in the first trimester.

Table VIII.11. The number of days of hospitalization in 2021

No. crt.	No. days of hospitalization	Total
1	Quarter I	3813
2	Quarter II	2073
3	Quarter III	2382
4	Quarter IV	2677

Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

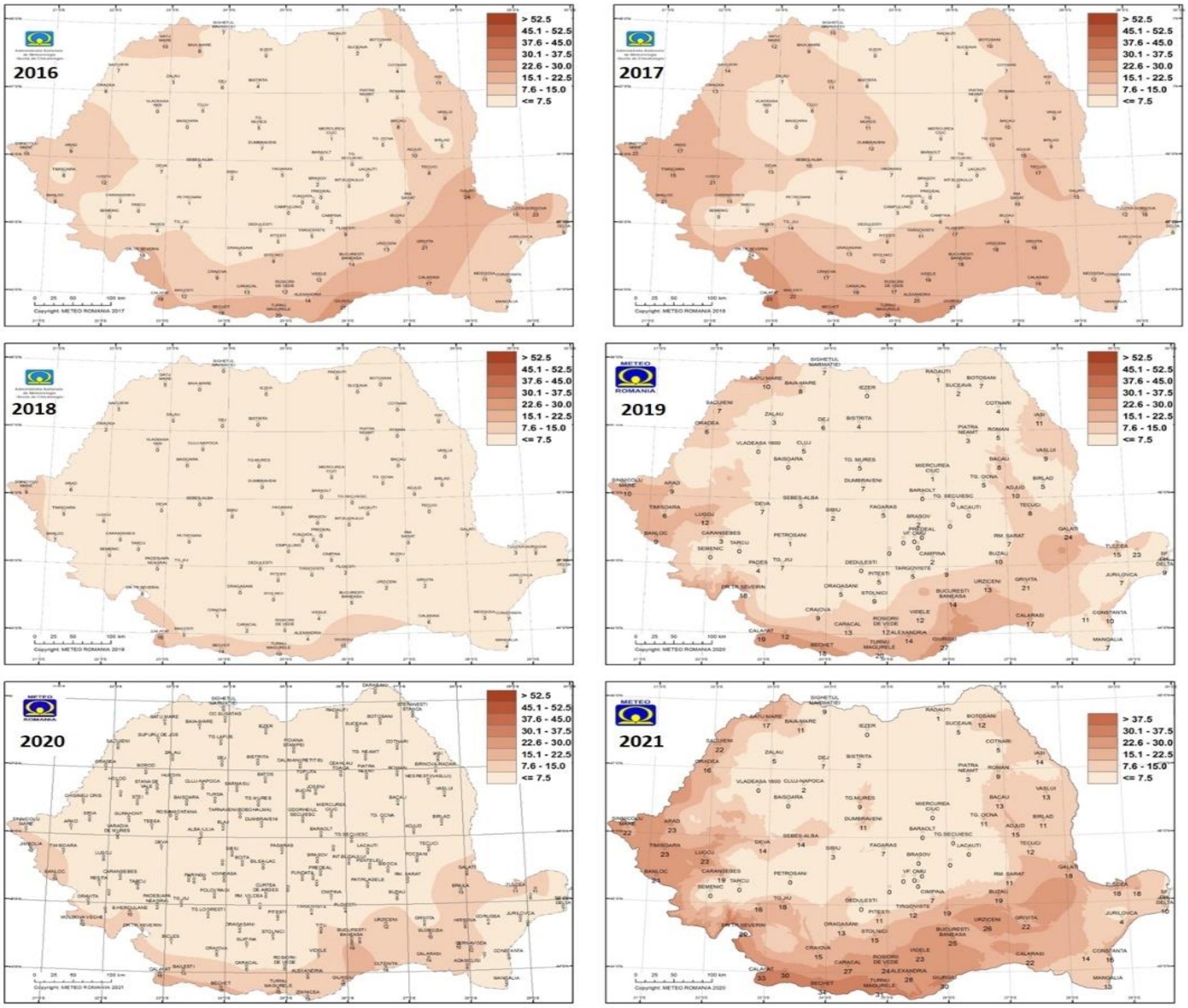
Figure VIII.27. The number of days of hospitalization in 2021



Source: National Institute of Public Health – National Center for Monitoring Risks in the Community Environment

In conclusion, Climate Change has effects on the health of the population, according to records in the ReSanMed module in 2021, with most conditions appearing in the cold season, for people over 45 years old. The summer of 2021 was noted for the highest values of the number of days in which the THI temperature-humidity index exceeded the critical threshold of thermal discomfort (80 units) in the last 5 years.

Figure VIII.28. Number of days in 2016-2020 and in 2021 when the ITU temperature-humidity index exceeded the critical thermal discomfort threshold (80 units)



Source: National Meteorological Administration

Energy

RO 62

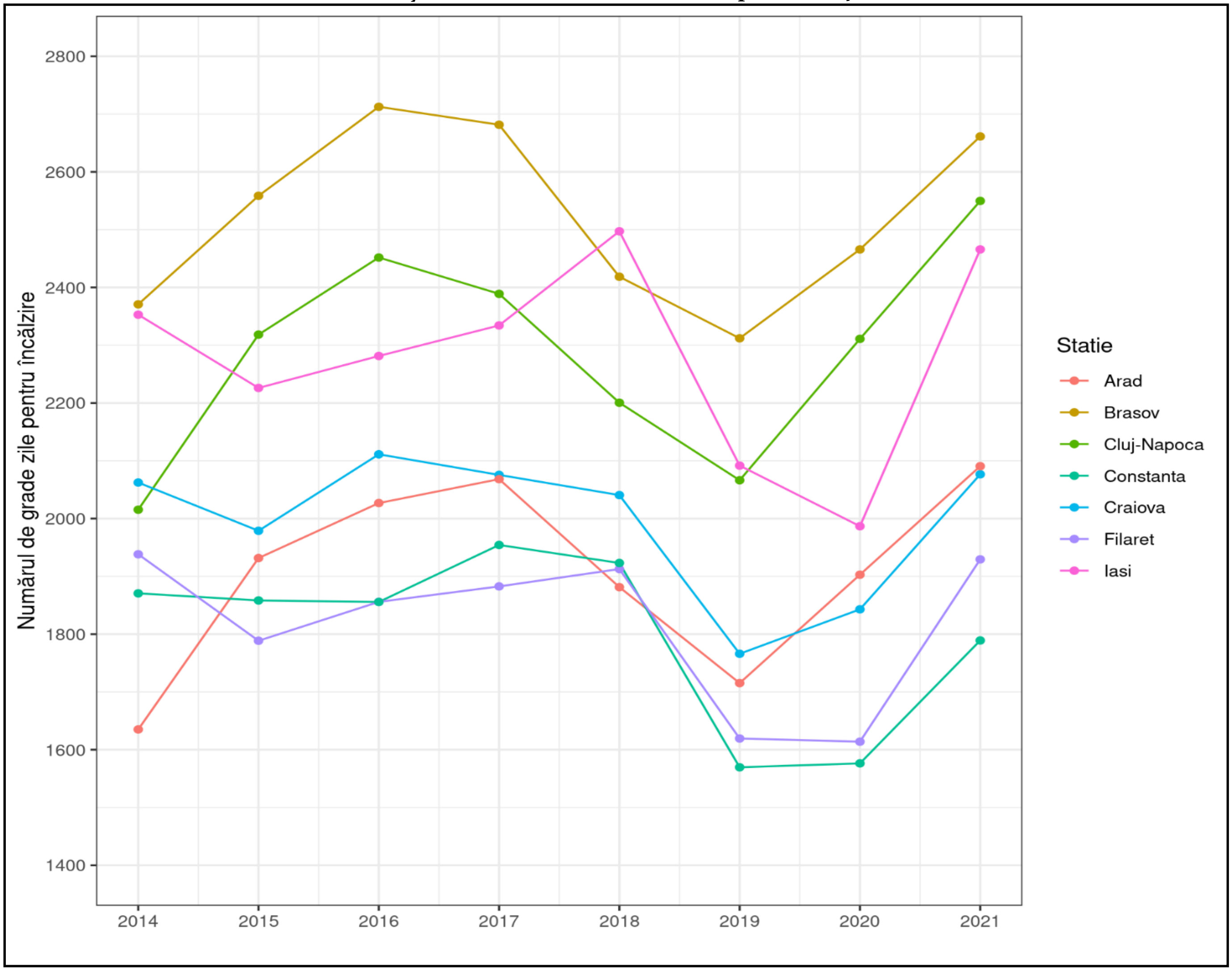
Indicator code Romania: RO 62
EEA indicator code: CLIM 47

TITLE: **NUMBER OF DEGREE-DAYS FOR HEATING**

DEFINITION: This indicator presents the trend at national level of the number of degree-days for heating.

In 2021 compared to 2020, the number of degree-days for heating increased for all analyzed stations.

Figure VIII.29. The number of degree-days for heating, corresponding to meteorological data from 7 cities covering the territory of Romania, calculated for the period 2014-2021



Source: National Meteorological Administration

DETERMINING FACTORS AND PRESSURES ON CLIMATE CHANGE

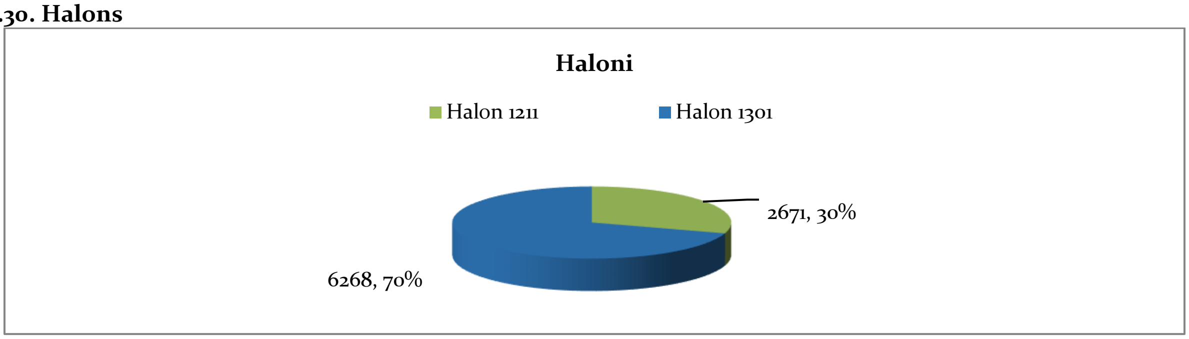
OZONE LAYER DEPLETING SUBSTANCES

RO 06
Indicator code Romania: RO 06 EEA indicator code: CSI 06
TITLE: **PRODUCTION AND CONSUMPTION OF SUBSTANCES THAT LEAD TO THE DESTRUCTION OF THE OZONE LAYER**
DEFINITION: This indicator quantifies the annual production and consumption of substances that deplete the ozone layer (ODS – Ozone-Depleting Substances) in Romania. ODS are long-lived chemicals containing chlorine and bromine that destroy the stratospheric ozone layer.

Consumption of ozone-depleting substances according to Regulation 1005/2009 in 2021

halons for extinguishing fires on aircraft, military all-terrain vehicles, military ships
- H 1301 = 6268 kg
- H 1211 = 2671 kg

Figure VIII.30. Halons



Source: National Environmental Protection Agency

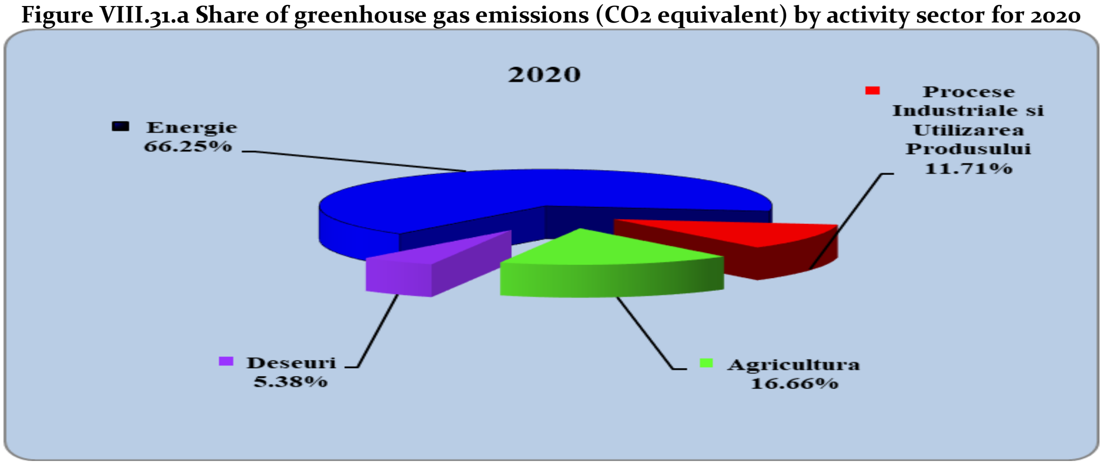
GREENHOUSE GAS EMISSIONS

Table VIII.12. Greenhouse gas emissions by activity sector

No. Crt.	Sector/Sub-sector - INEGES	Emissions (kt CO_2 equiv.)		Trend (%)	
		2019	2020		
1	**Energy**	76,350.44	72,834.34	-4.61	↘
	- Energy industry	22,130.93	18,339.29	-17.13	↘
	-Manufacturing industry and constructions	13,656.83	14,781.93	8.24	↗
	- Transport	18,936.57	18,401.03	-2.83	↘
	- Institutional commercial	2,250.68	2,090.24	-7.13	↘
	-Residential	7,946.08	8,366.10	5.29	↗
	- Fugitive emissions	9,212.56	8,584.68	-6.82	↘
2	**Industrial processes and product use**	12,786.25	12,867.96	0.64	↗
3	**Agriculture**	18,861.24	18,315.85	-2.89	↘
4	**Waste**	5,941.45	5,916.18	-0.43	↘
5	**Total GHG (excluding LULUCF)**	113,939.38	109,934.33	-3.52	↘

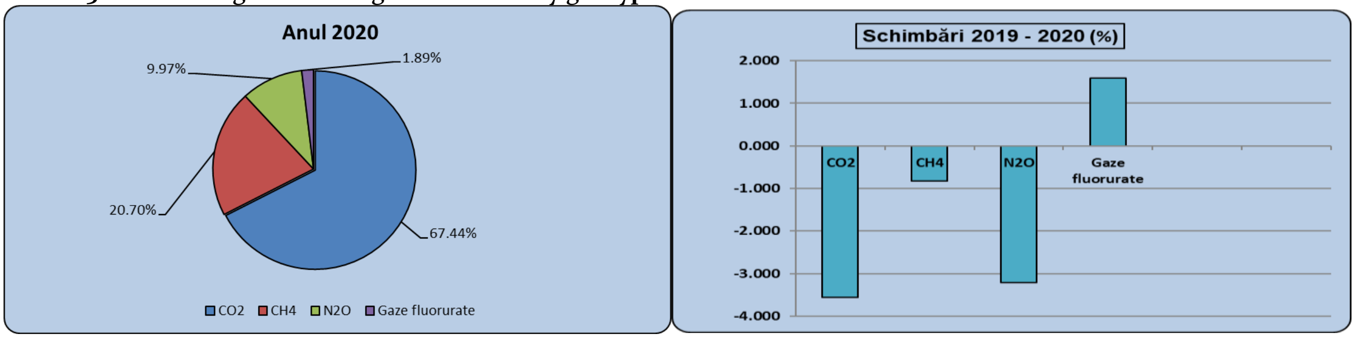
Source: ANPM

Figure VIII.31.a Share of greenhouse gas emissions (CO_2 equivalent) by activity sector for 2020



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

Figure VIII.31.b Share of greenhouse gas emissions by gas type



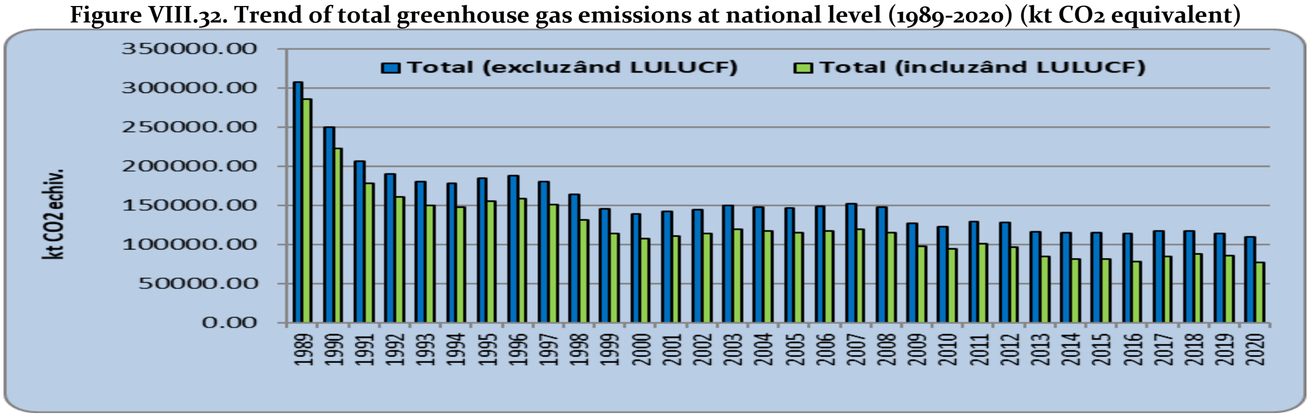
Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

GREENHOUSE GAS EMISSIONS TRENDS

RO 10
Indicator code Romania: RO 10 EEA indicator code: CSI 10
TITLE: **TREND OF GREENHOUSE GAS EMISSIONS**
DEFINITION: This indicator presents the existing trends in greenhouse gas emissions. It analyzes the trends (total and by sector), in relation to the obligations of the Member States to respect the objectives of the Kyoto protocol.

In 2020, total greenhouse gas emissions (excluding the contribution of the "Land use, land use change and forestry - LULUCF) sector decreased by 64.20% compared to the level of emissions in 1989, while net GHG emissions /retentions (taking into account CO2 retentions) decreased by 73.02%.
Total greenhouse gas emissions in 2020, excluding sequestration by absorbers, amounted to 109,934.33 kt CO2 equivalent.
The emission trend reflects the changes during this period characterized by the transition to the market economy; the period can be divided into three sub-periods: 1989-1999, 2000-2008 and 2009-2020.
The decline in economic activities and energy consumption between 1989 and 1992 directly caused the reduction in total emissions during this period. Emissions started to increase until 1996, following the revitalization of the economy. Considering the start of operation of the first reactor at the Cernavodă nuclear power plant (1996), emissions decreased again in 1997. The decrease continued until 1999. The level of emissions increased after 2000 and reflects the economic development in the period 2000- 2008. The limited decrease in GHG emissions in 2005, compared to 2004 and 2006 levels, was caused by the hydrological year positively influencing energy production in hydroelectric plants. Due to the global financial and economic crisis, GHG emissions decreased again in 2009-2012 and stabilized in 2013-2016. In 2017-2018, GHG emissions increased slowly in relation to the increase in the level of economic activities.

Figure VIII.32. Trend of total greenhouse gas emissions at national level (1989-2020) (kt CO_2 equivalent)



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

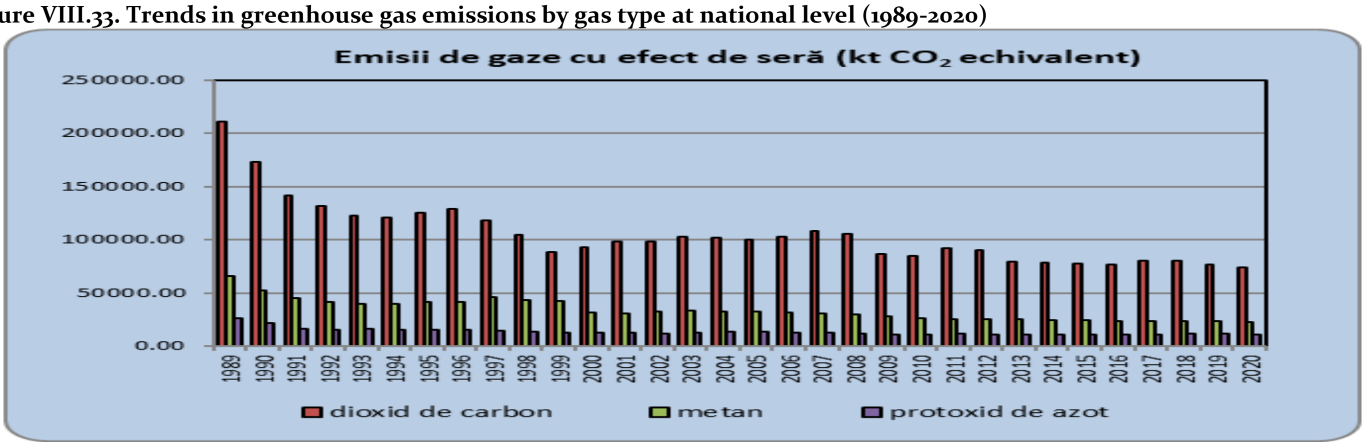
Among the greenhouse gases monitored at national level, carbon dioxide is the most significant pollutant, followed by methane and nitrous oxide.

*Carbon dioxide (CO2)*represents the most important anthropogenic greenhouse gas. The decrease in CO2 emissions in 2020 by 64.86% compared to 1989 (from 210,970.96 kt in 1989 - 68.71% to 74,138.01 kt in 2020 - 67.44%) is caused by the decrease in the amount of fossil fuels burned in the energy sector (especially in the production of electricity and heat, as well as manufacturing and construction industries) as a result of the decline in activity.

Methane emissions (CH4), mainly related to fugitive emissions from the extraction and distribution of fossil fuels and livestock, decreased in 2020 by 65.25% compared to 1989 (from 65,484.39 kt CO2 equivalent in 1989 to 22,757.37 kt CO2 equivalent in 2020). The decrease in CH4 emissions in agriculture is due to the decrease in the level of animal husbandry.

*N2O emissions*are generated mainly in the activities in agricultural soils in the agricultural sector and in the activities in the chemical industry in the Industrial Processes sector. The decline of these activities (decline in animal husbandry, decrease in synthetic N fertilizers applied to soil quantities, decrease in the level of crop production) is reflected in the trend of N2O emissions, and they decreased in 2020 by 58.06% (from 26,143.74 kt CO2 equivalent in 1989 to 10,965.12 kt CO2 equivalent in 2020).

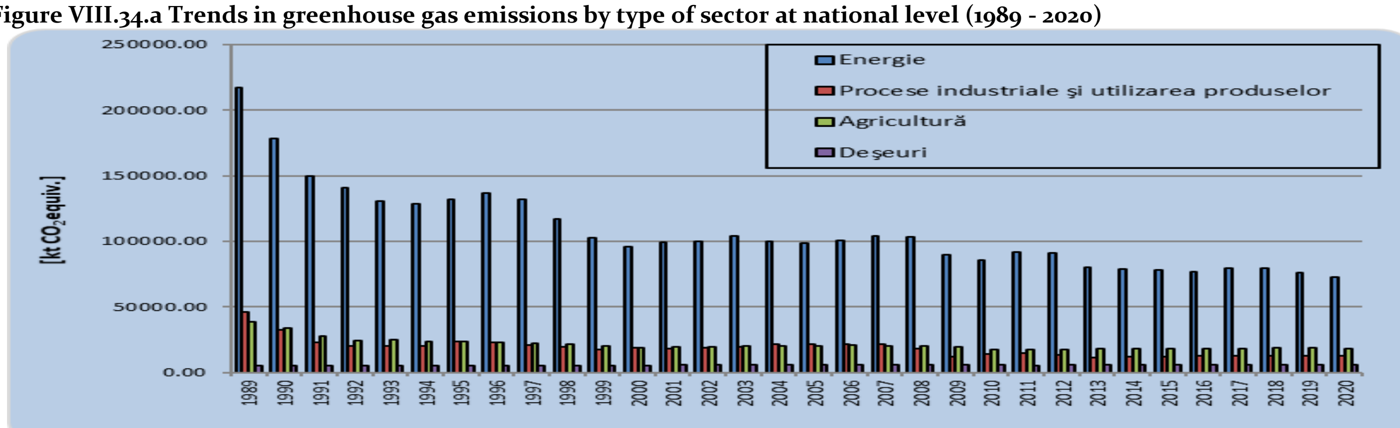
Figure VIII.33. Trends in greenhouse gas emissions by gas type at national level (1989-2020)



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

The figure below represents the trends of GHG emissions by each sector of INEGES, excluding the LULUCF sector. GHG emissions from the energy sector decreased by 66.50% compared to the base year 1989. A significant 72.06% decrease in GHG emissions was recorded in the Industrial Processes and Product Use sector in 2020 compared to the 1989 level as a result of the decline or cessation of certain production activities. GHG emissions from the Agriculture sector also decreased in 2020 by 52.25% compared to emissions in 1989, this fact based on the following causes: the decline of the animal breeding sector, the decrease in vegetable agricultural productions, the decrease in the quantities of fertilizers N-based synthetics applied to the soil. In the Waste sector, emissions increased in 2020 by 13.82%,

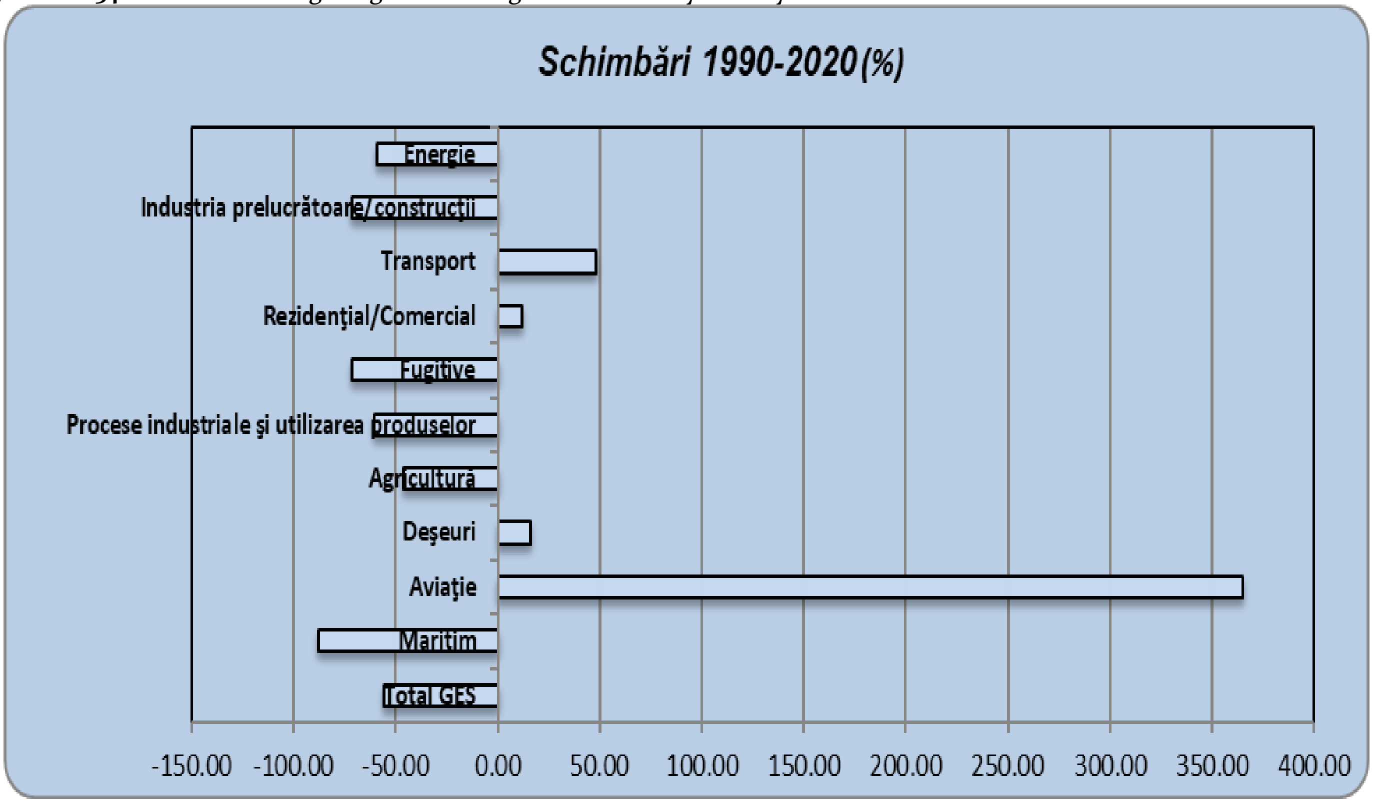
Figure VIII.34.a Trends in greenhouse gas emissions by type of sector at national level (1989 - 2020)



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

The figure below represents the changes in GHG emissions, for each sector of INEGES, at the level of 2020 compared to 1990.

Figure VIII.34.b Absolute change in greenhouse gas emissions by activity sector



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

AGGREGATED DATA ON GHG EMISSIONS PROJECTIONS

Projections of greenhouse gas emissions

RO 11

Indicator code Romania: RO 11
EEA indicator code: CSI 011

TITLE: **PROJECTIONS OF GREENHOUSE GAS EMISSIONS**

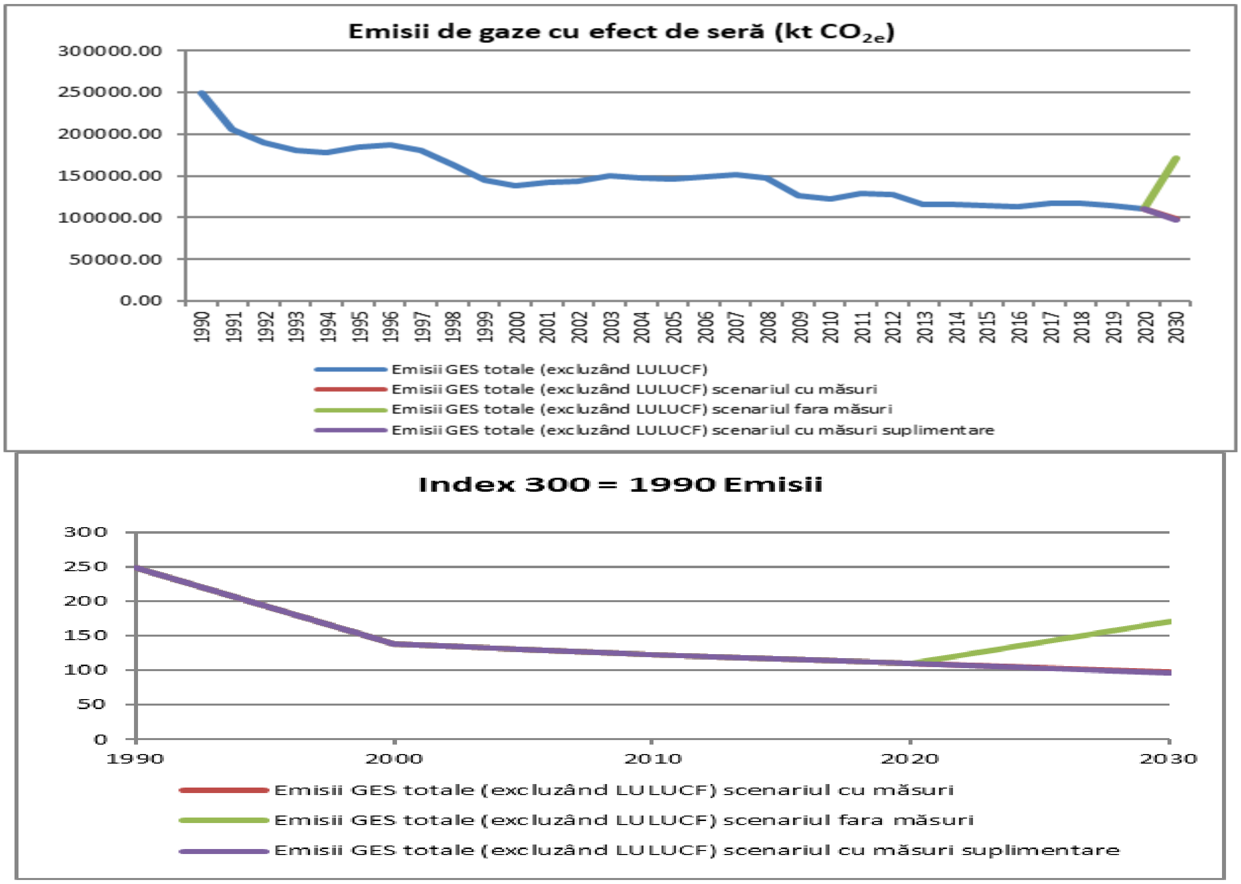
DEFINITION: This indicator illustrates the anticipated trends regarding the level of anthropogenic emissions of greenhouse gases. The purpose of this indicator concerns the estimation of the degree of fulfillment of the objectives established by the policies regarding climate change. Estimated progress is calculated as the difference between emission projections and the objectives established by the Kyoto Protocol. Greenhouse gases are those regulated by the Kyoto Protocol (CO_2, CH_4, N_2O, SF_6, HFCs, PFCs and NF_3).

Forecasts of greenhouse gas emissions were made for 3 scenarios:

1. The reference scenario that does not include special activities to reduce greenhouse gas emissions ("scenario without measures");
2. The scenario similar to the reference one from the point of view of the evolution of economic and social indicators, but which contains policies and programs for reducing greenhouse gas emissions ("scenario with measures");
3. The scenario with additional measures - similar to the reduction scenario, but containing programs with additional measures to reduce greenhouse gas emissions ("scenario with additional measures").

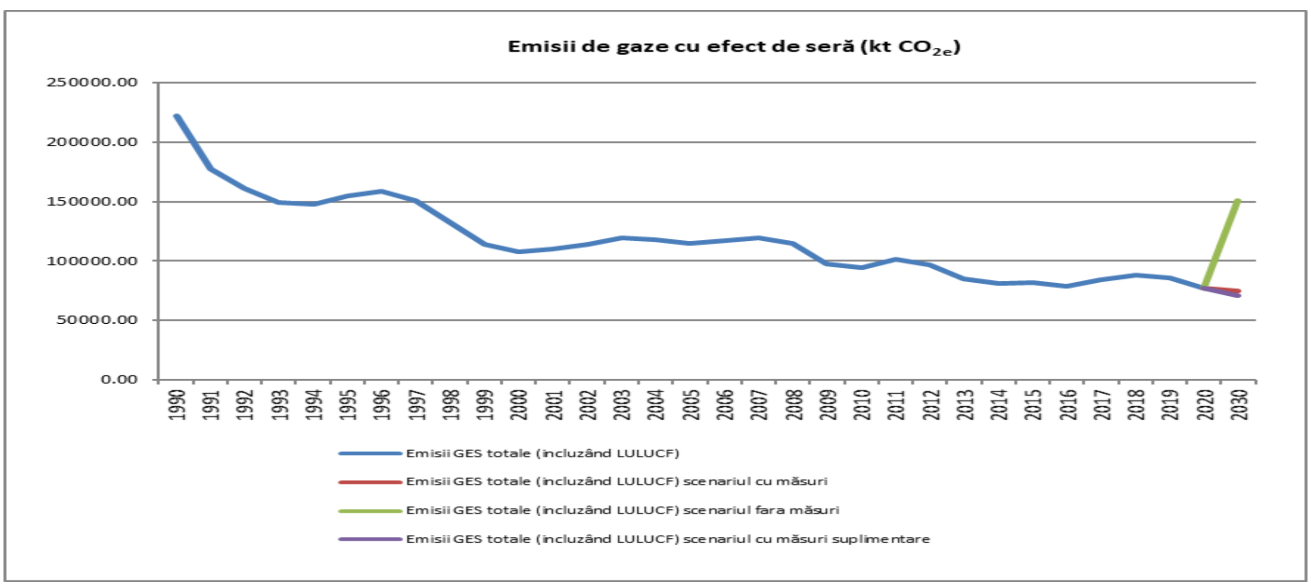
The projections of greenhouse gas emissions made for the three scenarios show an upward trend in the period 2021-2030.

Figure VIII.35. Trends (1990-2020) and projections (2021-2030) of greenhouse gas emissions (excluding LULUCF) at national level



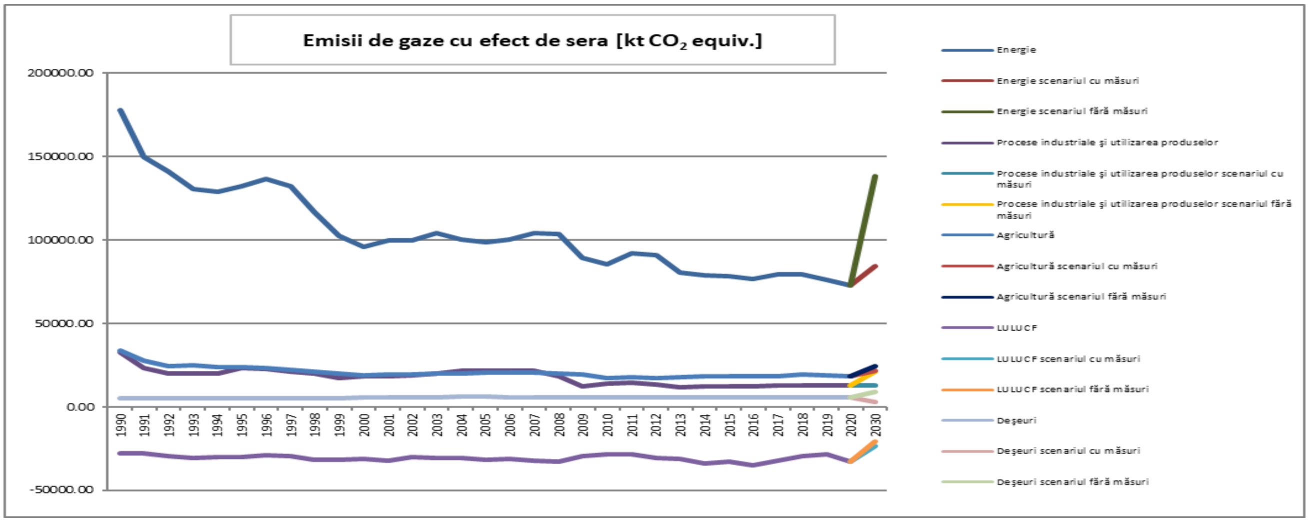
Data source: Ministry of Environment, Waters and Forests - Romania's Fourth Biennial Report under the UNFCCC December 2020

Figure VIII.36. Trends (1990-2020) and projections (2021-2030) of greenhouse gas emissions (including LULUCF) at national level



Data source: Ministry of Environment, Waters and Forests - Romania's Fourth Biennial Report under the UNFCCC December 2020

Figure VIII.37. Trends (1990-2020) and projections (2021-2030) of greenhouse gas emissions by sectors of activity, at national level



Data source: Ministry of Environment, Waters and Forests - Romania's Fourth Biennial Report under the UNFCCC December 2020

ACTIONS FOR MITIGATION AND ADAPTATION TO CLIMATE CHANGE

Use of alternative and cleaner fuels

RO 37

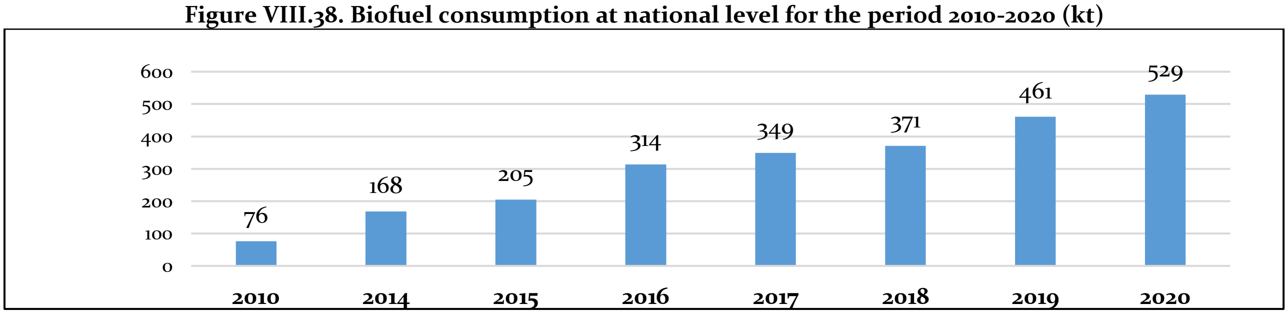
Indicator code Romania: RO 37
EEA indicator code: CSI 037

TITLE: **USE OF ALTERNATIVE AND CLEANER FUELS**

DEFINITION:The share of fuels with low or zero sulfur content and biofuels in the total consumption of fuels for road transport (in % of fuels sold for the purpose of transport).

At the national level, the data presented in the figure below indicate an increase in the use of biofuels in 2020 by 85.6% compared to 2010.

Figure VIII.38. Biofuel consumption at national level for the period 2010-2020 (kt)



Source: Eurostat Energy Questionnaire – Oil

Electricity produced from renewable energy sources

RO 31

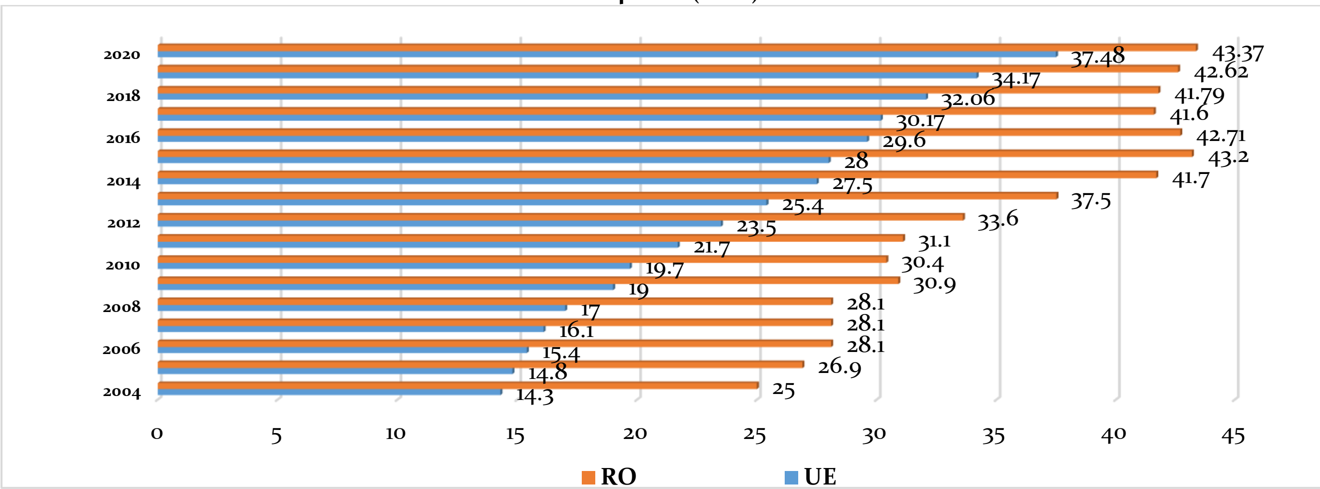
Indicator code Romania: RO 31
EEA indicator code: CSI 31

TITLE :**CONSUMPTION OF ELECTRICAL ENERGY PRODUCED FROM RENEWABLE ENERGY SOURCES**

DEFINITION: The share of electricity produced from renewable energy sources represents the ratio between the electricity produced from renewable energy sources and the gross internal consumption of electricity, expressed as a percentage. It measures the contribution of electricity produced from renewable energy sources to gross domestic electricity consumption.

In 2020 at national level, 43.37% of the total value of electricity was obtained by harnessing renewable energy sources. Supporting ecological solutions (with low impact on the environment) for the production of electricity based on renewable sources contributes to the reduction of greenhouse gas emissions from the energy sector.

Figure VIII.39. Electricity produced from renewable energy sources at national and EU-28 level, for the period 2004-2020 (ktoe)



Source: Eurostat[*https://ec.europa.eu/eurostat/web/energy/data/shares*](https://ec.europa.eu/eurostat/web/energy/data/shares)

Consumption of primary energy produced from renewable sources

RO 30

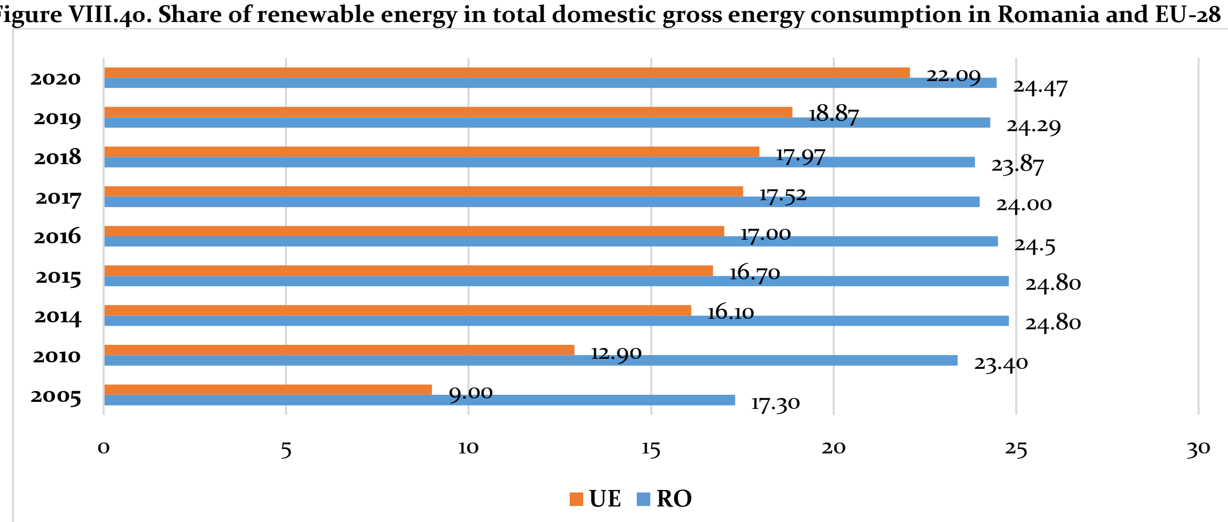
Indicator code Romania: RO 30
EEA indicator code: CSI 30 / ENER 29

TITLE: **PRIMARY ENERGY CONSUMPTION PRODUCED FROM RENEWABLE ENERGY SOURCES**

DEFINITION:The share of renewable energy consumption represents the ratio between the gross internal consumption of energy produced from renewable energy sources and the total gross internal energy consumption, calculated for a calendar year, expressed as a percentage.

At national level, the share of renewable energy in the total gross domestic energy consumption shows a slightly downward trend for the period 2014-2018, and in 2020 there was an increase of approximately 0.7% compared to the value established in the previous year.

Figure VIII.40. Share of renewable energy in total domestic gross energy consumption in Romania and EU-28 (%)



Source: Eurostat https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_ind_ren&lang=en

Chapter IX - URBAN ENVIRONMENT, HEALTH AND LIFE QUALITY

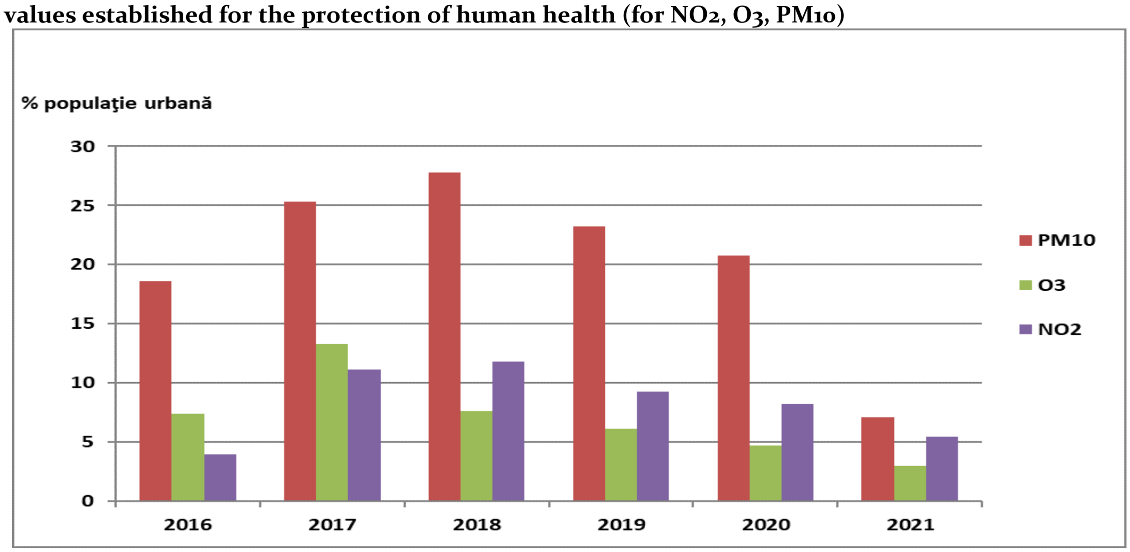
URBAN ENVIRONMENT AND LIFE QUALITY: STATUS AND CONSEQUENCES

Exceedances of the average annual concentration of PM10, NO2, SO2 and O3 in certain urban agglomerations

RO 04
Indicator code Romania: RO 04 EEA indicator code: CSI 04
TITLE: EXCEEDING THE AIR QUALITY LIMIT VALUES IN URBAN AREAS
DEFINITION: The indicator represents the percentage of the urban population potentially exposed to atmospheric concentrations (in µg/m³) of sulfur dioxide (SO_2), particles in suspention (PM10), nitrogen dioxide (NO_2) and ozone (O_3) that exceed the limit value established for human health protection.

The National Air Quality Monitoring Network (RNMCA/NAQMN) performs continuous measurements of sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), ozone (O_3), particles in suspention (PM10 and PM2.5) , monocyclic aromatic hydrocarbons (benzene, toluene, o, m, p-xylene, ethyl-benzene), polycyclic aromatic hydrocarbons and heavy metals. Air quality for each monitoring station is represented by quality indices, established based on the concentration values of the main atmospheric pollutants measured.
Also, the pollutant concentrations expressed in µg/m³ are reported, as well as the number of exceedances of the limit values established for human health, for each individual station.

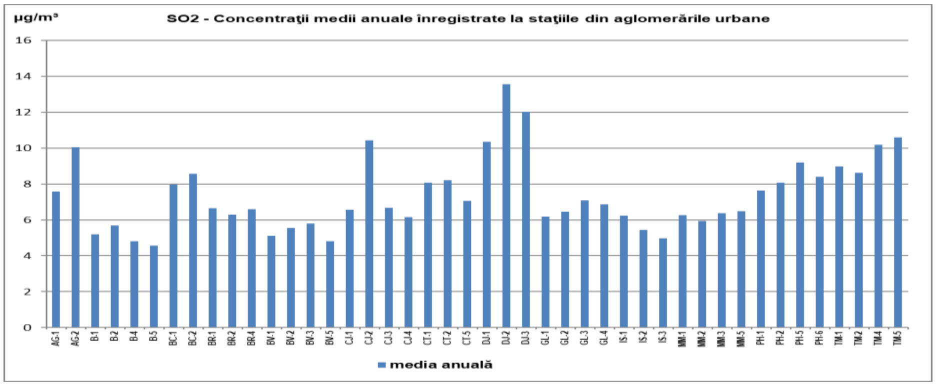
Figure IX.1 Evolution of the percentage of the urban population exposed to pollutant concentrations that exceed the limit values/target values established for the protection of human health (for NO2, O3, PM10)

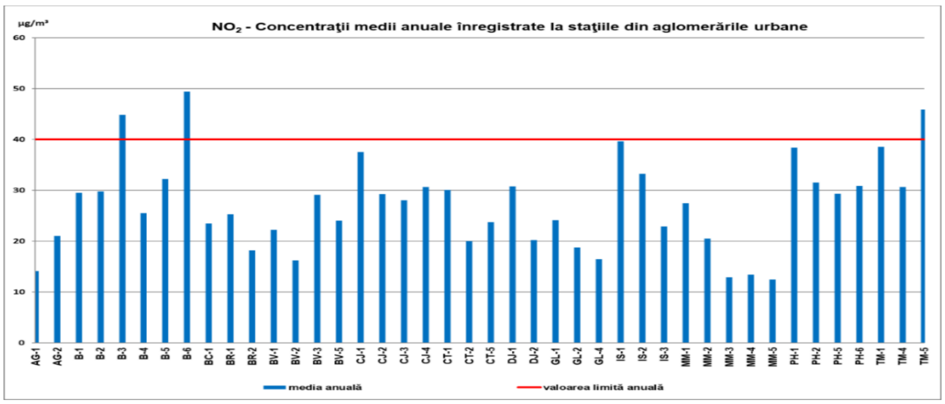


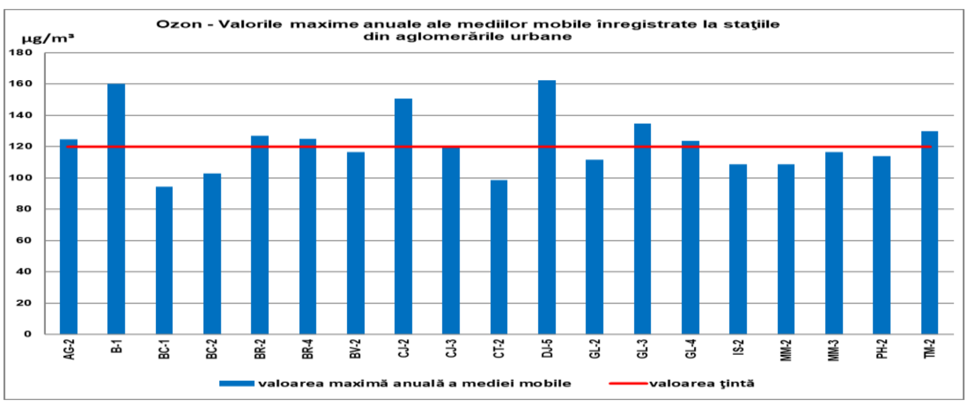
Source: NEPA

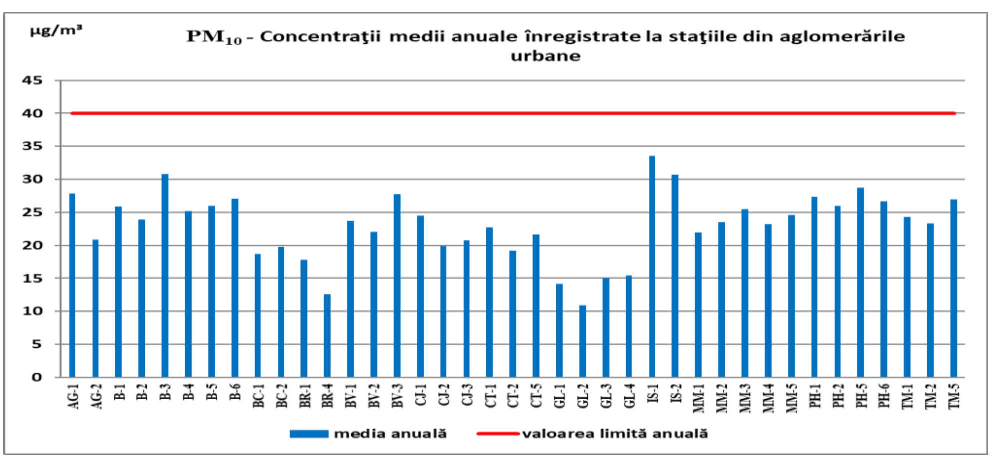
According to the provisions of Law No. 104/2011 regarding ambient air quality, 13 urban agglomerations have been established in Romania (the municipalities of Bacău, Baia Mare, Brașov, Brăila, Bucharest, Cluj-Napoca, Constanța, Craiova, Galați, Iași, Pitești, Ploiești, and Timișoara). In these agglomerations, there are automated monitoring stations, which are used for monitoring and assessing the ambient air quality.
Below, the graph presents the data obtained in the year 2021 from these stations, for the most important pollutants: SO_2, NO_2, O_3, PM10.

Figure IX.2 Annual average concentrations of air pollutants recorded at monitoring stations in urban agglomerations in 2021



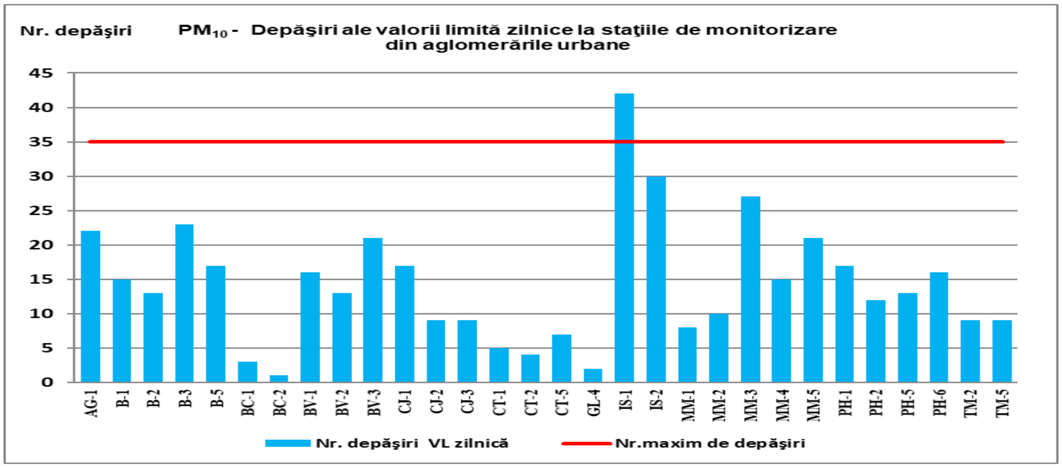






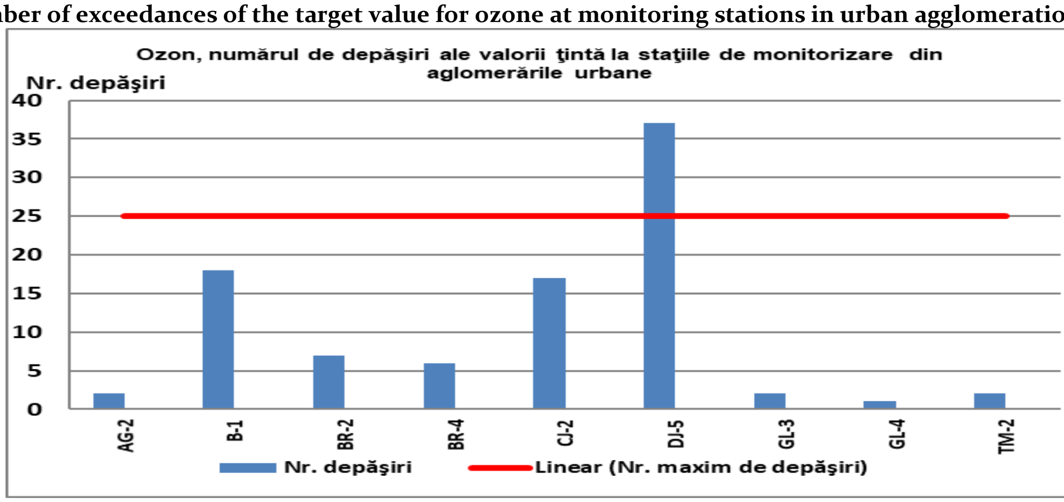
Source: NEPA

Figure IX.3 Number of exceedances of the daily limit value for PM10 particles in suspention at monitoring stations in urban agglomerations in 2021



Source: NEPA

Figure IX.4 Number of exceedances of the target value for ozone at monitoring stations in urban agglomerations in 2021



Source: NEPA

The data presented in the graphs above highlight the fact that in urban agglomerations in Romania the main and most important pollutants are the particles in suspention PM10 and nitrogen oxides, generated mainly by traffic and combustion processes in large thermoelectric plants or for residential heating. The short-term or long-term effects of these pollutants on human health are multiple, affecting the respiratory and cardiovascular systems and causing lung diseases, ENT diseases, allergic diseases, cardiovascular diseases, etc. The most affected risk groups are children, the elderly and people with chronic diseases.

Exposure of the population of urban agglomerations to flood risk – Floods and health

RO 61

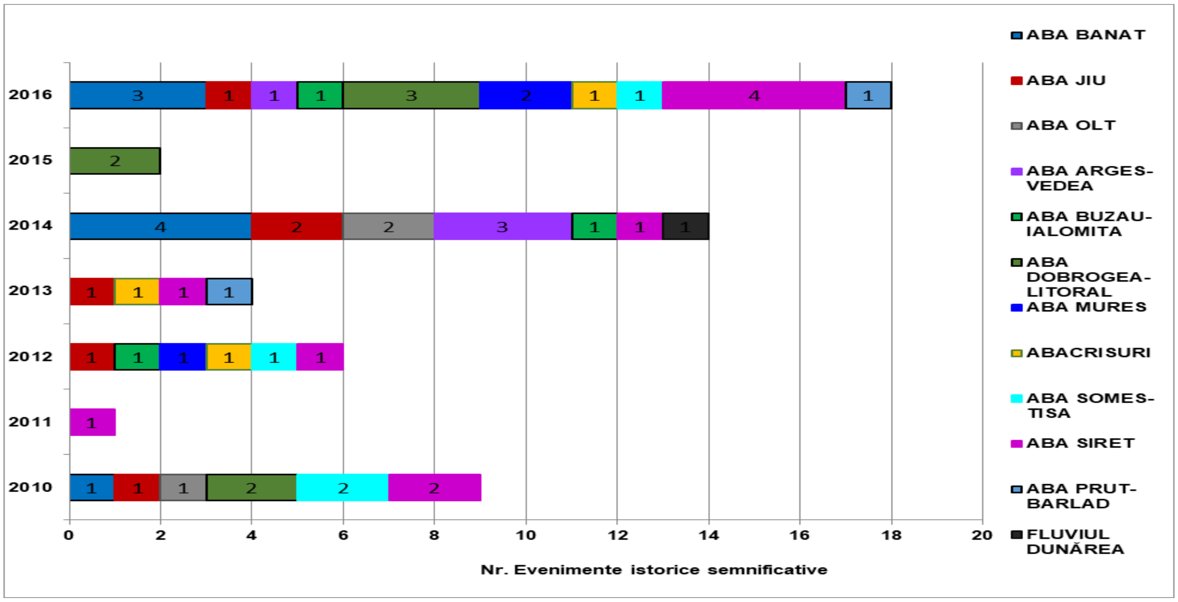
Indicator code Romania: RO 61
EEA indicator code: CLIM 46

TITLE: FLOODS AND HEALTH

DEFINITION: This indicator is defined as the number of people affected by floods per million inhabitants. "Affected persons", as defined in EM-DAT (The International Disaster Database), are persons in need of immediate assistance during a period of emergency, including displaced or evacuated persons.
The measure unit is represented by the number of people affected by floods (dead, injured, evacuated, with destroyed homes, cases of illness due to the consumption of contaminated water) per million inhabitants.

For the period 2010 - 2016, within the 11 River Basin Administrations and the Danube River, 54 significant historical flood events have been identified, as shown in Figure IX.5.

Figure IX.5 Significant historical flood events at the level of the Water Basin Administration and the Danube River for the period 2010 - 2016



Source: NIHWM

Based on the methodology for designating areas with potentially significant flood risk, during the second implementation cycle of Directive 2007/60/EC on floods, new areas with potential significant flood risk were established. As of the year 2019, a total of 526 areas with potential significant flood risk were reported to the European Commission at the national level. The second implementation cycle of Directive 2007/60/EC is ongoing, and during Phase 3, the development of Flood Risk Management Plans will propose specific measures for areas with potential significant flood risk to protect the population and assets. The implementation of these proposed measures will mitigate the risk of such undesirable events. The Flood Risk Management Plans will support the decision-making process and contribute to increasing awareness and understanding of flood risk, especially in areas with potential significant flood risk. In the course of 2021 (Table IX.21), floods affected 35 counties, while 6 counties did not report any flood-related damages (Călărași, Dolj, Giurgiu, Mehedinți, Sibiu, Timiș). Within these 35 counties, a total of 205 urban localities were affected. The highest number of urban localities affected was in Maramureș County (25 urban localities), followed by Suceava County with 23 urban localities, Vâlcea County with 20 urban localities, Hunedoara County with 16 urban localities, Botoșani County with 15 urban localities, Prahova and Gorj Counties with 11 urban localities each, Dâmbovița County with 10 urban localities, Vaslui County with 8 urban localities, Bistrița Năsăud and Bacău Counties with 6 urban localities each, Galați County with 5 urban localities, Bihor, Brașov, Harghita, Iași, and Neamț Counties with 4 urban localities each, Caraș Severin, Cluj, and Mureș Counties with 3 urban localities each, while Arad, Argeș, Ilfov, and Vrancea Counties have 2 affected urban localities each. Buzău, Constanța, Olt, Satu Mare, Sălaj, and Teleorman Counties did not report any affected urban localities, while Brăila, Covasna, Ialomița, and Tulcea Counties each had one affected urban locality.

Table IX.1 Periods and brief description of the causes of floods that occurred in the year 2020 and the affected localities

No. crt.	COUNTY (localities affected)	PERIOD (produced phenomenon)

1.	**ALBA** **163 localities** **Abrud**, **Câmpeni (Vârși, Valea Bistrii, Câmpeni, Mihoești), Ocna Mureș, Zlatna (Feneș, Zlatna),** Albac (Albac), Arieșeni (Galbena, Izlaz, Arieșeni, Cobleș, Avramești, Arieșeni), Avram Iancu (Dumăcești, Avram Iancu, Cârăști, Vidrișoara, Mărtești, Jojei, Dolești, Valea Uțului, Helerești, Coroiești, Incești, Căsoaia, Vidrișoara, Helerești), Berghin (Berghin), Bistra (Lunca Merilor, Gârde, Crețești, Hodișești, Țărănești, Aronești, Novăcești, Ciuldești, Durăști, Poiana, Bălești, Cheleteni, Hudricești, Lipaia, Sălăgești, Dâmbureni, Nămas, Dealu Muntelui, Bistra, Vârșii Mari, Bârlești, Ștefanca, Poiu, Trișorești, Rătitiș, Gănești, Cretești, Mihăiești, Lunca Largă, Runcuri), Bucium (Bucium, Valea Poienii), Ciugud (Ciugud), Ciuruleasa (Ciuruleasa, Bodrești, Bidigești, Mătișești, Morărești, Vulcan, Ghedulești, Boglești), Crăciunelu de Jos (Crăciunelu de Jos), Garda de Sus (Huzărești, Biharia, Garda Seacă, Garda de Sus), Hopârta (Hopârta, Turdaș), Horea (Horea), Ighiu (Ighiu), Întregâlde (Întregâlde, Tecșești, Modolești, Dealu Geoagiului), Livezile (Livezile, Poiana Aiudului), Lupșa (Lupșa, Mănăstire, Hădărău, Valea Lupșii, Musca), Mirăslău (Mirăslău), Mogoș (Valea Cocești, Mogoș, Mămăligani), Ocoliș (Ocoliș, Runc, Lunca Largă), Pianu (Pianu de Sus), Poiana Vadului (Costești, Păștești, Duduieni, Făgetu de Jos, Făgetu de Sus, Poiana Vadului), Ponor (Ponor, Vala Bucurului, Geogel, După Deal), Poșaga (Poșaga de Sus), Râmeț (Cheia, Cotorăști, Valea Mănăstirii), Roșia Montană (Dăroaia, Roșia Montană, Ignățești, Iacobești, Curături, Cărpiniș, Gura Roșiei, Coasta Henții, Șoal), Sălciua (Sălciua de Sus, Valea Largă, Sălciua de Jos), Săliștea (Săliștea), Săsciori (Săsciori, Loman, Tonea), Sohodol (Gura Sohodol, Sohodol, Vlădoșești, Bilănești, Nicorești, Deoncești, Poiana, Băzești, Munești), Sona (Sona, Lunca Târnavei, Biia), Stremț (Geoagiu de Sus), Șugag (Șugag, Mărtinie), Vadu Moților (Necșești, Bodești, Dealu Frumos, Vadu Moților), Valea Lungă (Glogoveț), Vidra (Vidra, Nemeși, Lunca Bisericii, Lunca de Jos, Goiești, Vârtănești, Lunca Vesești, Ponorel, Drăgoiești-Lunca, Oidești, Dos, Bobărești, Lunca, Lunca Goiești).	08-12.02.2021 -Overflow, runoff from slopes, torrents, puddles. 16-17.03.2021 - runoff from slopes. 14.04.2021 -runoff from slopes. 18-31.05.2021 - overflow, runoff from slopes, torrents. 09-24.06.2021 - overflow, runoff from slopes, torrents, puddles. 01-21.07.2021 -overflow, runoff from slopes, torrents, heavy rainfall. 05-18.08.2021 -runoff from slopes, storm. 24-27.12.2021 -overflow, runoff from slopes, torrents.
2	**ARAD** **21 localities** **Sebiș (Sebiș, Donceni**), Almaș (Almaș), Archiș (Archiș), Brazii (Madrigești, Secaș), Chișindia (Păiușeni), Dieci (Dieci, Roșa, Crocna, Revetiș), Gurahonț (Gurahonț), Hălmăgel (Hălmăgel), Hălmagiu (Hălmagiu, Bănești), Moneasa (Moneasa), Pleșcuța (Tălagiu, Pleșcuța, Gura Văii, Rostoci), Șilindia (Șilindia).	06-07.01.2021 -runoff from slopes, torrents, heavy rainfall 14-21.05.2021 -overflow, runoff from slopes, torrents, heavy rainfall. 26-28.12.2021 -overflow, runoff from slopes, heavy rainfall.
3	**ARGEȘ** **115 localities** **Câmpulung, Curtea de Argeș**, Albeștii de Muscel (Albești, Cândești), Arefu (Arefu), Babana (Babana), Bălilești (Băjești, Bălilești, Priboaia, Valea Mare Bratia, Ulița, Poienița, Golești), Bârla (Urlueni, Bârla), Berevoești (Berevoești), Boteni (Boteni, Lunca), Brăduleț (Bradetu, Alunișu, Brăduleț, Cosaci, Galeșu), Budeasa (Budeasa Mică, Budeasa Mare, Valea Mărului), Bughea de Jos, Bughea de Sus, Buzoești (Buzoești, Șerboeni), Călinești (Văleni Podgoria), Cepari (Ceparii Pământeni, Cărpeniș, Ceparii Ungureni, Urluiești, Zamfirești, Șendrulești, Valea Măgurei), Cetățeni (Cetățeni, Lăicăi), Ciofrângeni (Piatra, Schitu Matei, Burluși, Ciofrângeni), Ciomăgești (Dogari, Ciomăgești, Cungrea), Cocu (Răchitele de Sus, Cocu, Răchitele de Jos), Corbi (Corbi, Jgheaburi, Corbșori, Poienărei, Poduri), Coșești (Leicești, Jupânești, Pacioiu, Petrești), Cotmeana (Drăgolești, Dealu Pădurii, Costești, Vârloveni), Dâmbovicioara (Podu Dâmboviței, Dâmbovicioara), Domnești (Domnești), Dragoslavele (Dragoslavele, Valea Hotarului), Godeni (Capu Piscului, Godeni), Hârtiești (Hârtiești, Lucieni, Lespezi, Dealu), Lerești (Lerești, Pojorâta), Mihăești (Valea Popii, Drăghici, Văcarea), Mioarele (Cocenești, Mățău), Nucșoara (Nucșoara, Sboghițești, Slatina), Poienarii de Argeș (Tomulești), Poienarii de Muscel (Groșani), Recea (Recea, Deagu de Jos), Rucăr (Sătic), Săpata (Mârțești, Lipia, Bănărești), Stâlpeni (Rădești, Stâlpeni, Livezeni, Pițigaia), Stoenești (Slobozia), Șuici (Șuici, Ianculești, Păuleni, Rudeni), Tigveni (Bârseștii de Sus, Bârseștii de Jos, Tigveni, Vlădești, Badislava, Bălteni), Țițesti (Valea Mănăstirii), Uda (Greabăn), Valea Iașului (Cerbureni, Borovinești, Ungureni), Valea Mare Pravăț (Gura Pravăț, Valea Mare Pravăț, Nămăești).	10-20.03.2021 -overflow, landslide with bed blockage, erosion. 25.05.-30.06.2021 -overflow, runoff from slopes, the sewage network inability to take over, landslide with bed blockage, precipitation, landslide, hail. 19-21.07.2021 -overflow, runoff from slopes, torrents. 28-30.08.2021 -overflow, runoff from slopes, landslide with bed blockage, storm. 10-14.12.2021 -overflow, storm, landslide, precipitation.

4	**BACĂU** **184 localities** **Comănești**, **Dărmănești**, **Moinești**, **Slănic Moldova**, **Târgu Ocna**, **Onești**, Agas (Agas, Cotumba, Cosnea, Preluci), Ardeoani (Argeoani, Leontinesti), Asau (Paltinis, Apa Asau, Asau, Lunca Asau, Ciobanus), Balcani (Schitu Frumoasa, Balcani, Ludasi, Frumoasa), Barsanesti (Albele, Bratesti, Caraclau), Beresti Tazlau (Tescani, Beresti tazlau, Turluianu, Enachesti, Prisaca, Romanesti), Berzunti (Berzunti, Dragomir, Buda), Bogdanesti (Bogdanesti, Filipesti), Brusturoasa (Brusturoasa, Cuchinis, Buruienis, Hangandesti), Buciumi (Buciumi, Racauti), Caiuti (Caiuti, Vranceni, Floresti, Marcesti, Pralea), Casin (Casin, Curita), Colonesti (Spria, Calini, Valea Mare), Damienesti (Damienesti, Calugareni), Dofteana (Stefan Voda, Seaca, Haghic, Cucuieti, Dofteana, Larga, Bogata), Ghimes Faget (Bolovanis), Gura Vaii (Gura Vaii, Paltinata), Horgesti (Recea, Sohodor, Horgesti, Galeri, Baga, Racatau Razesi), Itesti (Itesti), Livezi (Balaneasa, Orasa), Magiresti (Valea Arinilor, Prajesti, Magiresti, Stanesti), Magura (Magura, Crihan, Sohodol, Dealu Mare), Manastirea Casin (Manastirea Casin, Lupesti, Parvulesti, Scutaru), Margineni (Margineni, Trebes, Barati, Valea Budului, Luncani, Poiana, Podis, Padureni), Oituz (Poiana Sarata, Ferastrau-Oituz, Oituz, Harja, Calcai), Oncesti (Tarnita), Orbeni (Orbeni, Scurta), Palanca (Ciughes, Palanca, Popoiu), Pancesti (Pancesti), Parava (Parava, Dragusani, Radoaia), Pargaresti (Pargaresti, Satu Nou, Nicoresti, Bahna, Parau Boghii), Parincea (Vladnic, Valeni, Milestii de Sus, Milestii de Jos, Poieni, Nastaseni, Barna), Parjol (Parjol, Barnesti, Basesti, Hemieni, Tarata, Haineala, Campeni, Bahnaseni, Pustiana, Bahnaseni, Pustiana, Basasti), Poduri (Poduri, Valea Sosii, Prohozesti, Bucsesti, Cornet, Cernu), Racaciuni (Racaciuni), Rachitoasa (Rachitoasa, Tochilea, Burdusaci, Danaila, Barcana, Putini, Farcasa, Buda, Bucsa), Sanduleni (Stufu), Sascut (Contesti, Pancesti, Schineni, Sascut Sat), Scorteni (Bogdanesti, Grigoreni, Scorteni, Floresti, Stejaru), Solont (Cucuieti, Sarata, Solont), Stefan cel Mare (Viisoara, Gutinas, Bogdana, Stefan cel Mare, Negoiesti), Strugari (Strugari, Nadisa, Cetatuia, Pietricica, Rachitis, Iaz), Targu Trotus (Targu Trotus, Tuta, Viisoara), Tatarasti (Ghedana, Dragesti, Giurgeni, Tatarasti, Ungureni, Cornii de Jos, Cornii de Sus), Valea Seaca (Valea Seaca, Cucova), Zemes (Zemes).	16-17.03.2021 -runoff from slopes, heavy rainfall 30-31.05.2021 -runoff from slopes, heavy rainfall. 19-21.07.2021 -overflow, runoff from slopes, torrents. 07.06-06.07.2021 -overflow, runoff from slopes, heavy rainfall. 14-26.06.2021 -overflow, runoff from slopes, torrents, the sewage network inability to take over, heavy rainfall, erosion. 11-19.07.2021 -overflow of Pârâu Bălăneasa (not registered), Pârâu Orasa -runoff from slopes, heavy rainfall. 2-29.07.2021 -overflow Pârâul Solont, Pârâul Cucuieți -runoff from slopes, heavy rainfall. 18.08.2021 -runoff from slopes, heavy rainfall.
5	**BIHOR** **70 localities** **Beiuș, Stei, Vașcău (Colești, Vașcău),** Aușeu (Luncșoara), Budureasa (Budureasa, Burda), Buntești (Lelești, Dumbrăvani, Brădet, Ferice, Săud, Poienii de Sus, Poienii de Jos, Buntești), Căbești (Căbești, Sohodol), Câmpani (Valea de Sus, Hîrșești, Fânațe), Căpâlna (Ginta), Cociuba Mare (Cheșa), Cristioru de Jos (Poiana, Săliște de Vașcău), Curățele (Cresuia, Pocioveliște, Curățele, Nimăiești), Dobrești (Dobrești, Topa de Sus, Luncasprie), Drăgănești (Drăgănești, Belejeni, Livada Beiușului, Mizieș, Tigăneștii de Beiuș, Sebiș), Drăgești (Drăgești, Stracoș), Finiș (Finiș), Lugașu de Jos (Lugașu de Jos, Lugașu de Sus), Lunca (Briheni), Măgești (Căcuciu Nou, Josani, Măgești, Butani), Pietroasa (Giulești, Chișcău, Boga, Cociuba Mică, Pietroasa), Pomezeu (Sitani), Remetea (Remetea, Meziad), Rieni (Rieni, Ghighișeni), Roșia (Lazuri, Roșia), Șinteu (Valea Târnei, Șinteu, Huta Voivozi), Șoimi (Borz, Sânnicolau de Beiuș), Tărcaia (Tărcăița, Mierag, Tărcaia, Totoreni), Tinca (Tinca), Uileacu de Beiuș (Uileacu de Beiuș).	18-23.05.2021 -overflow, runoff from slopes, torrents, heavy rainfall. 23-24.05.2021 -runoff from slopes. 30.06-01.07.2021 -runoff from slopes, heavy rainfall. 15.07.2021 -overflow R. Rachiteasa -runoff from slopes, heavy rainfall. 28.07.2021 -runoff from slopes, heavy rainfall. 14.12.2021 -runoff from slopes, heavy rainfall, torrents. 25-27.12.2021 -overflow R. Crisul Pietros, R. Craiasa -runoff from slopes.

6	**BISTRIȚA NĂSĂUD** **82 localities** **Beclean**, **Bistrița, Năsăud** (**Nasăud**, **Lusca**), **Sângeorz Băi** (**Sângeorz Băi**, **Cormaia**), Bistrița Bârgăului (Bistrita Bargaului), Braniștea (Braniștea), Budacu de Jos (Budus, Budacu de Jos, Monariu, Jelna), Cetate (Orheiu Bistritei, Satu Nou), Chiochis (Sannicoara), Cosbuc (Cosbuc), Dumitra (Tarpiu, Dumitra, Cepari), Feldru (Nepos, Feldru), Galatii Bistritei (Tonciu), Ilva Mare (Ilva Mare, Ivaneasa), Ilva Mica (Ilva Mica), Josenii Bargaului (Josenii Bargaului), Lesu (Lunca Lesului, Lesu), Livezile (Livezile, Valea Poienii), Lunca Ilvei (Luna Ilvei), Magura Ilvei (Arsita, Magura Ilvei), Mariselu (Mariselu), Monor (Monor, Gledin), Negrilesti (Breaza), Nimigea (Taure, Mintiu, Floresti), Nuseni (Nuseni), Parva (Parva), Rebra (Rebra), Rebrisoara (Gersa I, Gersa II, Rebrisoara), Rodna (Rodna), Runcu Salvei (Runcu Salvei), Sanmihaiu de Campie (Sanmihaiu de Campie, Brateni, Stupini, Salcuta, Zoreni), Sant (Sant, Valea Mare), Sieu (Sieu, Ardan, Soimus), Sieut (Sieut, Sebis, Lunca, Rustior), Spermezeu (Halmasau, Spermezeu, Dobricel, Dumbravita, Sita), Tarlisua (Moliset, Agries, Racatesu, Oarzina, Tarlisua, Borleasa, Agriesel, Lunca Sateasca), Telciu (Telcisor, Telciu), Tiha Bargaului (Tiha Bargaului), Urmenis (Sopteriu, Fanate), Zagra (Suplai, Perisor).	04 -11.02.2021 -overflow, runoff from slopes, torrents, heavy rainfall, snow cover melting. 02-05, 13-16, 23-24.04.2021 -runoff from slopes, torrents, heavy rainfall. 13-16.05.2021 -overflow, runoff from slopes, torrents, heavy rainfall. 31.05 - 14.06.2021 -runoff from slopes, torrents, heavy rainfall. 30.06 - 05.07.2021 -runoff from slopes, torrents, heavy rainfall. 31.07 - 16.08.2021 -runoff from slopes, heavy rainfall. 17 - 18.09.2021 -overflow R Ardan, R. Dumbrăvița, R. Luț, runoff from slopes, torrents, heavy rainfall. 16 - 28.12.2021 -overflow V Pavel, Dumbravei, P. Șesu (not registered), R. Șieu, -runoff from slopes, torrents, heavy rainfall, snow cover melting.
7	**BOTOȘANI** **142 localities** **Botoșani, Bucecea** (**Bucecea, Calinesti**), **Dărăbani** (**Darabani, Bajura**), **Săveni** (**Bozieni**), **Stauceni** (**Victoria, Tocileni, Siliștea, Stăuceni**), **Ștefănești** (**Ștefanești, Stânca, Bobulești, Bădiuți, Ștefănești Sat**), Albești (Jijia, Buimăceni, Costiugeni, Mascateni, Albesti, Tudor Vladimirescu), Avrameni (Timus, Panaitoaia, Ichimeni, Dimitrie Cantemir), Blandesti (Soldanesti, Cerchejeni), Braesti (Braesti, Poiana, Popeni), Broscauti (Broscauti, Slobozia), Calarasi (Plesani, Libertatea, Calarasi), Concesti (Concesti), Copalau (Cerbu), Cordareni (Cordareni, Slobozia, Grivita), Corlateni (Corlateni, Carasa, Podeni, Vladeni), Corni (Corni), Cotusca (Crasnaleuca, Cotu Miculinti), Cristinesti (Damileni), Draguseni (Draguseni, Sarata Draguseni, Podriga), Durnesti (Durnesti, Babiceni, Brosteni, Guranda), Frumusica (Radeni, Stroiesti, Sendreni, Vladeni Deal, Boscoteni), George Enescu (Dumeni, Arborea, Stanca, Popeni), Gorbanesti (Vanatori, Siliscani), Hanesti (Hanesti, Borolea, Sarata Basarab), Havarna (Havarna, Garbeni, Tataraseni, Balinti), Hiliseu Horia (Hiliseu Horia, Corjauti, Hiliseu Crisan, Iezer), Hudesti (Hudesti, Mlenauti, Baseu, Alba, Baranca), Ibanesti (Dumbravita, Ibanesti), Leorda(Leorda, Dolina, Costinesti, Mitoc), Manoleasa (Loturi, Iorga, Manoleasa Prut, Flondora), Mihai Eminescu (Catamaresti Deal, Catamaresti, Cervicesti, Cucorani, Ipotesti, Stancesti, Manolesti), Mileanca (Mileanca, Codreni, Scutari, Selistea), Mitoc (Mitoc), Nicseni (Dacia, Nicseni, Dorobanti), Paltinis (Horodistea, Slobozia, Cuzlau, Paltinis), Rachiti (Rachiti), Romanesti (Romanesti, Damideni, Sarata), Santa Mare (Santa Mare, Berza, Iliseni, Ranghilesti Deal, Bogdanesti, Badarai), Suharau (Suharau, Plevna, Smardan, Lisna, Oroftiana), Sulita (Sulita, Dracsani), Trusesti (Trusesti, Buhaceni), Tudora (Tudora), Vaculesti (Vaculesti, Gorovei, Saucenita), Varfu campului (Ionaseni, Lunca, Dobrinauti Hapai), Vladeni (Mandresti, Brehuiesti, Vladeni), Vlasinesti (Vlasinesti, Sarbi).	05-06.01.2021 -runoff from slopes. 28-29.05.2021 -runoff from slopes. 10-20.06.2021 -runoff from slopes, heavy rainfall. 30.06.2021 -runoff from slopes, heavy rainfall. 07-08.07.2021 -runoff from slopes, heavy rainfall. 09-28.07.2021 -runoff from slopes, storms, hail, heavy rainfall. 20-21.07.2021 -runoff from slopes, heavy rainfall. 02-05.08.2021 -gales, hail, heavy rainfall. 24.08.2021 -runoff from slopes, storms, hail, heavy rainfall. 27-29.08.2021 -runoff from slopes, heavy rainfall.

8	**BRAȘOV** **20 localities** **Brașov, Predeal, Râșnov, Săcele,** Bran (Simon, Sohodol, Bran), Budila (Budila), Halchiu (Halchiu), Hoghiz (Cuciulata), Mandra (Mandra, Sona), Moieciu (Moieciu de Sus, Moieciu de Jos, Cheia, Magura), Tarlungeni (Tarlungeni, Zizin), Ungra (Ungra, Daisoara).	13.04.2021 -runoff from slopes. 20-24.6.2021 -runoff from slopes, -overflow Teis (not registered), R. Olt, R Târlung, R Zizin, R Daisoara. 19-20.07.2021 -runoff from slopes -overflow R. Bungaleasa, Valea Popii (not registered, R Simon, R Sohodol, R Poarta, R Turcu, R Panicel, Pr Ghimbasel, R Barsa. 29.07-01.08.2021 -overflow, runoff from slopes. 28-29.08.2021 -overflow, runoff from slopes, flooding, the sewage network inability to take over 28-29.09.2021 -overflow Pr Provita (not registered), Pr Ghimbasel -runoff from slopes, the sewage network inability to take over 11-13.12.2021 -runoff from slopes.
9	**BRĂILA** **5 localities** **Însurăței,** Chișcani (Lacu Sărat), Maxineni (Latinu, Corbu Vechi), Vădeni (Vădeni).	14-24.06.2021 -puddles, the sewage network inability to take over, heavy rainfall. 19-24.06.2021 -overflow R Siret.
10	**BUZĂU** **79 localities** Beceni (Gura Dimienii, Izvoru Dulce, Valea Părului, Florești, Dogari, Mărgăriți, Beceni), Berca (Berca, Joseni, Rătești), Bisoca (Bisoca, Băltăgari, Lacurile, Lopătăreasa, Pleși, Recea, Sările, Șindrila), Blăjani (Blăjani), Bozioru (Bozioru), Buda (Alexandru Odobescu, Dănulești), Calvini (Calvini, Bâscenii de Sus, Bâscenii de Jos, Olari, Frăsinet), Cănești (Gonțești, Negoșina, Valea Verzei), Căina (Cătina, Corbu), Cernătești (Cernătești, Aldeni, Fulga, Băești, Manasia), Chiojdu (Cătiașu), Colți (Colți), Gura Teghii (Gura Teghii, Păltiniș, Varlaam, Furtunești), Lopătari (Lopătari, Ploștina, Săreni), Măgura (Măgura), Odăile (Odăile, Posobești, Capu Satului, Valea Ștefanului, Gorani, Corneanu), Panatau (Panatau), Pardoși (Pardoși, Costomiru, Valea Schioului, Chiperu, Valea lui Lalu), Sărulești (Sărulești), Scorțoasa (Scorțoasa, Policiori, Plopeasa, Dalma, Golu Grabicina, Gura Văii, Grabicina de Jos, Deleni, Balta Tocila), Siriu (Gura Siriului), Tisau (Tisău, Valea Sălciilor, Pădurenii), Unguriu (Unguriu), Valea Salciei (Valea Salciei), Vintilă Vodă (Vintilă Vodă, Bodinești, Petrăchești, Podu Muncii).	01.05-30.06.2021 -runoff from slopes, heavy rainfall. 01- 31.08.2021 -runoff from slopes, heavy rainfall. 10.12- 13.01.2022 -runoff from slopes, heavy rainfall.

11	**CARAȘ - SEVERIN** **40 localities** **Bocșa**, **Oravița**, **Reșița**, Armeniș (Armenis), Berzasca (Liubcova), Berzovia (Berzovia), , Carasova (Carasova), Copacele (Zorile), Cornereva (Obita, Prislop, Zbegu, Strugasca, Poiana Lunga, Prisacina), Dalboset (Dalboset), Dalboset (Sopotu Vechi), Dognecea (Dognecea), Ezeris (Ezeris), Farliug (Farliug, Scaius), Ocna de Fier (Ocna de Fier), Paltinis (Delinesti, Ohabita), Ramna (Valeapai, Ramna), Sichevita (Sichevita, Valea Sichevitei, Brestelnic, Zasloane, Crusovita, Liborajdea, Martinovăț), Socol (Pârneaura, Zlatița), Sopotu Nou (Ravensca), Târnova (Târnova), Teregova (Teregova, Rusca), Văliug (Văliug), Zorlențu Mare (Zorlențu Mare).	06.01.2021 -runoff from slopes, heavy rainfall 12.01.2021 -runoff from slopes, infiltrations 24.01.2021 – 08.02.2021 -Barzava river overflow -runoff from slopes, infiltrations, heavy rainfall 10-24.02.2021 -runoff from slopes, freeze-thaw, infiltrations, heavy rainfall 15-16.03.2021 -Slaveni river overflow, infiltrations 17-28.05.2021 -runoff from slopes 25.05.2021 – 02.06.2021 -watercourses overflow -runoff from slopes 19-20.07.2021 -watercourses overflow -runoff from slopes 29.08.2021 -runoff from slopes 11-12.12.2021 -infiltrations, freeze-thaw phenomenon, landslide.
12	**CLUJ** **144 localities** **Cluj Napoca**, **Huedin (Huedin, Bicălatu)**, Aghireșu (Leghia, Aghireșu, Inucu, Macău), Aiton (Aiton, Rediu), Baciu (Baciu, Popești, Mera), Beliș (Beliș, Bălcești, Dealu Botii, Giurcuța de Sus), Borșa (Borșa-Crestaia, Ciumăfaia), Buza (Buza, Rotunda), Căianu (Căianu, Căianu Vamă, Văleni, Vaida Cămăraș, Căianu Mic, Bărăi), Cămărașu (Cămărașu, Sâmboleni, Naoiu), Capușu Mare (Dângău Mare, Dângău Mic, Bălcești, Agârbiciu, Păniceni, Căpușu Mare, Căpușu Mic, Straja, Dumbrava), Cătina (Cătina, Feldioara, Copru, Valea Caldă, Hagău), Ceanu Mare (Ceanu Mare, Iacobeni, Fânașe, Strucut, Hodai Boian, Dosu Napului, Ciurgău, Bolduț), Chinteni (Chinteni, Feiurdeni, Vechea, Săliștea Veche, Măcicașu, Deușu, Pădureni), Ciucea (Ciucea, Vânători), Ciurila (Săliște, Pruniș, Pădureni, Șutu, Filea de Jos, Filea de Sus, Ciurila, Sălicea), Cojocna (Cojocna, Huci, Straja, Cara, Boju), Cornești (Lujerdiu, Tioltiur, Bârlea), Feleacu (Feleacu, Vâlcele, Gheorgheni, Sărădiș), Florești (Tăuți, Luna de Sus), Frata (Berchieșu, Soporu de Câmpie), Garbau (Cornești), Geaca (Geaca, Legii, Chiriș, Puini, Sucutard, Lacu), Gilau (Someșu Rece), Iara (Făgetu Ierii, Ocolișel), Măguri-Răcătău (Măguri-Răcătău, Măguri, Muntele Rece), Mărișel (Mărișel), Mica (Valea Luncii, Dâmbu Mare, Sânmărghita, Mica, Nireș, Mănăstirea), Mociu (Ghirișu Roman, Chesău, Roșieni, Boteni, Crișeni, Zorenii de Vale), Moldovenești (Moldovenești, Podeni, Bădeni, Plăiești), Negreni (Negreni, Prelucele, Bucea), Panticeu (Sărata, Panticeu, Cătălina, Dârja, Cubleșu Someșan), Poieni (Valea Drăganului, Tranișu, Lunca Vișagului, Poieni), Râșca (Râșca, Dealu Mare, Lăpuștești), Recea Cristur (Osoi, Căprioara, Elciu, Recea Cristur), Săvădisla (Finițel, Lita), Suatu (Aruncuta), Tureni (Tureni), Valea Ierii (Valea Ierii), Vultureni (Vultureni, Băbuțiu, Bădești, Chidea, Făureni, Șoimeni).	17-19.03.2021 -overflow Pr. Tioltur, Pr. Ciurzii, runoff from slopes, torrents 02-20.04.2021 -watercourses overflow -runoff from slopes, torrents 13-31.05.2021 -watercourses overflow -runoff from slopes, torrents 12.06.2021-11.07.2021 -watercourses overflow -runoff from slopes, torrents 15-18.07.2021 -overflow -runoff from slopes, torrents 19.07.2021 – 06.08.2021 -watercourses overflow -runoff from slopes, torrents 16-18.08.2021 -runoff from slopes 29-31.08.2021 -watercourses overflow -runoff from slopes
13	**CONSTANȚA** **23 localities** Adamclisi (Zorile, Urluia), Aliman (Aliman, Dunăreni, Vlahii), Crucea (Băltăgești), Horia (Horia), Ion Corvin (Ion Corvin, Viile, Crângu), Lipnița (Coslugea, Carvăn, Lipnița, Izvoarele), Lumina (Lumina), Peștera (Peștera, Izvorul Mare, Ivrinezu Mare), Rasova (Rasova, Cochirleni), Saligni (Stefan cel Mare), Topraisar (Biruința), Tuzla (Tuzla).	27.01.2021 – 01.02.2021 -heavy rainfall 29.05.2021 – 01.06.2021 -heavy rainfall 12-15.06.2021 -heavy rainfall 23-25.06.2021 -heavy rainfall 01-12.07.2021 -heavy rainfall 27.08.2021 -heavy rainfall

14	**COVASNA** **18 localities** **Târgu Secuiesc (Lunga)**, Bățani (Bățanii Mici, Herculian), Brateș (Pachia), Cătălina (Cătălina), Chichiș (Băcel), Dobârlău (Lunca Mărcușului), Ghelința (Ghelința), Malnaș (Malnaș Băi), Ozun (Ozun, Sântionlunca), Reci (Reci), Sânzieni (Sânzieni, Petriceni), Turia (Turia), Zăbala (Zăbala), Zagon (Zagon, Păpăuți).	27.05.2021 -runoff from slopes 18-23.06.2021 -overflow R. Negru, Pr. Baraolt, Pr. Covasna, Pr. Ghelinta, Pr. Zagon -runoff from slopes 01-05.07.2021 -overflow Pr. Casin, Pr. Estelnic, Pr. Cetatea de Piatra, Pr. Turia, Pr. Paun
15	**DÂMBOVIȚA** **80 localities** **Pucioasa (Glodeni, Malurile, Diaconești, Pucioasa, Pucioasa Sat, Bela, Miculești)**, **Fieni (Fieni, Costești)**, **Târgoviște**, Bezdead (Costisata, Magura, Brosteni, Tunari, Bezdead), Buciumeni (Valea Leurzii, Buciumeni, Dealu Mare), Cândești (Cândești Vale, Cândești Deal), Dobra (Mărcești), Finta (Finta Veche, Gheboaia, Bechinești, Finta Mare), Iedera (Iedera de Sus, Iedera de Jos, Colibași, Cricovul Dulce), Lucieni (Lucieni), Malu cu Flori (Micloșanii Mari, Capu Coastei, Micloșanii Mici, Malu cu Flori, Copăceni), Mănești (Mănești, Drăgăești-Ungureni, Drăgăești Pământeni), Moroeni (Muscel, Moroeni, Dobrești), Perșinari (Perșinari), Pietrari (Pietrari), Pucheni (Pucheni, Vârfureni, Brădățel, Valea Largă), Râu Alb (Râu Alb de Sus), Răzvad (Gorgota, Valea Voievozilor, Răzvad), Runcu (Bădeni, Ferestre, Piatra, Runcu, Siliștea, Brebu), Șotânga (Șotânga, Teiș), Ulmi (Dimoiu), Văcărești (Văcărești, Bungetu), Valea Lungă (Șerbăneasa, Valea Lungă Gorgota, Moșia Mică, Izvoru, Ștubeie Tisa), Vârfuri (Șuvița, Cârlănești, Merișoru, Vârfuri, Cojoiu, Ulmetu, Stătești), Visinești (Urseiu, Visinești, Sultanu), Vulcana Băi (Vulcana de Sus, Vulcana Băi), Vulcana Pandele (Toculești).	04-12.01.2021 -watercourses overflow -runoff from slopes 19-20.05.2021 -puddles, heavy rainfall 28.05.2021 – 02.06.2021 -watercourses overflow -runoff from slopes, puddles, the sewage network inability to take over, heavy rainfall, landslides, bank erosion 10.06.2021 -overflow Pr. Slanic -runoff from slopes, puddles, the sewage network inability to take over, heavy rainfall 27.06.2021 -watercourses overflow -runoff from the slopes, the sewage network inability to take over, heavy rainfall, landslides, bank erosion 02.07.2023 -overflow Pr. Cricovul Dulce -runoff from the slopes, the sewage network inability to take over, heavy rainfall, bank erosion 20.07.2021 -overflow R. Ialomița, Pr. Ialomicioara II -runoff from slopes, puddles, heavy rainfall, bank erosion 18.08.2021 -overflow, torrents, heavy rainfall, bank erosion 28-29.08.2021 -overflow -runoff fom slopes, the sewage network inability to take over, channel blocking landslides, heavy rainfall, bank erosion, flood flows 11-12.12.2021 -overflow -runoff from slopes, the sewage network inability to take over, heavy rainfall, bank erosion, flood flows

16	**GALAȚI** **49 localities** **Galați**, **Târgu Bujor (Târgu Bujor, Moscu, Umbrărești), Berești**, Bălăbănești (Bălăbănești, Bursucani, Lungești), Bălășești (Bălășești, Ciurești, Pupezeni), Băneasa (Băneasa), Berești Meria (Onciu, Aldești, Balintești, Slivna, Prodănești, Săseni, Puricani), Braniștea (Braniștea), Costache Negri (Costache Negri), Drăgușeni (Drăgușeni, Fundeanu, Adam, Căuiești, Știețești, Ghinghești), Fârățănești (Fârțănești), Foltești (Foltești, Stoicani), Jorăști (Jorăști, Lunca, Zărnești), Măstăcani (Măstăcani, Chiraftei), Matca (Matca), Munteni (Ungureni), Oancea (Oancea, Slobozia Oancea), Pechea (Pechea), Piscu (Piscu), Rădești (Rădești, Oanca), Scânteiești (Fântânele), Schela (Schela), Smulți (Smulți), Suceveni (Suceveni), Valea Mărului (Valea Mărului, Mândrești).	14.05.2021 -heavy rainfall 15-24.06.2021 -runoff from slopes, heavy rainfall 02-06.07.2021 -runoff from slopes, puddles, heavy rainfall 20.07.2021 -runoff from slopes, heavy rainfall 04-07.08.2021 -overflow R. Chineja -runoff from slopes, the sewage network inability to take over, heavy rainfall
17	**GORJ** **78 localities** **Bumbesti-Jiu, Novaci, Târgu Cărbunești (Târgu Cărbunești, Cojani, Curteana, Cretesti), Tismana (Tismana, Sohodol, Costeni, Racoți, Celei)**, Bustuchin (Poienița, Bustuchin), Văgiulești (Văgiulești), Albeni (Albeni), Alimpești (Nistorești, Corșoru), Baia de Fier (Baia de Fier, Cernadia), Bălănești (Băănești, Ohaba), Bălești (Bălești), Bolboși (Bolboși, Bălăcești, Igirosu, Ohaba Jiu, Valea, Bolboasa), Câlnic (Stejerei), Crasna (Cărpiniș, Radoși, Cărpiniș), Drăgotești (Drăgotești), Godinești (Godinești), Lelești (Frătești), Licurici (Totea, Frumușei, Negreni), Logrești (Măru), Motru (Horăști, Ploștina), Mușetești (Mușetești, Arseni), Padeș (Padeș, Văieni, Călugăreni, Orzești, Motru Sec), Peștișani (Peștșani, Seuca, Gureni, Brădiceni, Hobița), Polovragi (Polovragi, Racovița), Prigoria (Bucșana), Roșia de Amaradia (Roșia de Amaradia, Ruget, Seciurile, Becheni, Stejaru), Runcu (Runcu, Suseni), Săcelu (Săcelu, Blahnița de Sus), Samarinești (Samarinești, Larga, Boca), Schela (Schela, Sâmbotin), Slivilești (Slivilești, Miculești), Stănești (Vălari, Vaidei, Alexeni, Curpen), Telești (Telești, Șomănești).	04-13.01.2021 24-26.01.2021 -overflow -runoff from slopes, torrents, puddles, the sewage network inability to take over, landslides with bed blockage, heavy rainfall 18-19.05.2021 -runoff from slopes, puddles, the sewage network inability to take over, heavy rainfall 28.05-01.06.2021 -runoff from slopes, the sewage network inability to take over, heavy rainfall 14-15.06.2021 -runoff from slopes, the sewage network inability to take over, heavy rainfall July 2021 -runoff from slopes, the sewage network inability to take over, heavy rainfall August 2021 -runoff from slopes, the sewage network inability to take over, heavy rainfall
18	**HARGHITA** **52 localities** **Miercurea Ciuc, Odorheiu Secuiesc (Odorheiu Secuiesc), Toplița (Toplița), Vlăhița**, Bilbor (Bilbor, Răchitiș), Ciucsângeorgiu (Ciucsângeorgiu, Eghersec, Potiond, Ghiurche, Armășeni, Armășenii Noi, Bancu), Corbu (Corbu, Capu Corbului), Corund (Corund), Cozmeni (Cozmeni, Lăzărești), Dealu (Tibod, Ulcani), Feliceni (Hoghia, Forțeni, Tăureni), Lueta (Lueta), Lunca de Jos (Lunca de Jos), Lunca de Sus (Lunca de Sus), Merești (Merești), Mugeni (Mugeni), Ocland (Ocland, Crăciunel), Plăieșii de Jos (Iacobeni, Plăieșii de Jos, Cașinu Nou), Sândominic (Sândominic), Sânsimion (Sânsimion), Sântimbru (Sântimbru, Sântimbru-Băi), Sărmaș (Sărmaș, Hodoșa, Fundoaia, Runc, Platonești), Satu Mare (Satu Mare), Siculeni (Siculeni), Subcetate (Filpea, Călnaci), Tulgheș (Tulgheș, Pintic), Tușnad (Tușnad, Tușnadu Nou, Vrabia), Vârșag (Vârșag),	16-17.05.2021 -runoff from slopes 08.06.2021 -overflow -runoff from slopes 15-27.06.2021 -overflow -runoff from slopes 22.06.2021 -overflow -runoff from slopes 01-20.07.2021 -overflow -runoff from slopes 28.07.2021 -runoff from slopes

19	**HUNEDOARA** **94 localities** **Aninoasa, Brad (Brad, Valea Bradului, Mesteacăn, Ruda-Brad, Țărățel), Călan (Streisângeorgiu), Hațeg (Hațeg, Silvașu de Sus, Silvașu de Jos), Lupeni, Simeria (Simeria Veche), Uricani (Uricani, Câmpu lui Neag, Valea de Brazi), Vulcan (Vulcan),** Baia de Criș (Baia de Criș, Țebea, Rișca, Cărăstău, Văleni, Lunca), Balșa (Balșa, Vălișoara, Galbina, Roșia, Mada, Bunești, Techereu, Poiana, Poienița, Oprișești), Blăjeni (Blăjeni), Buces (Tarnita, Mihaileni), Bulzeștii de sus (Bulzeștii de sus, Bulzeștii de Jos, Giurgești), Bunila (Alun, Valea Dobrii, Bunila, Cernișoara Florese, Poienița Voinii), Cerbal (Cerbal), Certeju de Sus (Certeju de Sus), Criscior (Criscior), Densuș (Densuș, Ștei, Hățăgel), General Berthelot (General Berthelot, Tuștea, Livezi, Fărcădin), Ghelari (Ghelari, Plop), Ilia (Braznic, Săcămaș, Bacea, Valea Lungă), Lelese (Runcu Mare, Cerișor, Lelese), Orăștioara de Sus (Ludeștii de Sus, Costești Deal), Răchitova (Răchitova, Ciula Mică, Ciula Mare, Boița), Ribița (Crișan, Dumbrava de Jos), Sălașu de Sus (Sălașu de Sus, Paroș, Ohaba de sub Piatră), Șoimuș (Șoimuș, Boholt, Bejan, Chișcădaga, Câinelu de Jos, Fornadia, Sulighete), Toplița (Dăbâca, Vălari, Hășdău, Toplița), Vața de Jos (Vața de Jos, Vața de Sus, Ocișor, Ociu, Brotuna, Birtin, Prihodiște, Tătărăștii de Criș, Târnava de Criș, Basarabasa).	04-05.01.2021 -overflow -runoff from slopes, heavy rainfall 15-18.03.2021 -overflow -runoff from slopes 14-15.04.2021 -runoff from slopes 18-19.05.2021 -overflows R. Vața, R. Crișul Alb, R. Uibănești (Bulzești), R. Junc, R. Brad -runoff from slopes 18-27.06.2021 -overflow R. Rachitov, R. Galben -runoff from slopes 30.06-02.07.2021 -overflow Pr. Nail -runoff from slopes 15-20.07.2021 -overflows R. Silvas, R. Galben, Pr. Valea Dancan, R. Valarita, R. Valea Satului, blockages, the sewage network inability to take over -runoff from slopes, heavy rainfall 28.07.2021 -overflows Pr. Crevedia -runoff from slopes 17-18.09.2021 -runoff from slopes 11-12.12.2021 -Pr. Mohora overflows -runoff from slopes 25-27.12.2021 -overflows R. Crișul Alb, R. Vața, R. Obarșa, R. Uibărești -runoff from slopes
20	**IALOMIȚA** **4 localities** **Fierbinți Târg (Grecii de Jos)**, Gheorghe Doja (Gheorghe Doja), Giurgeni (Giurgeni), Scânteia (Scânteia).	13.06-08.07.2021 -heavy rainfall, canal irrigation infiltrations

21	**IAȘI** **188 localities** **Hârlău (Pârcovaci)**, **Pașcani (Boșteni, Sodomeni, Gâștești)**, Alexandru I. Cuza (Alexandru I. Cuza, Scheia), Balș (Balș, Boureni, Coasta Măgurii), Belcești (Munteni, Tansa, Ulmi, Liteni, Satu Nou), Bivolari (Bivolari), Brăești (Brăești, Cristești, Albești), Butea (Butea, Miclăușeni), Ciohorani (Ciohorani), Ciortești (Ciortești, Coropceni, Rotaria), Coarnele Caprei (Coarnele Caprei, Arama, Petroșica), Comarna (Comarna), Costești (Costești, Giurgești), Cotnari (Cotnari, Zbereni, Cireșeni, Făgăt, Valea Racului, Cârjoaia, Bahluiu), Cozmești (Cozmești, Podolenii de Sus, Podolenii de Jos), Cristești (Cristești), Cucuteni (Cucuteni, Săcărești), Dagâța (Dagâța, Băăușești, Zece Prăjini, Piscul Rusului, Mănăstirea, Boatca, Tarnița), Dobrovăț (Dobrovăț), Dolhești (Dolhești, Brădicești, Pietriș), Drăgușeni (Drăgușeni, Frenciugi), Dumești (Dumești, Chilișoaia, Banu, Păușești, Hoisești), Golăiești (Golăiești, Cotu lui Ivan), Gropnița (Gropnița, Sângeri, Forăști, Mălăești, Săveni, Bulbucani), Hălăucești (Hălăucești), Hărmănești (Boldești, Hărmăneștii Vechi), Heleșteni (Heleșteni, Hărmăneasa, Oboroceni), Ipatele (Ipatele, Alexești, Bacu, Cuza Vodă), Lespezi (Dumbrava, Bursuc Deal, Heci, Buda), Lețcani (Lețcani, Cogeasca), Lungani (Lungani, Goești, Zmeu, Crucea), Madarjac (Madarjac), Mircești (Mircești, Iugani), Mironeasa (Mironeasa), Miroslovești (Miroslovești, Soci), Mogoșești (Mogoșești, Hadâmbu), Mogoșești-Siret (Muncelu de Sus, Mogoșești Siret, Tudor Vladimirescu), Motca (Motca), Oțeleni (Oțeleni, Hândrești), Popești (Popești, Vama, Doroșcani, Obrijeni, Hărpășești), Popricani (Popricani, Țipilești, Moimești, Cotu Morii, Vânători, Vulturi, Cârlig, Cuza Vodă), Prisăcani (Prisăcani), Răchiteni (Răchiteni), Ruginoasa (Ruginoasa, Dumbrăvița, Rediu, Vascani), Scheia (Scheia, Căuești, Satu Nou, Cioca Boca, Poiana Scheii, Căușești), Schitu Duca (Satu Nou, Poiana, Pocreaca, Slobozia, Dumitreștii Gălății), Sinești (Sinești, Osoi, Stornești, Bocnița), Șipote (Șipote, Iazu Nou, Chișcăreni), Sirețel (Sirețel, Slobozia, Satu Nou), Stolniceni Prăjescu (Stolniceni Prăjescu, Cozmești, Brătești), Strunga (Brătulești), Tansa (Tansa, Suhuleț), Tătăruși (Tătăruși, Pietrosu, Uda), Țibana (Țibana, Poiana Mănăstirii, Moara Ciornei, Gârbești, Poiana de Sus), Țibănești (Țibănești, Jigoreni, Vălenii, Griești, Răsboieni, Glodenii Gândului, Tungujei, Recea), Țigănași (Țigănași, Mihail Kogălniceanu, Carniceni, Stejarii), Todirești (Todirești, Băiceni), Tomești (Tomești, Goruni, Chicerea, Vlădiceni), Valea Lupului (Valea Lupului), Valea Seacă (Valea Seacă, Topile, Conțești), Vânători (Vânători, Crivești, Hârtoape, Vlădnicuț), Voinești (Voinești, Schitu Stavnic, Slobozia, Lungani, Vocotești).	15-18.03.2021 -runoff from slopes, heavy rainfall 18-19.05.2021 -overflows R. Bahluet -runoff from slopes, heavy rainfall, bank erosion 27-29.05.2021 -runoff from slopes, heavy rainfall 02-03.06.2021 -runoff from slopes, heavy rainfall 15-23.06.2021 -runoff from slopes, heavy rainfall 28.06-04.07.2021 -runoff from slopes, heavy rainfall 06-07.07.2021 -runoff from slopes, heavy rainfall 12.07.2021 -runoff from slopes, heavy rainfall 19-21.07.2021 -runoff from slopes, heavy rainfall 29.07-05.08.2021 -blockages, runoff from slopes, heavy rainfall, storm, hail 27-28.08.2021 -runoff from slopes, heavy rainfall
22	**ILFOV** **10 localities** **Bragadiru**, **Popești Leordeni**, Ciolpani (Ciolpani), Corbeanca (Tamași), Dragomirești-Vale (Dragomirești-Vale), Găneasa (Găneasa), Grădiștea (Grădiștea), Moara Vlăsiei (Moara Vlăsiei), Periș (Periș), Petrăchioaia (Petrăchioaia).	11.06-29.07.2021 -the sewage network inability to take over, heavy rainfall

23	**MARAMUREŞ** **90 localities** **Baia Mare, Baia Sprie (Baia Sprie, Tăuții de Sus, Chiuzbaia), Borșa (Borșa, Băile Borşa), Cavnic, Dragomirești, Săliștea de Sus, Sighetu Marmației (Sighetu Marmației, Iapa), Șomcuta Mare (Vălenii Șomcutei, Buciumi, Finteușu Mare, Ciolt, Șomcuta Mare, Hovrila, Codru Butesii), Târgu Lapuș, Ulmeni (Mânău, Someș-Uileac, Arduzel, Vicea, Chelința), Vișeu de Sus**, Bârsana (Bârsana), Bistra (Crasna Vișeului), Budești (Budești), Călinești (Călinești, Cornești, Văleni), Cernești (Măgureni, Brebeni, Trestia), Coaș (Coaș, Întrerâuri), Coltău (Coltău), Copalnic-Mănăștur (Laschia, Vad, Făurești, Berința, Copalnic, Copalnic-Deal, Cărpiniș, Curtuiușu Mic, Preluca Nouă, Preluca Veche, Rușor), Cupșeni (Cupșeni, Costeni, Libotin, Ungureni), Fărcașa (Tamaia), Giulești (Berbești), Groși (Groși, Satu Nou de Jos, Ocoliș), Groșii Țibleșului (Groșii Țibleșului), Lăpuș (Lăpuș), Leordina (Leordina), Mireșu Mare (Mireșu Mare, Iadara, Remeți pe Someș, Tulghieș), Moisei (Moisei), Oncești (Oncești), Poienile de sub Munte (Poienile de sub Munte), Poienile Izei (Poienile Izei), Repedea (Repedea), Rozavlea (Rozavlea, Salta), Ruscova (Ruscova), Săcel (Săcel), Satulung (Fersig, Hideaga), Șieu (Șieu), Șișești (Șișești, Surdești, Plopiș, Negreia, Dănești), Strâmtura (Strâmtura, Glod), Vima Mică (Vima Mică, Aspra, Dealu Corbului, Peteritea, Sălnița, Vima Mare), Vișeu de Jos (Vișeu de Jos).	03-12.02.2021 -overflows R. Cavnic, R. Sasar, Valea Brazi, Valea Borcut, R Iza, Pr. Chiuzbaia, Pr. Ungureni, R. Fririza -runoff from slopes, heavy rainfall 12-24.05.2021 -overflows Viseu river, Someș river -runoff from slopes, heavy rainfall, puddles, the sewage network inability to take over 25.06-12.07.2021 -overflows Ruscova river, Drahmirov river, Viseu river, Vaser river, Iza river, Cavnic river, Socolau stream, Ruscova river -runoff from slopes, torrents, puddles, heavy rainfall, the sewage network inability to take over 16-21.07.2021 -runoff from the slopes, puddles, heavy rainfall, the sewage network inability to take over, storm, wind 01-02.08.2021 -runoff from slopes, torrents, heavy rainfall, puddles, the sewage network inability to take over
24	**MUREŞ** **59 localities** **Iernut, Reghin, Târnăveni**, Adămuș (Adămuș, Crăiești), Bahnea (Bahnea, Lepindea, Bernadea, Daia, Gogan), Bălăușeri (Chendu, Filitelnic), Bereni (Bereni, Mărculeni, Bara), Breaza (Breaza, Filpișu Mare, Filpișu Mic), Ernei (Ernei, Icland, Dumbrăvioara, Săcăreni), Gălești (Gălești, Sânvăsii), Gurghiu (Adrian, Cașva, Fundoaia, Gurghiu, Larga, Păuloaia, Orșova, Glăjărie), Ibănești (Ibănești, Blidireasa, Ibănești-Pădure, Pârâu Mare, Zimți, Tisieu, Tireu, Lăpușna, Brădețelu, Dulcea), Măgherani (Măgherani, Lilea Nirajului), Mica (Mica), Ogra (Lăscud, Giuluș), Sânpaul (Sânpaul), Sânpetru de Câmpie (Sânpetru de Câmpie, Dâmbu, Tușinu, Satu Nou, Bârlibaș), Saschiz (Mihai Viteazu, Cloașterf), Valea Largă (Valea Largă, Valea Pădurii), Zău de Câmpie (Zău de Câmpie, Botei).	12.02.2021 -overflows R. Mureș 02-03.04.2021 -runoff from slopes, heavy rainfall 17-31.05.2021 -Tarnava Mica river overflows, R. Gurghiu, Pr. Lascud, Pr. Sarata -runoff from slopes, torrents, heavy rainfall 11-15.06.2021 -runoff from slopes, torrents, heavy rainfall, the sewage network inability to take over 25.06-03.07.2021 -runoff from slopes, puddles, heavy rainfall, the sewage network inability to take over, storm 19.07.2021 -Pr. Terebici overflows -runoff from slopes, puddles, the sewage network inability to take over, hail 17-18.08.2021 -runoff from slopes, heavy rainfall

25	**NEAMȚ** **184 localities** **Bicaz (Izvoru Muntelui, Potoci, Izvoru Alb), Piatra Neamț**, Agapia (Agapia, Săcălușești, Văratec, Filioara), Alexandru cel Bun (Vădurele, Agârcia, Viișoara, Bistrița, Scăricica), Bălțătești (Bălțătești, Valea Arini, Seaca), Bârgăuani (Bârgăuani, Breaza, Certieni, Hârtop, Bălănești, Ghelăiești, Dârloaia, Vlădiceni, Homiceni), Bicaz Chei (Bicaz Chei, Bârnadu, Ivaneș), Bodești (Bodești, Oslobeni, Bodeștii de Jos), Boghicea (Boghicea, Căușeni, Slobozia, Nistria), Borca (Borca, Sabasa, Madei, Pârâul Cârjei, Pârâul Pantei, Soci), Borlești (Borlești, Mastacăn, Șovoaia, Ruseni, Nechit), Bozieni (Bozieni, Crăiești), Ceahlău (Ceahlău, Bistricioara), Crăcăoani (Poiana Crăcăoani, Cracăul Negru, Magazia, Crăcăoani, Mitocu Bălan), Dămuc (Dămuc, Huisurez, Trei Fântâni), Dobreni (Dobreni), Dochia (Dochia, Bălușești), Doljești (Doljești, Buhonca), Drăgănești (Drăgănești, Orțăști, Râșca, Șoimărești), Dragomirești (Dragomirești, Mastacăn, Hlăpești, Unghi), Dulcești (Dulcești, Cârlig, Roșiori), Dumbrava Roșie (Dumbrava Roșie, Cut, Brășăuți, Izvoare), Fărcașa (Stejaru, Fărcașa, Busmei, Popești), Făurei (Budești, Climești, Făurei), Gâdinți (Gâdinți), Gârcina (Gârcina, Cuejdiu, Almaș), Gherăești (Gherăești), Ghindăoani (Ghindăoani), Girov (Girov, Gura Văii, Turturești, Căciulești, Botești, Popești, Dănești, Doina, Verșești), Grințies (Grințies, Poiana, Bradu), Grumăzești (Grumăzești, Curechiștea, Topolița, Netezi), Hangu (Hangu, Ruginești, Buhalnița, Grozăvești, Chiriteni), Ion Creangă (Ion Creangă, Averești, Izvoru, Muncelu, Recea, Stejaru), Negrești (Negrești), Oniceni (Valea Enei, Mărmureni, Oniceni, Pietrosu, Solca, Poiana Humei, Gorun), Pâncești (Ciurea, Holm, Tălpălăi, Pâncești, Patricheni), Pângarați (Pângărăcior, Oanțu, Preluca, Pângarați), Păstrăveni (Păstrăveni, Rădeni), Petricani (Petricani, Târpești, Boiștea, Tolici), Pipirig (Dolhești, Leghin, Stânca, Pipirig, Boboiești, Pâțâligeni, Pluton), Poiana Teiului (Poiana Teiului, Roșeni, Petru Vodă, Poiana Largului, Dreptu), Poienari (Poienari, Săcăleni), Romani (Goșmani, Romani), Ruginoasa (Rusinoasa, Bozienii de Sus), Sagna (Vulpășești), Stănița (Poienile Oancei, Ghidion Ghicerea, Todireni), Ștefan cel Mare (Ștefan cel Mare, Bordea, Deleni, Soci), Tarcău (Tarcău, Straja, Cazaci, Brateș), Tazlău (Tazlău), Țibucani (Davideni, Țibucanii de Jos, Țibucani), Tupilați (Totoiești, Hanu Ancuței, Tupilați, Arămoaia), Urecheni (Urecheni, Ingărești), Vânători Neamț (Lunca, Vânători Neamț), Zănești (Zănești).	16- 18.03.2021 -runoff from slopes. 06-08.04.2021 -runoff from slopes. 13.06- 05.07.2021 -overflow, runoff from slopes, torrents, puddles, heavy rainfall. 18- 22.07.2021 -overflow R. Pluton-Dolhesti, R. Neamt (Ozana), R. Anton (unregistered), R. Velnita, R. Stejar, R. Bitcii (unregistered), R. Strungii (unregistered), torrent River, R. Bistricioara, R. Grinties, etc. -runoff from slopes, torrents, heavy rainfall. 24- 25.08.2021 -overflow R Horaita -heavy rainfall
26	**OLT** **14 localities** Movileni (Movileni, Bacea), Sâmburești (Lăunele, Tonești), Tătulești (Mîgura, Lunca, Mircești), Vitomirești (Bulimanu, Vitomirești, Donești), Vulturești (Dienci, Valea lui Alb, Vulturești, Vlăngărești).	15-21.03.2021 -overflow Pr Cungra, -runoff from slopes, heavy rainfall.

27	**PRAHOVA** **64 localities** **Azuga, Breaza (Valea Târsei, Nistorești, Gura Beliei, Frăsinet, Podu Vadului), Bușteni, Comarnic, Mizil, Sinaia, Slănic,** Adunați (Ocina de Jos, Adunați, Ocina de Sus), Aluniș (Aluniș, Ostrovu), Bănești (Bănești), Bătrâni (Bătrâni, Poiana Mare), Bertea (Bertea, Lutu Roșu), Cerașu (Slon), Chiojdeanca (Chiojdeanca), Cornu (Cornu de Jos), Dumbrăvești (Mălăeștii de Sus, Găvănel, Sfârleanca), Gornet (Gornet, Cuib, Nucet), Gura Vadului (Gura Vadului), Măgureni (Măgureni), Podenii Noi (Sfăcăru, Ghiocel, Podu lui Galben, Popești, Nevesteasca), Poiana Câmpina (Poiana Câmpina, Răgman), Posești (Nucșoara de Jos), Provița de Jos (Provița de Jos, Drăgăneasa, Piatra), Provița de Sus (Provița de Sus), Puchenii Mari (Puchenii Mari), Scorțeni (Bordenii Mici, Bordenii Mari, Scorțeni, Mislea), Starchiojd (Starchiojd), Ștefești (Ștefești, Scurtești), Târgșorul Vechi (Stăncești), Tătaru (Tătaru, Podriga, Siliștea), Valea Călugărească (Coslegi, Valea Nicovani, Valea Mantei, Valea Poienii, Valea Largă, Pantazi, Rachieri), Valea Doftanei (Teșila).	04-06.01.2021 -overflow R Teleajen, -runoff from slopes, torrents. 27.05-01.06.2021 -overflow R Teleajen, pr Provita, pr Varbilau pr Campea s.a., -runoff from slopes, torrents, puddles. the sewage network inability to take over. 11-13.06.2021 -overflow Pr Provita, Pr Valea Nucului (not registered), -runoff from slopes, torrents, puddles. 22-28.06.2021 -overflow, runoff from the slopes, torrents, puddles, the the sewage network inability to take over. 02-03.07.2021 -overflow Pr Mislea, Pr Telega, Pr Valea Seacă, Pr Runc, -runoff from slopes, torrents, puddles. 20-21.07.2021 -overflow, runoff from the slopes, torrents, puddles, the the sewage network inability to take over. 18-19.08.2021 -runoff from slopes, puddles. 28-30.08.2021 -overflow, runoff from slopes, torrents, puddles, the sewage network inability to take over. 12-13.12.2021 -overflow R Prahova, Pr Azuga, R Teleajen, R Doftana -runoff from slopes, torrents, puddles, the the sewage network inability to take over
28	**SATU MARE** **12 localities** Beltiug (Rătești, Ghirisa, Giungi, Bolda), Bogdan (Babta), Socond (Socond, Stana, Cuta, Soconzel, Hodisa), Supur (Supuru de Jos, Hurezu Mare).	13-15.05.2021 -overflow Pr. Maria, Pr. Cerna, Pr. Bolda, Pr. Valea Baii -runoff from slopes.
29	**SĂLAJ** **10 localities** Creaca (Jac), Cristolt (Cristolt, Valeni, Oiana Ontii, Muncel), Ileanda (Perii Vadului, Rastoci, Luminisu, Sasa, Barsauta).	01.08.2021 -runoff from slopes, heavy rainfall 08-23.05.2021 -overflows, runoff from slopes, puddles, heavy rainfall

30	**SUCEAVA** **209 localities** **Cajvana, Câmpulung Moldovenesc, Dolhasca (Dolhasca, Silistea Noua, Probota), Fălticeni**, **Frasin (Plutonita, Doroteia, Bucșoaia, Frasin), Liteni (Liteni, Siliștea, Rotunda, Corni), Milisăuți, Rădăuți, Solca, Vatra Dornei (Vatra Dornei, Argestru, Rosu, Todireni), Vicovu de Sus (Vicovu de Sus, Bivolaria),** Adancata (Adancata, Fetesti), Arbore (Arbore, Clit), Baia (Baia, Bogata), Balcauti (Balcauti, Gropeni, Negostina), Berchisesti (Corlata, Berchisesti), Bogdanesti (Bogdanesti), Breaza (Breaza, Breaza de Sus), Brodina (Dubiusca, Cununschi, Ehreste, Zalomestra, Paltin, Sadau, Norocu, Brodina, Falcau), Brosteni (Darmoxa, Pietroasa, Cotargasi, Holdita, Holda, Brosteni), Burla (Burla), Cacica (Runcu, Solonetu Nou, Partestii de Sus, Cacica), Calafindesti (Botosanita Mare, Calafindesti), Comanesti (Comanesti, Humoreni), Cornu Luncii (Braiesti, Baisesti, Sinca, Sasca Mare, Paiseni), Cosna (Cosna, Romanesti, Podu Cosnei), Dolhesti (Dolhestii Mari, Dolhestii Mici, Valea Bourei), Dorna Arini (Cozanesti, Ortoaia, Gheorghiteni, Dorna Arini), Dorna Candrenilor (Poiana Negrii, Dorna Candrenilor), Dornesti (Iaz, Dornesti), Draguseni (Draguseni, Brosteni), Dumbraveni (Dumbraveni, Salageni), Fantanele (Stamate, Fantanele), Fratautii Noi (Fratautii Noi, Costisa), Frumosu (Frumosu, Deia), Gramesti (Gramesti, Balinesti, Botosanita Mica, Rudesti), Granicesti (Granicesti, Iacobesti), Hantesti (Hantesti, Beresti), Horodnic de Jos (Horodnic de Jos), Horodnic de Sus (Horodnic de Sus), Horodniceni (Horodniceni, Rotopanesti, Mihaiesti, Bradatel), Iacobeni (Iacobeni, Mestecanis), Ilisesti (Ilisesti), Ipotesti (Tisauti, Lisaura, Ipotesti), Izvoarele Sucevei (Brodina), Manastirea Humorului (Manastirea Humorului, Poiana Micului), Mitocu Dragomirnei (Mitocasi, Mitocu Dragomirnei, Dragomirna, Lipoveni), Moara (Bulai, Moara Nica, Moara Carp, Liteni, Vornicenii Mari), Moldova Sulita (Moldova Sulita, Benia), Moldovita (Argel), Musenita (Bainet, Bancesti, Vascauti), Panaci (Catrinari, Glodu, Dragoiasa), Patrauti (Patrauti), Poiana Stampei (Dornisoara, Praleni, Pilugani, Tataru), Poieni Solca (Poieni Solca), Pojorata (Pojorata), Preutesti (Arghira, Basarabi, Preutesti), Putna (Putna), Radaseni (Lamaseni, Radaseni), Rasca (Rasca, Dumbraveni, Slatioara), Saru Dornei (Saru Dornei, Saru Bucovinei), Scheia (Scheia, Sfantu Ilie), Siminicea (Grigoresti, Siminicea), Slatina (Slatina, Gainesti, Herla), Stroiesti (Stroiesti, Zaharesti, Valcelele), Stulpicani (Stulpicani, Negrileasa), Todiresti (Costana, Parhauti, Sarghiesti, Todiresti, Solonet), Udesti (Stirbat, Chiliseni, Udesti, Plavalari, Manastioara, Securiceni, Luncusoara), Ulma (Magura, Lupcina, Costileva, Ulma, Nisipitu), Vadu Moldovei (Ioneasa, Nigotesti, Mesteceni, Vadu Moldovei, Dumbravita, Ciumulesti), Valea Moldovei (Mironu, Valea Moldovei), Vama (Molid, Stramtura, Vama), Veresti (Bursuceni, Corocaiesti, Hancea, Veresti), Vicovu de Jos (Vicovu de Jos), Volovat (Volovat), Vultuesti (Valea Glodului, Giurgesti, Osoi, Meresti, Vulturesti, Plesesti), Zamostea (Nicani, Tautesti, Zamostea), Zvoristea (Dealu, Buda, Stanca, Poiana, Slobozia).	11.03-15.04.2021 -overflows R Suceava, Pr Iepure (not registered) -runoff from slopes, freeze-thaw. 18.04-13.05.2021 -runoff from slopes. 27.05-04.06.2021 -overflows, runoff from slopes, torrents 14.06-02.07.2021 -overflows R Suceava, Pr Negrișoara, Pr Pietroasa, etc. -runoff from slopes, freeze-thaw 16-20.07.2021 -overflows R Moldova, Pr Benia, Pr Darmoxa, Pr Negrișoara, Pr Sulita, -runoff from slopes. 22.07-03.08.2021 -overflows, runoff from slopes. 17-24.08.2021 -overflows R Bistrița, Pr Solonet, Pr Saha (not registered), R Moldova, Pr Humor -landslide with bed blocking 14.09.2021 -runoff from slopes.
31	**TELEORMAN** **4 localities** Viisoara (Viisoara), Scrioastea (Scrioastea, Brebina, Cucuieti)	17-19.05.2021 -runoff from slopes. 13-15.12.2021 -runoff from slopes.
32	**TULCEA** **16 localities** **Isaccea**, Frecăței (Frecăței, Cataloi, Poșta, Telița), Hamcearca (Hamcearca, Balabancea, Nifon), Horia (Horia), I.C. Bratianu (I.C. Bratianu) Jijila (Jijila, Garvan), Luncavita (Luncavita, Rachelu), Niculitel (Niculițel), Văcăreni (Văcăreni).	14-24.06.2021 -runoff from slopes, heavy rainfall

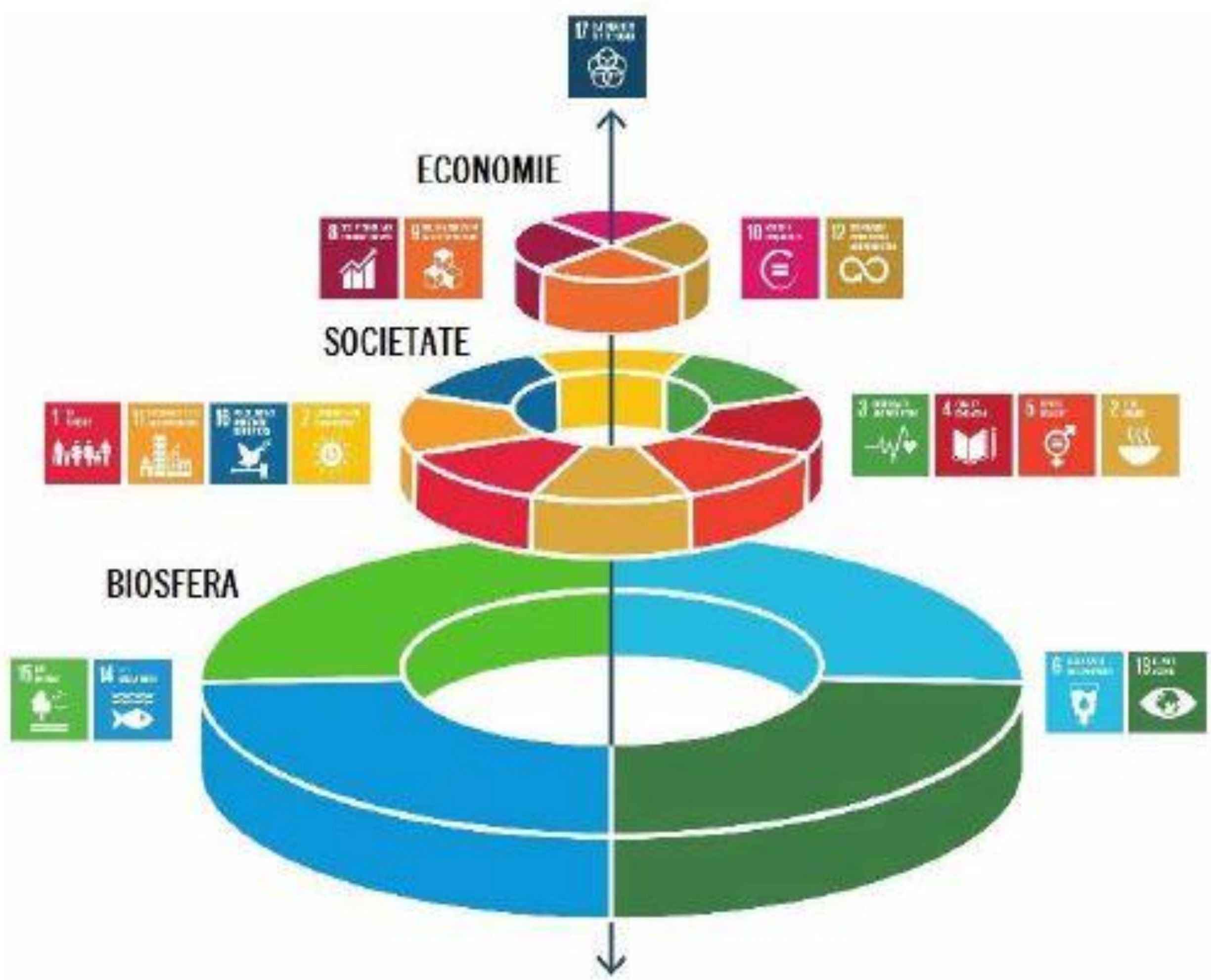
33	**VASLUI** **228 localities** **Bârlad, Murgeni (Murgeni, Floreni, Carja, Raiu, Latesti, Schineni, Sarateni)**, Arsura (Arsura, Mihail Kogalniceanu, Pahnesti, Fundatura), Bacani (Bacani, Baltateni, Drujesti, Suseni, Vulpaseni), Bacesti (Bacesti, Vovriesti, Paltinis, Babusa, Armaseni, Tibanestii Buhlii), Banca (Banca, Mitoc, Sarbi, Stoisesti, Ghermanesti, Miclesti, Tifu, Gara Banca), , Bogdanesti (Bogdanesti, Orgoiesti, Visinari, Buda, Horoiata), Botesti (Botesti, Gugesti), Codaesti (Codaesti, Pribesti, Ghergheleu), Cozmesti (Cozmesti, Balesti, Fastaci), Danesti (Danesti, Emil Racovita, Bereasa, Botoaia, Tatarani, Rascani), Deleni (Deleni, Bulboaca, Zizinca), Delesti (Delesti, Manastirea, Harsova, Fundatura, Albesti, Raduiesti), Dimitrie Cantemir (Gusitei, Urlati, Hurdugi, Grumezoaia), Dodesti (Dodesti, Urdesti), Dragomiresti (Dragomiresti, Babuta, Poiana Pietrei, Popesti, Radeni, Ciuperca, Tulesti, Vladia), Duda-Epureni (Valea Grecului), Dumesti (Dumesti, Valea Mare, Dumestii Vechi, Schinetea), Epureni (Epureni, Horga, Barlalesti, Bursuci), Falciu (Falciu, Ranzesti, Bozia, Bogdanesti, Odaia Bogdana, Copaceana), Feresti (Feresti), Fruntiseni (Fruntiseni, Grajdeni), Gagesti (Gagesti, Peicani, Tupilati), Garceni (Garceni, Dumbraveni, Trohan, Racova, Racovita, Slobozia), Gherghesti (Gherghesti, Lunca, Chetrosu, Corodesti, Draxeni, Lazu, Soci), Grivita (Grivita, Odaia Bursucani, Trestiana), Iana (Iana, Halaresti, Silistea, Vadurile), Ivanesti (Ivanesti, Cosca, Brosteni, Valea Mare, Fundatura Mare, Buscata, Harsoveni, Valea Oanei, Blesca, Ursoaia, Iezerel, Cosesti, Fundatura Mica), Laza (Laza, Sauca, Rasnita), Lipovat (Lipovat, Corbu, Chitoc, Fundu Vaii, Capusneni), Perieni (Perieni), Pogana (Tomesti, Bogesti, Mascurei, Carjoani), Pogonesti (Pogonesti, Polocin, Belcesti), Poienesti (Poienesti, Frasinu, Poienesti-Deal, Floresti), Puiesti (Fulgu, Lalesti, Galtesti, Rusi, Calimanesti, Fantanele, Cetatuia, Rotari, Bartalus Mocani, Bartalus Razesi), Pungesti (Pungesti, Silistea, Stejaru, Armasoaia, Toporasti, Cursesti Deal, Cursesti Vale), Rafaila (Rafaila), Rebricea (Rebricea, Ratesu Cuzei, Craciunesti, Tatomiresti, Draxeni, Sasova, Bolati, Tufestii de Jos), Rosiesti (Rosiesti, Gura Idrici, Idrici, Rediu, Codreni, Valea lui Darie), Solesti (Bousori, Valea Silistei), Stanilesti (Stanilesti, Budu Cantemir, Chersacosu, Poganesti), Stefan cel Mare (Stefan cel Mare, Cantalaresti, Brahasoaia), Suletea (Suletea, Fedesti, Jigalia, Rascani), Tacuta (Mircesti), Todiresti (Todiresti, Viisoara, Huc, Dragesti, Silistea, Plopoasa, Cotic, Valea Popii, Sofronesti), Viisoara (Viisoara, Viltoresti, Valeni, Halta Dodesti), Vinderei (Vinderei, Docaneasa, Gara Talasman, Docani, Bradesti, Obarseni, Valea Lunga), Voinesti (Voinesti, Avramesti, Marasesti, Bancesti, Uricari, Stancaseni, Obarseni, Obarsenii Lingurari), Vulturesti (Vulturesti, Voinesti), Vutcani (Vutcani), Zapodeni (Zapodeni, Portari), Zorleni (Zorleni, Popeni).	15-22.06.2021 -runoff from slopes, the sewage network inability to take over 01-02.07.2021 -runoff from slopes 04-06.08.2021 -overflows R. Dobrovat -runoff from slopes, the sewage network inability to take over, heavy rainfall

34	**VÂLCEA** **147 localities** **Băile Govora (Prajila, Curăturile, Gâtejești), Băile Olănești (Livadia, Olănești, Cheia, Comanca), Bălcești (Bălcești, Otetelișu), Berbești (Dealu Aluniș, Valea Mare, Dămțeni, Roșioara, Târgu Gângulești), Brezoi (Brezoi, Păscoaia, Vasilatu), Călimănești (Jiblea Veche, Jiblea Nouă), Horezu (Romanii de Sus),** Alunu (Alunu, Bodești, Igoiu, Roșia), Bărbătești (Bărbătești, Bârzești, Bodești), Berislăvești (Rădăcinești, Berislăvești, Stoenești), Boișoara (Boișoara), Cernișoara (Cernișoara, Mădulari), Costești (Pietreni, Costești, Bistrița, Văratici), Dănicei (Valea Scheiului), Drăgoești (Drăgoești, Buciumeni), Francești (Mănăilești, Viișoara, Francești, Moșteni, Dezrobiți), Galicea (Cremenari, Valea Râului, Cocoru, Bratia din Deal), Geamăna (Geamăna), Glăvile (Olteanca), Golești (Tulei Câmpeni, Aldești, Gibești, Popești, Blidari, Opătești), Grădiștea (Valea Grădiștei), Gușoeni (Măgureni), Lădești (Lădești), Lăpușata (Sărulești, Berești, Broșteni, Șerbănești, Scorușu), Malaia (Ciungetu, Malaia, Săliștea), Măldărești (Telechești, Măldărești, Ciupa, Măldareștii de Jos), Mateești (Turcești), Milcoiu (Căzănești, Ciutești, Izbășești), Muereasca (Găvănești, Francești Coasta, Muereasca, Hotarele, Muereasca de Sus, Andreiești), Nicolae Bălcescu (Corbii din Vale, Dosu Râului), Orlești (Orlești), Oteșani (Oteșani, Sub Deal, Bogdănești, Cârstănești), Păușești (Păușești, Păușești Otăsău, Șerbănești, Buzdugan, Văleni, Cernelele, Barcanele, Șolicești), Păușești Măglași (Valea Cheii, Vlăduceni, Pietrari, Coasta, Păușești Măglași, Perișani (Perișani, Mlăceni, Băiașu, Spinu, Surdoiu), Pietrari (Pietrari), Popești (Popești, Dăești, Meleni, Curtea, Valea Caselor, Urși), Racovița (Copăceni, Tuțulești, Bradu Clocotici), Roșiile (Cherăști, Zgubea, Românești, Rățălești, Păsărei, Hotăroaia, Pertești), Sălătrucel (Șerbănești, Pătești, Sălătrucel), Sinești (Ciucheți, Popești, Urzica, Sinești, Dealu Bisericii), Șirineasa (Slăvitești), Stoenești (Deleni), Stoilești (Giuroiu), Titesti (Titești, Cucoiu), Vaideeni (Vaideeni, Izvoru Rece, Marița, Cornet, Cerna), Vlădești (Vlădești, Priporu, Trundin), Zătreni (Zătreni, Dealul Văleni).	04-05.01.2021 -overflow Pr Otăsău, R Lotru, Strâmba, Taraia, Cernișoara, Cerna, Olănești, Bistrita -runoff from slopes, the the sewage network inability to take over, heavy rainfall. 16.03.2021 -runoff from slopes, the the sewage network inability to take over, heavy rainfall. 20.05-02.06.2021 -runoff from slopes, the the sewage network inability to take over, heavy rainfall. 11-13.06.2021 -overflow, runoff from slopes, heavy rainfall. 20-22.06.2021 -the sewage network inability to take over, heavy rainfall. 12-13.12.2021 -overflow, runoff from slopes, heavy rainfall.
35	**VRANCEA** **170 localities** **Adjud (Șișcani, Adjudu Vechi),** Dumitrești (Dumitrești), Gura Caliței (Dealu Lung, Groapa Tufei, Groapa Catrinei, Cocoșari, Rașca, Gura Caliței, Plopu, Bălănești, Poenile, Șotârcari, Lacul lui Baban), Andreiașu de Jos (Andreiașu de Jos, Butucoasa, Răchitașu, Fetig, Hotaru, Tilila), Mera (Mera, Milcovel, Livada, Vulcăneasa, Roșioara), Valea Sării (Prisaca, Valea Sării, Mătăcina), Dumbrăveni (Dumbrăveni), Păulești (Păulești, Hăulișca), Răcoasa (Gogoiu, Verdea), Soveja (Dragosloveni), Vizantea Livezi (Mesteacănu, Vizantea Mănăstirească), Tulnici (Coza, Tulnici, Lepșa, Greșu), Biliești (Biliești), Nereju (Nereju, Nereju Mic, Sahastru, Chiricani, Brădăcești), Soveja (Dragosloveni), Câmpuri (Câmpuri, Rotileștii Mici, Gura Văii), Reghiu (Reghiu, Ursoaia, Răiuți, Farcaș, Șindrilari), Paltin (Prahuda, Ghebari, Paltin, Țepa), Câmpineanca (Câmpineanca), Vidra (Irești, Șerbești, Ruget, Tichiriș, Viișoara, Vidra), Bârsești (Bârsești, Topești), Poiana Cristei (Poiana Cristei, Mahriu, Petreanu), Cotești (Cotești, Valea Cotești, Goleștii de Sus), Chiojdeni (Seciu, Cătăuți, Podurile, Chiojdeni, Tulburea, Lojnița, Luncile, Mărăcini), Dumitrești (Dumitrești, Siminoc, Motnău, Lăstuni, Valea Mică, Poienița, Blidari, Dumitreștii Față, Biceștii de Jos, Biceștii de Sus, Roșcari, Lupoaia, Trestia, Siminoc, Galoiești), Spulber (Spulber, Țipău, Păvălari, Carșochesti -Corabița, Morărești, Tojanii de Jos), Naruja (Podu Stoica, Naruja, Rebegari), Nistorești (Brădetu, Valea Neagră, Podu Schiopului, Vetrești Herăstrău, Ungureni, Românești, Făgetu, Bâtcari, Nistorești), Boghești (Prisecani, Iugani, Chițcani), Garoafa (Ciuslea, Făurei, Garoafa), Păunești (Paunești, Viișoara), Homocea (Lespezi, Costișa), Păulesti (Păulești, Hăulișca), Negrilești (Negrilești), Vrâncioaia (Bodești, Poiana, Vrâncioaia, Spinești, Ploștina), Valea Sării (Prisaca, Valea Sări, Poduri, Mătăcina, Colacu), Suraia (Suraia), Vârteșcoiu (Faraoanele), Pufești (Domnești Sat, Ciorani), Cârligele (Blidari, Bonțești, Cârligele), Urechești (Urechești), Tulnici (Coza), Soveja (Dragosloveni), Bârsești (Bârsești, Topești), Nistorești (Brădetu, Podu Schiopului, Ungureni, Făgetu), Dumbrăveni (Dragosloveni, Dumbrăveni), Reghiu (Ursoaia, Șindrilari), Răcoasa (Varnița), Vintileasca (Tănăsari, Neculele), Poiana Cristei (Dumbrava), Movilița (Diocheți-Rediu), Paltin (Prahuda, Paltin), Bolotești (Găgești, Vităneștii de sub Măgura, Pietroasa, Putna), Țifești (Clipicești).	15-21.03.2021 -overflow Pr Peletic, Pr Rascuta, R Milcov, R Ramna, -runoff from slopes, heavy rainfall, bank erosion. 12-21.05.2021 -overflow Pr. Dragomira -runoff from slopes, the the sewage network inability to take over, heavy rainfall. 18-29.06.2021 -overflow R Putna, Pr Coza, Pr Tisita, R Zabala, R Dragomirna, R Susita, R Milcovel, R Milcov, R Putna, R Ramnicu Sarat -runoff from slopes, heavy rainfall, erosion. 27.06-27.07.2021 -overflow, runoff from slopes, heavy rainfall. 02-12.08.2021 -runoff from slopes, heavy rainfall. 28-29.08.2021 -overflow R Zabala Pr Tulburea, R Putna, -runoff from slopes, heavy rainfall. 11-13.12.2021 -oveflows R Zabala, Pr Olari, -runoff from slopes, heavy rainfall.

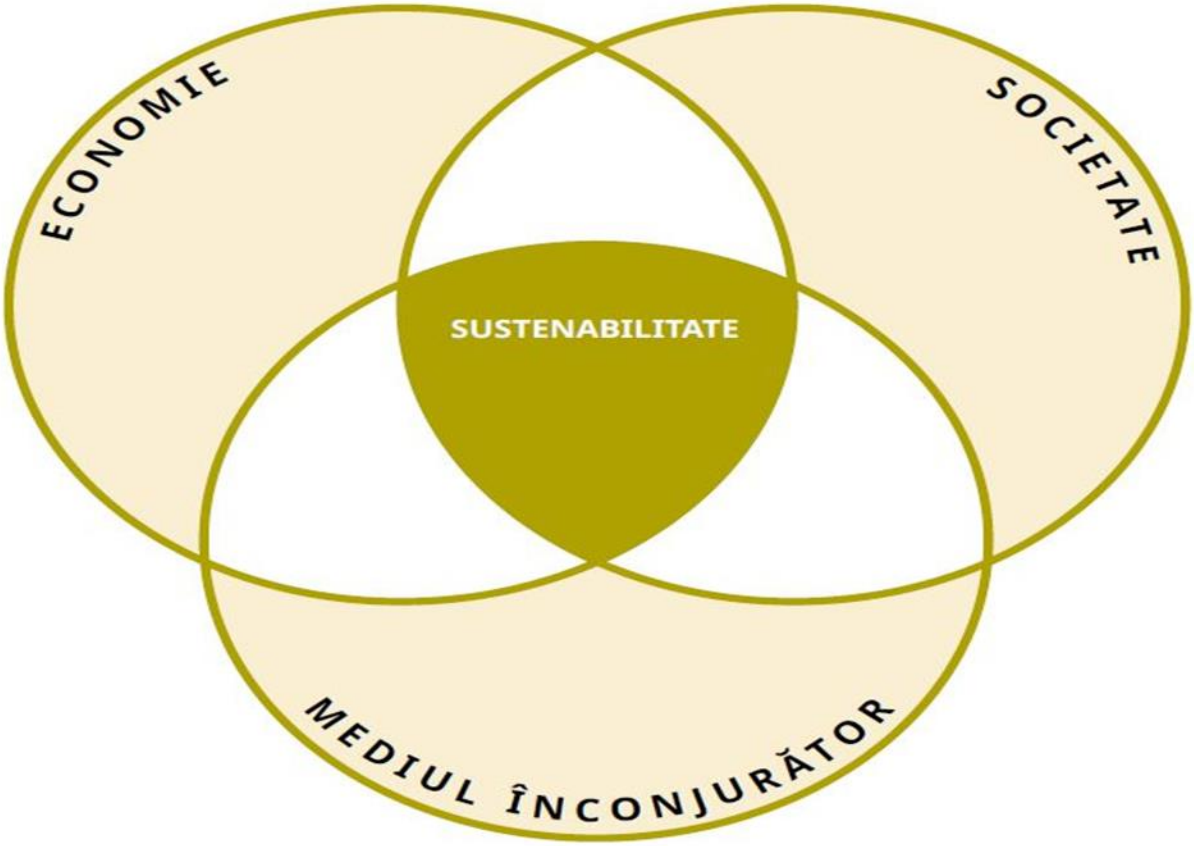
Source: NIHWM

X. MONITORING ENVIRONMENTAL RADIOACTIVITY

This chapter does not mention specific indicators according to Order of the Minister of Environment and Water Management No. 618/30.03.2015 – the entire chapter can be accessed at the link:
http://www.anpm.ro/documents/12220/2209838/RSM2021.compressed.pdf/885bf754-d757-443c-a2ac-1a90fab5d64b



Source: The educational package for teachers developed within the project"Walk the (Global) Walk: Mobilizing young people in Europe to support the Sustainable Development Goals"



XI. CONSUMPTION AND THE ENVIRONMENT

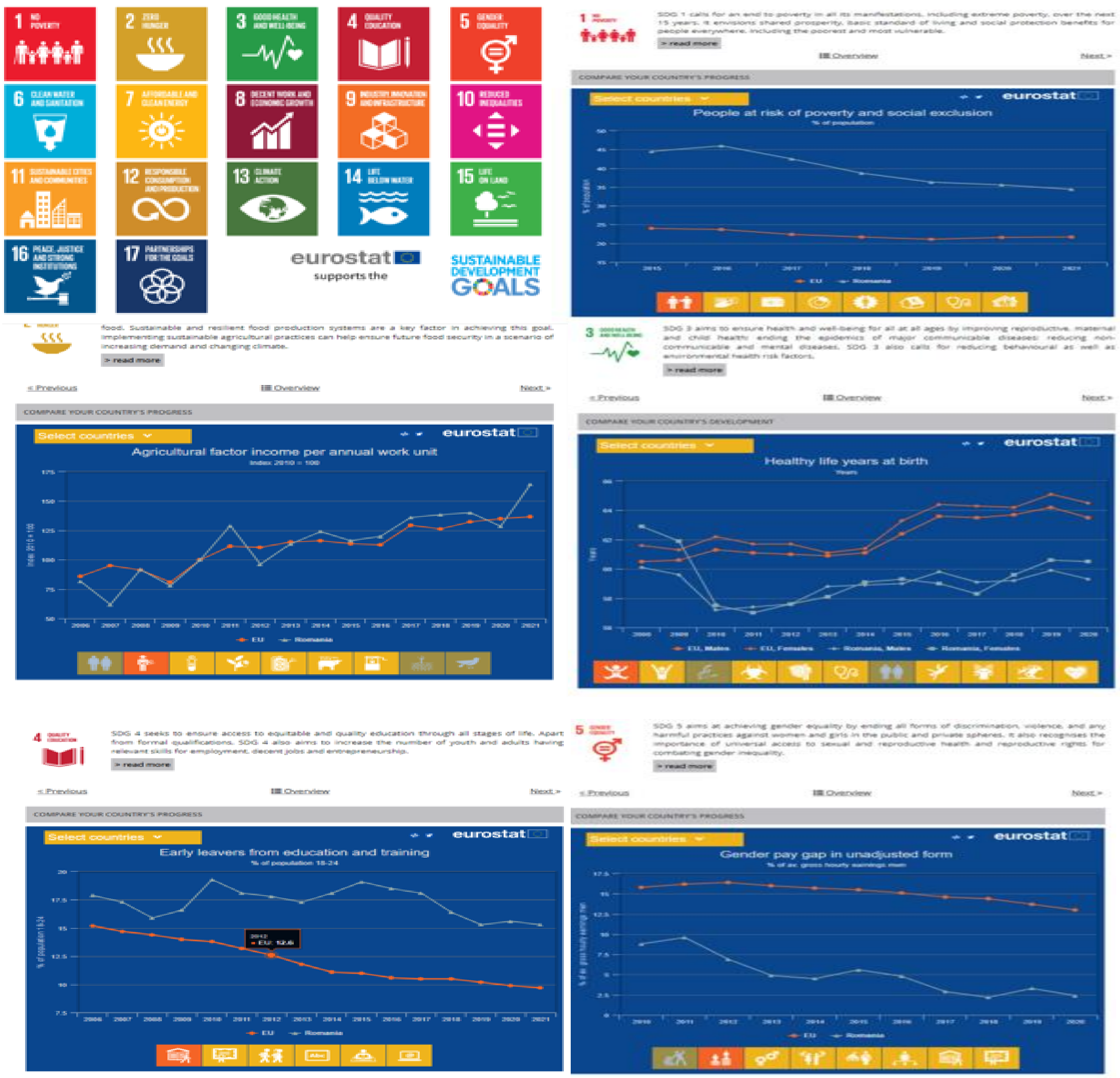
In 2015, Romania adopted the *2030 Agenda for sustainable development*, a UN program of global action in the field of development, with a universal character and which promotes the balance between the three dimensions of sustainable development - economic, social and environmental. At the center of the 2030 Agenda are *the 17 Sustainable Development Goals (SDGs*), gathered informally and under the name of Global Goals. Through the Global Goals, an ambitious action agenda is established for the next 15 years with a view to eradicating extreme poverty, combating inequalities and injustice and protecting the planet by 2030:

1. *No poverty*– Eradication of poverty in all its forms and in any context.
2. *"Zero" hunger*– Eradicating hunger, ensuring food security, improving nutrition and promoting sustainable agriculture.
3. *Health and well-being*- Ensuring a healthy life and promoting the well-being of all at any age.
4. *Quality education*- Guaranteeing quality education and promoting lifelong learning opportunities for all.
5. *Gender equality*- Achieving gender equality and empowering all women and girls.
6. *Clean water and sanitation*– Ensuring the availability and sustainable management of water and sanitation for all.
7. *Clean energy at affordable prices*- Ensuring everyone's access to energy at affordable prices, in a safe, sustainable and modern way.
8. *Decent work and economic growth*- Promoting sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.
9. *Industry, innovation and infrastructure*– Building resilient infrastructures, promoting sustainable industrialization and encouraging innovation.
10. *Reduced inequalities*- Reducing inequalities within countries and from one country to another.
11. *Sustainable cities and communities*– Development of cities and human settlements so that they are open to all, safe,

resilient and sustainable.

12. *Responsible consumption and production*- Ensuring sustainable consumption and production patterns.
13. *Climate action*- Taking urgent measures to combat climate change and its impact.
14. *Aquatic life*- Conservation and sustainable use of oceans, seas and marine resources for sustainable development.
15. *Terrestrial life*– Protecting, restoring and promoting the sustainable use of terrestrial ecosystems, sustainable forest management, combating desertification, stopping and repairing soil degradation and stopping biodiversity loss.
16. *Peace, justice and effective institutions*- Promoting peaceful and inclusive societies for sustainable development, access to justice for all and the creation of efficient, responsible and inclusive institutions at all levels.
17. *Partnerships for the achievement of objectives*- Consolidation of means of implementation and revitalization of the global partnership for sustainable development.

Below is an excerpt from EUROSTAT of the evolution of some sustainable development indicators monitored by Romania for the 17 *Sustainable Development Goals(SDG),* for the period 2015 – 2020/2021.
(Source: EUROSTAT,*https://ec.europa.eu/eurostat/web/sdi/indicators*)



6 CLEAN WATER AND SANITATION
SDG 6 calls for ensuring universal access to safe and affordable drinking water, sanitation and hygiene, and ending open defecation. It also aims at improving water quality and water-use efficiency and encouraging sustainable abstractions and supply of freshwater.
> read more
< Previous
Overview
Next >
COMPARE YOUR COUNTRY'S PROGRESS
Select countries
eurostat
People living in households without basic sanitary facilities (such as bath, shower, indoor flushing toilet)
% of population
EU
Romania

7 AFFORDABLE AND CLEAN ENERGY
SDG 7 calls for ensuring universal access to modern energy services, improving energy efficiency and increasing the share of renewable energy. To accelerate the transition to an affordable, reliable, and sustainable energy system, countries need to facilitate access to clean energy research, promote investment in energy infrastructure and clean energy technology.
> read more
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Overview
Next >
COMPARE YOUR COUNTRY'S PROGRESS
Select countries
eurostat
Primary energy consumption
Index, 2005 = 100
EU
Romania

8 DECENT WORK AND ECONOMIC GROWTH
SDG 8 recognises the importance of sustained economic growth and high levels of economic productivity for the creation of well-paid quality jobs and the achievement of global prosperity. SDG 8 calls for providing opportunities for full and productive employment and decent work for all while eradicating forced labour, human trafficking and child labour and promoting labour rights and safe and secure working environments.
> read more
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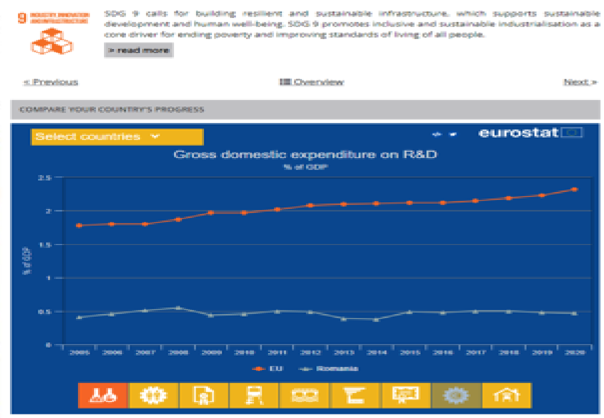
Overview
Next >
COMPARE YOUR COUNTRY'S PROGRESS
Select countries
eurostat
Real GDP
EU
Romania



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
SDG 9 calls for building resilient and sustainable infrastructure, which supports sustainable development and human well-being. SDG 9 promotes inclusive and sustainable industrialisation as a core driver for ending poverty and improving standards of living of all people.
> read more
< Previous
Overview
Next >
COMPARE YOUR COUNTRY'S PROGRESS
Select countries
eurostat
Gross domestic expenditure on R&D
% of GDP
EU
Romania

10 REDUCED INEQUALITIES
SDG 10 calls for increasing the income of bottom 40 % of the population and reducing inequalities based on income, sex, age, disability, race, class, ethnicity, religion and opportunity by adopting relevant policies and legislation. It also aims to improve the regulation and monitoring of financial markets and institutions.
> read more
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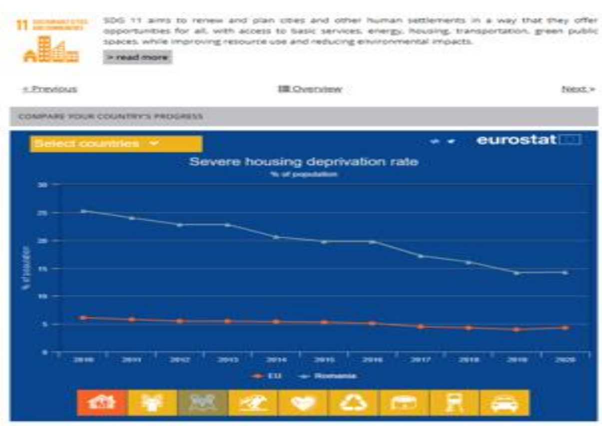
Overview
Next >
COMPARE YOUR COUNTRY'S PROGRESS
Select countries
eurostat
Disparities in GDP per capita
EU
Romania



11 SUSTAINABLE CITIES AND COMMUNITIES
SDG 11 aims to renew and plan cities and other human settlements in a way that they offer opportunities for all, with access to basic services, energy, housing, transportation, green public spaces, while improving resource use and reducing environmental impacts.
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Next >
COMPARE YOUR COUNTRY'S PROGRESS
Select countries
eurostat
Severe housing deprivation rate
% of population
EU
Romania

12 RESPONSIBLE CONSUMPTION AND PRODUCTION
SDG 12 calls for action on all fronts: adoption of sustainable practices and sustainability reporting by businesses; promotion of sustainable procurement practices and rationalisation inefficient fossil-fuel subsidies by policy-makers; environmentally-aware lifestyles of consumers; development of new technologies and production and consumption methods by researchers and scientists and others.
> read more
< Previous
Overview
Next >
COMPARE YOUR COUNTRY'S PROGRESS
Select countries
eurostat
Raw material consumption
EU
Romania

13 CLIMATE ACTION
SDG 13 seeks to implement the commitment to the United Nations Framework Convention on Climate Change and operationalise the Green Climate Fund. It aims to strengthen countries' resilience and adaptive capacity to climate-related hazards and natural disasters by integrating climate change mitigation and adaptation measures into national strategies, policies and planning.
> read more
< Previous
Overview
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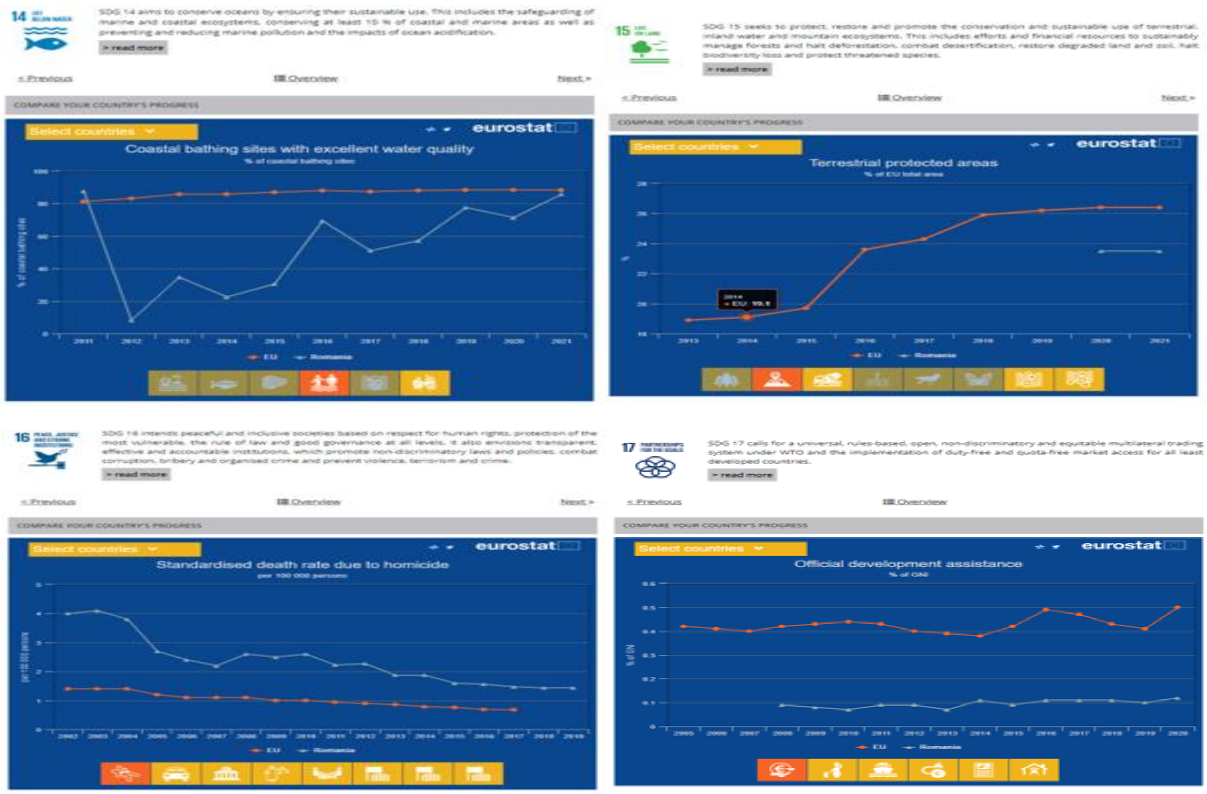
COMPARE YOUR COUNTRY'S PROGRESS
Select countries
eurostat
Net greenhouse gas emissions
EU
Romania

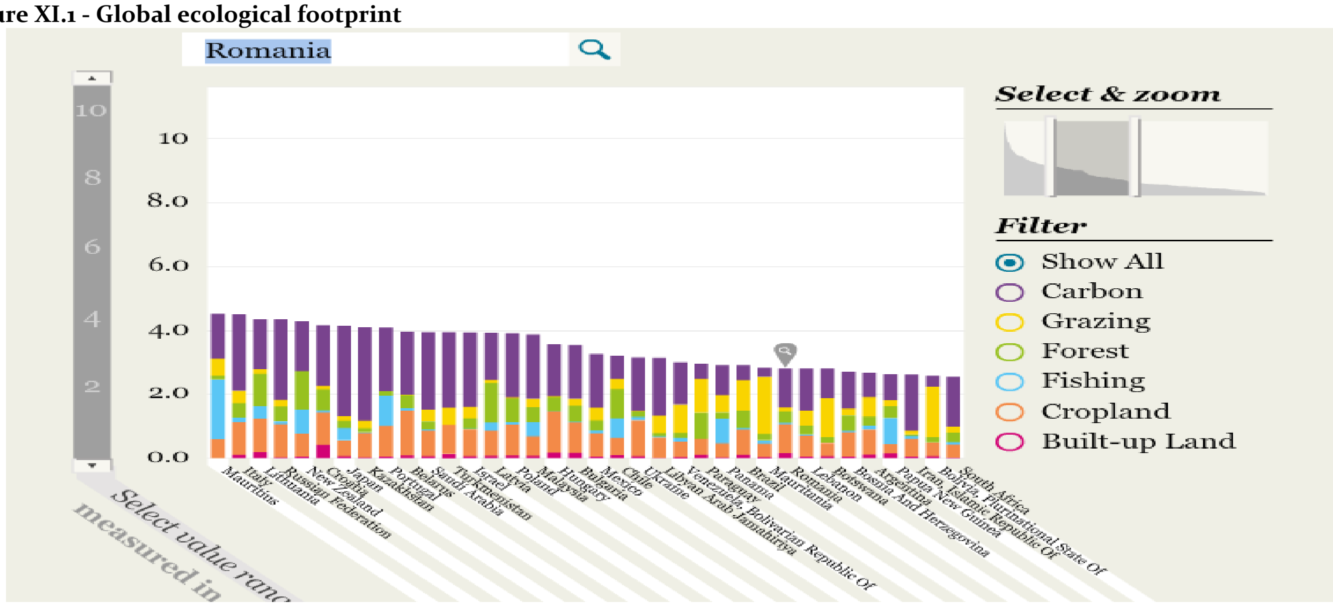


Source: EUROSTAT, https://ec.europa.eu/eurostat/web/sdi/indicators

TRENDS REGARDING CONSUMPTION

According to WWF (World Wide Fund for Nature) estimates, the economic growth of the European Union has doubled the ecological impact on the planet in the last 30 years. Although it holds only 7.7% of the global population and 9.5% of the planet's biocapacity, the European Union is responsible for 16% of the global ecological footprint (figure XI.1).

Figure XI.1 - Global ecological footprint



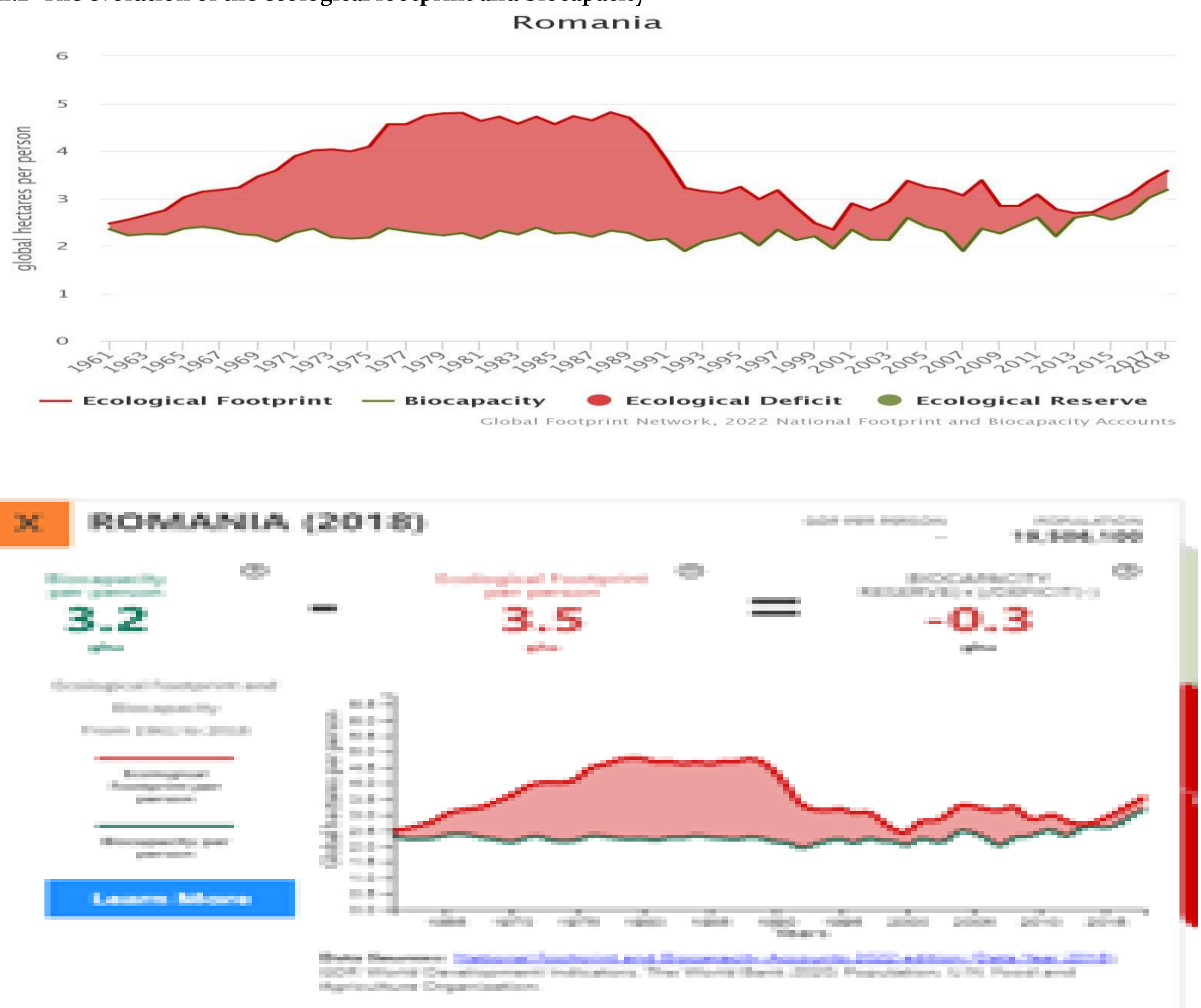
Source:http://wwf.panda.org

Romania ranks 46th worldwide, and 13th in the EU in terms of biocapacity - i.e. the ability of the country's ecosystems to produce useful biological materials and to absorb the residues (especially CO_2) produced by its inhabitants - shows the data published in the Living Planet Report, an annual study by the international organization WWF (World Wide Fund for Nature). So, we are one of the "capable" countries - still - in terms of the services provided by nature, the soil is not yet poisoned and worn out and can still produce food, the forests are not yet damaged and can provide the necessary resource of oxygen and absorb carbon, water is still filtered by vegetation and soil, managing to quench our thirst and water our fields.

Ecological footprint per capita places our country in 70th place in the world and the best in the entire European Union. The ecological footprint is the measure of the pressure that humans put on the environment. Each year, it is calculated based on the productive area of land and water needed to produce the resources consumed by an individual and to absorb the carbon generated by the whole process. At its very good position within the EU, Romania has an ecological footprint of 1.4 global hectares per capita (hgc), most of which comes from carbon emissions.

Figure XI.2 tracks the resource demand per person, **ecological footprint and biocapacity in Romania from 1961 – 2018** (*no data is published for 2019 – 2021*). The decrease of the ecological footprint in the years 2000 compared to the years 1969-1997 is observed, in the interval 2015-2018 the biocapacity was higher compared to the year 2013.

Figure XI.2 -The evolution of the ecological footprint and biocapacity



Source: http://data.footprintnetwork.org/#/countryTrends?cn=183&type=BCpc,EFCpc
National Footprint Accounts 2022 edition (Data Year 2018); building on World Development Indicators, The World Bank (accessed 2022 - no data for 2019 - 2021); UN Food and Agriculture Organization

Every year, **Earth Overshoot Day (EOD - Earth Overshoot Day** -*figure XI.3*), marks the date when mankind has used all the natural resources that the Earth regenerates throughout the year. ***Humanity consumed, on July 29, 2021 globally, the share of the Earth's natural resources for the year 2021***, as early as in 2019, after the speed of consumption had decreased in 2020 due to the blockages caused by the coronavirus pandemic, announces WWF (World Wide Fund for Nature) ***Humanity used in 2021 74% more than what the planet's ecosystems can regenerate - or "1.7 planets". From the EOD until the end of 2021, humanity operated in an ecological deficit regime.*** Notable determining factors include a 6.6% increase in carbon footprint in 2021 compared to 2020, as well as a 0.5% decrease in global forest biocapacity, largely caused by deforestation in the Amazon. In Brazil alone, 1.1 million hectares were lost in 2020, and estimates for 2021 indicated a year-on-year deforestation increase of up to 43%.

Romania reached its resource consumption quota for the year 2021 on June 21, compared to July 11 in 2020 and July 12 in 2019. For comparison, Bulgaria reached the resource consumption limit on June 21, Hungary on June 8, Slovakia on May 13 (Table XI.1). According to the International Energy Agency (IEA), CO2 emissions from domestic air transport and road transport remained 5% below 2019 levels in 2021, while international flights recorded a 33% reduction. On the other hand, global energy-related CO2 emissions were projected to increase by 4.8% compared to 2020, as economic recovery would entail a demand for fossil fuels. Particularly, coal usage worldwide was expected to increase significantly in 2021, contributing an estimated 40% to the total carbon footprint in 2021.

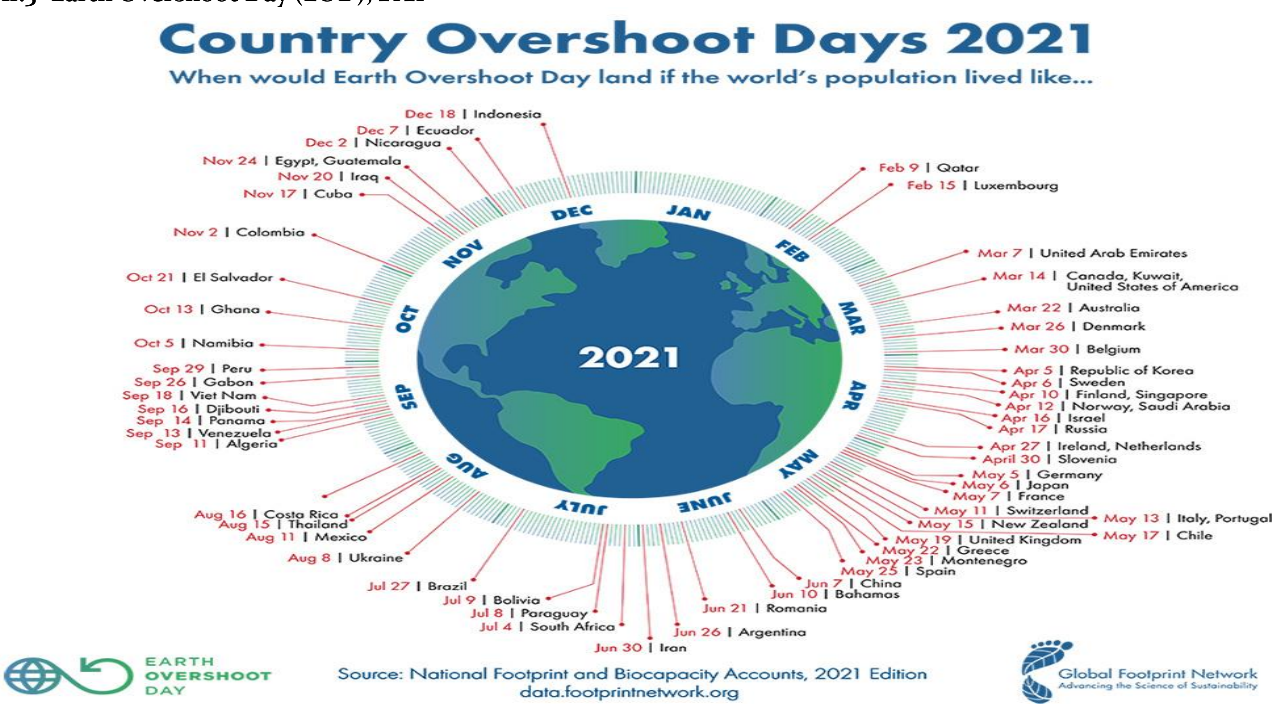
Table XI.1 -Overshoot Day (EOD) situation for the years 2019 - 2021 for several countries in Central and Eastern Europe

The country	***Overshoot Day 2019***	***Overshoot Day 2020***	***Overshoot Day 2021***
Slovakia	May 22	May 21	May 13
Hungary	June 14	June 14	June 8
Bulgaria	June 22	June 22	June 21
Romania	July 12	July 11	June 21

Source: https://wwf.ro/noutati/comunicate-de-presa

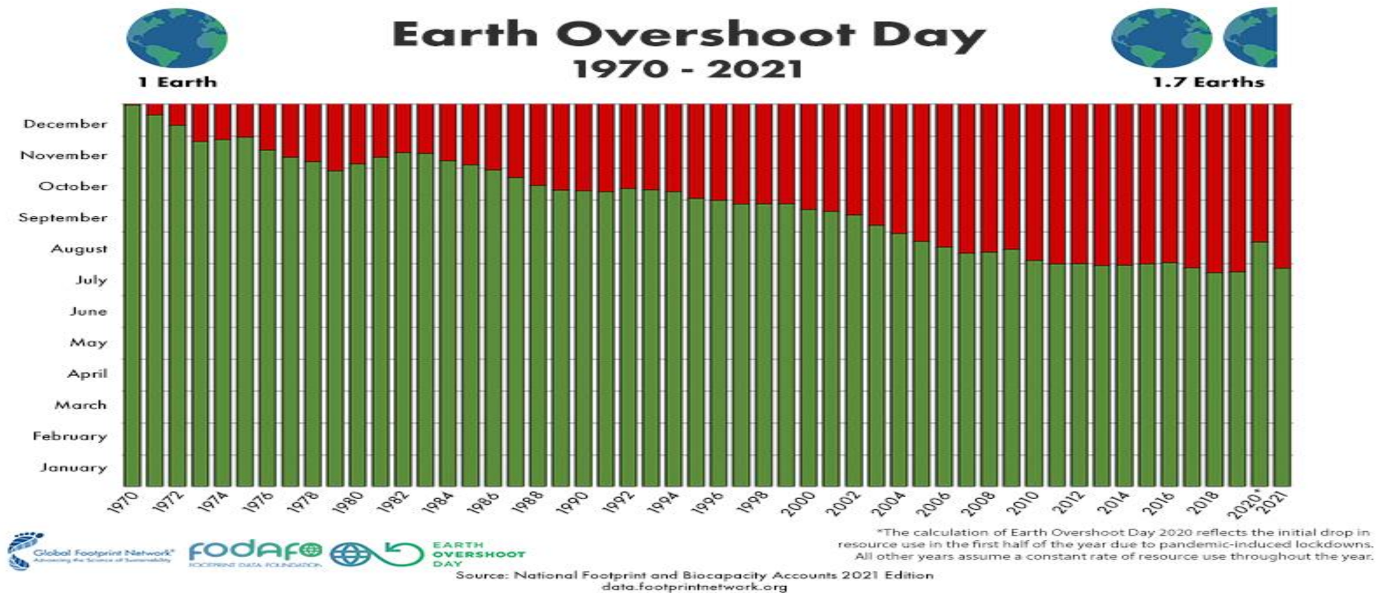
Researchers from the American NGO Global Footprint Network, who conduct this study annually since 1970, draw attention to the increasingly rapid consumption of resources, given the planet's limited capacity. ***Over the past 50 years, the date at which humanity begins to live 'on debt' occurs earlier and earlier: 1970 – December 29, 1980 – November 4, 1990 – October 11, 2000 – September 23, and 2010 – August 7. In 2019, humanity consumed resources on July 29, in 2020 on August 22, and in 2021 on July 29***. The three-week difference recorded in 2021 compared to 2020 was due to lockdowns and reduced activity following the pandemic. However, our consumption is still very high, despite the pandemic that struck humanity in 2020 and despite technological progress. The pressure on the environment has grown faster than the population, creating a deficit of natural resources.

Figure XI.3 -Earth Overshoot Day (EOD), 2021



On the other hand, the *Global FoodPrint Network* states that in 2021, there was a 6.6% increase in the global ecological footprint, compared to the same period in 2020 (figure XI.4), while the global forest biocapacity decreased in 2021 by 0.5% compared to 2020. In terms of consumption, the coronavirus has not produced changes, on the contrary, it has increased food waste and malnutrition among low-income populations.

Figure XI.4 -Earth Overshoot Day (EOD), 1970 – 2021



As humanity operates within the limits of Earth's ecological resources, moving the date of Earth Overload Day (EOD) 5 days later each year would allow humanity to reach single-planet compatibility before the year 2050.

Available solutions and financially advantageous, would consist of:

- ***Reducing food waste***- according to the WWF report "Driven to Waste", of all the food grown, approximately 40% remains unconsumed. Food waste represents 10% of total greenhouse gas emissions. In other words, by wasting food we emit almost twice as much greenhouse gas as all the cars driven in the US and Europe.
- ***Reduction of electricity consumption***–existing commercial technologies for buildings, industrial processes and power generation could move the EOD by at least 21 days without any loss of productivity or comfort.
- ***Using public transport or car sharing***–if we reduce the global driving footprint by 50% and assume that a third of the kilometers traveled by car are replaced by public transport and the rest by cycling and walking, the EOD will be delayed by 13 days.

FOOD AND BEVERAGES

Table XI.2 - Average annual consumption per inhabitant, of the main food and beverage products, 2016 - 2020

Main food and drinks	Units of measure	Years				
		2016	2017	2018	2019	2020
Cereals and cereal products in grain equivalent	Kg/capita	208.4	208.2	205.4	204.3	204.4
Cereals and cereal products in flour equivalent	Kg/capita	157.6	157.3	155.1	154.4	154.6
Wheat, rye in grain equivalent	Kg/capita	122.2	122.4	121.3	120.5	120.4
Potatoes	Kg/capita	95.5	96.6	95.5	92.3	93.4
Legumes	Kg/capita	2.1	2.4	4.1	4.0	3.6
Vegetables and vegetable products in fresh vegetable equivalent	Kg/capita	155.8	152.1	173.4	170.2	167.8
Fruit and fruit products in fresh fruit equivalent	Kg/capita	96	96.1	110.8	111.3	107.6
Sugar and sugar products in refined sugar equivalent (including honey)	Kg/capita	25.5	25.7	25.4	25.6	25.5
Meat and meat products in fresh meat equivalent	Kg/capita	65.5	68.4	73.3	74.4	74.1

Milk and milk products in milk equivalent 3.5% fat (excluding butter)	Kg/capita	253.7	251.4	258.2	259.8	260.2
Milk and milk products in milk equivalent 3.5% fat (excluding butter)	Liters/capita	246.3	244.1	250.8	252.2	252.6
Eggs	Pieces/capita	262	255	236	241	236
Fish and fish products in fresh fish equivalent	Kg/capita	5.9	6.3	6,7	7,8	6.3
Wine and wine products	Liters/capita	18	21.6	23.8	23.4	21.1
Beer	Liters/capita	88.9	89.5	90.1	89.1	87.7
Distilled alcoholic beverages (100% alcohol)	Liters of pure alcohol (100%) / capita	1.5	1.5	1.9	1.9	1.8
Soft drinks	Liters/capita	188.6	213.2	209.8	213.6	207.6
Total alcohol consumption (100% alcohol)	Liters of pure alcohol (100%) / capita	8.1	8.6	9.2	9.2	8.7

Source: National Institute of Statistics –https://insse.ro/cms/ro/tags/bilanturi-alimentare - until the date of preparation of this report, the data for the year 2021 have not been processed

The review of the main food products (table XI.2) in the period 2016-2020 reveals the following aspects:
- gradual increases were recorded for potatoes, milk and milk products in milk equivalent 3.5% fat (excluding butter);
- insignificant variations were recorded for cereals and cereal products in grain and flour equivalent, sugar and sugar products in sugar equivalent (including honey), meat and meat products in fresh meat equivalent, milk and milk products in milk equivalent 3, 5% fat (excluding butter), fish and fish products in fresh fish equivalent, distilled alcoholic beverages (100% alcohol);
- in 2020 there was a decrease in legumes, grains, vegetables and vegetable products in fresh vegetables equivalent, fruit and fruit products in fresh fruit equivalent, eggs, wine and wine products, beer, non-alcoholic beverages and total alcohol consumption (alcohol 100%).

The data on the average monthly consumption of the main food and beverage products, respectively, the endowment of households with durable goods, for the years 2019 – 2021 (tables XI.3 and XI.4), were taken from the publication "Romania in figures 2022", section "Population consumption" of the National Institute of Statistics - Source:https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

Table XI.3 -Average monthly consumption1) of the main food and beverage products

	UM	2019	2020	20212)
Fresh meat	kg	3,627	3,652	3,883
Meat products	kg	1,238	1,406	1,482
FATS	kg	1,187	1,183	1,220
Milk	LITER	5,523	5,330	5,446
Eggs	piece	14	14	15
Sugar	kg	0.703	0.673	0.674
Potatoes	kg	2,894	2,873	3,022
Vegetables and canned vegetables				
(in fresh vegetable equivalent)	kg	8,077	8,003	8,460
Fruits	kg	4,006	4,058	4,290
Mineral water and other non-alcoholic beverages	LITER	6,560	6,860	7,719
Beer	LITER	1,544	1,564	1,673
Wine	LITER	0.885	0.837	0.840
Brandy and natural brandies	LITER	0.211	0.192	0.193

1)Average monthly amounts per person (from individual households).
2)Provisional data. Source: Statistical survey of family budgets

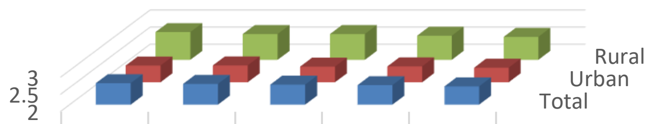
Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

Table XI.4 -Providing households with durable goods			
	average number per 100 households		
	2019	2020	2021[1])
Audio devices	60.2	62.3	62.9
Televisions - total	167.7	171.9	174.5
Refrigerators and freezers	70.3	70.8	70.5
Refrigerated combines	62.3	63.1	64.0
Gas cooking machines	98.8	99.3	99.5
Electric washing machines	77.6	80.7	81.6
Vacuum cleaners	77.8	79.9	81.0
Sewing machines	22.3	21.9	21.6
Bikes	45.1	46.5	47.3
Motorcycles and mopeds	0.9	0.7	0.7
Cars	41.1	42.4	44.9
[1])Provisional data.			
Source: Statistical research of family budgets.			

Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

HOUSING

Figure XI.5 - Evolution of the average number of persons per household (persons/household), 2017 – 2021

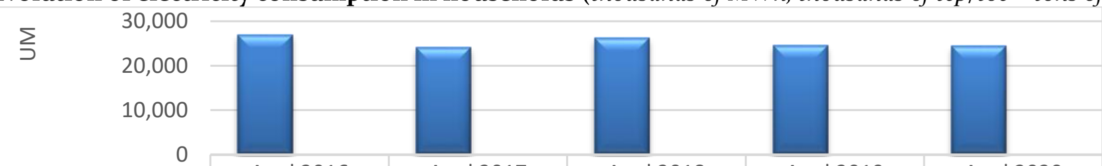


	2017	2018	2019	2020	2021
Total	2.627	2.606	2.585	2.569	2.533
Urban	2.487	2.492	2.457	2.463	2.425
Rural	2.811	2.753	2.753	2.705	2.671

Source: National Institute of Statistics

Electricity consumption in households

Figure XI. 6 - Evolution of electricity consumption in households (*thousands of MWh, thousands of tep/toe = tons of oil equivalent*)



	Anul 2016	Anul 2017	Anul 2018	Anul 2019	Anul 2020
Mwh	26,946	24,116	26,191	24,556	24,380
1.000Toe	2.33	2.07	2.25	2.11	2.09

Source: National Institute of Statistics - until the date of preparation of this report, the INS has not processed the data for the year 2021

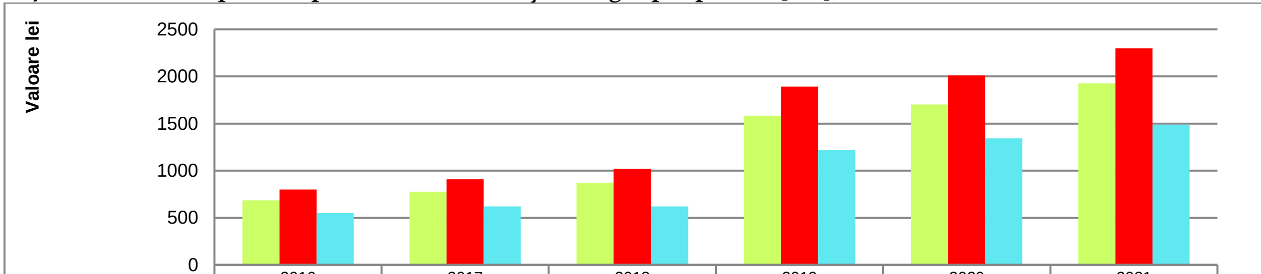
Average consumption expenditure per person

Table XI.5 - Total consumption expenditure - monthly averages per person [Lei], at the national level, 2016 – 2021

Total expenses monthly averages per person – lei -	YEAR 2016	YEAR 2017	YEAR 2018	YEAR 2019	YEAR 2020	YEAR 2021
TOTAL	683.94	776.07	871.81	1582.74	1701.77	1924.87
URBAN	799.35	909.97	1019.86	1892.95	2009,71	2300.15
RURAL	550.11	620.81	699.55	1221.09	1342.26	1487.3

Source: National Institute of Statistics - Press releases

Figure XI.7 - Total consumption expenditure - monthly averages per person [Lei], at national level, 2016 – 2021



	2016	2017	2018	2019	2020	2021
Total	683.94	776.07	871.81	1582.74	1701.77	1924.87
Urban	799.35	909.97	1019.86	1892.95	2009.71	2300.15
Rural	550.11	620.81	620.81	1221.09	1342.26	1487.3

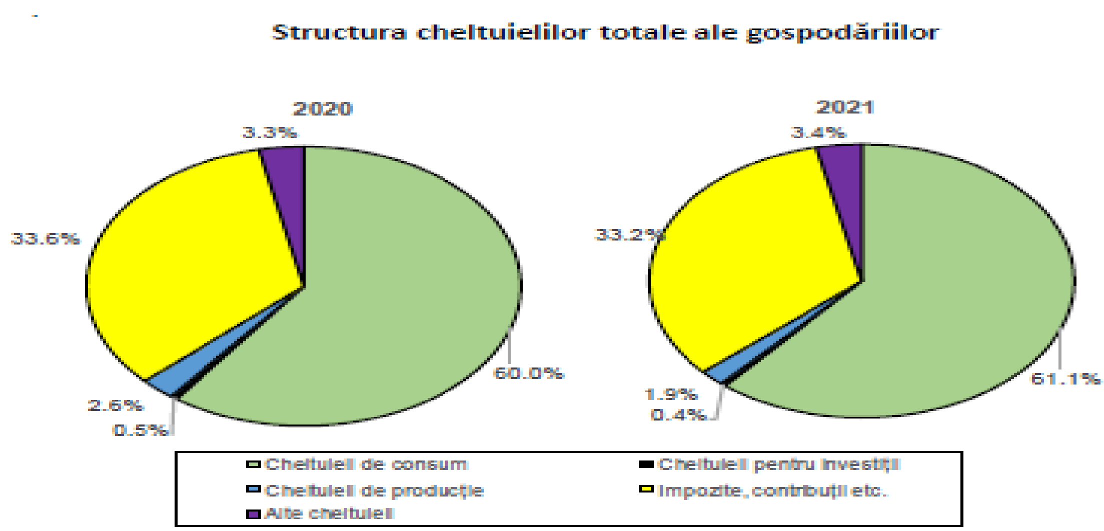
Source: National Institute of Statistics-Press Releases

Table XI.6 - Structure of total household consumption expenditure by destination, 2019 - 2021,[%]/ [lei]

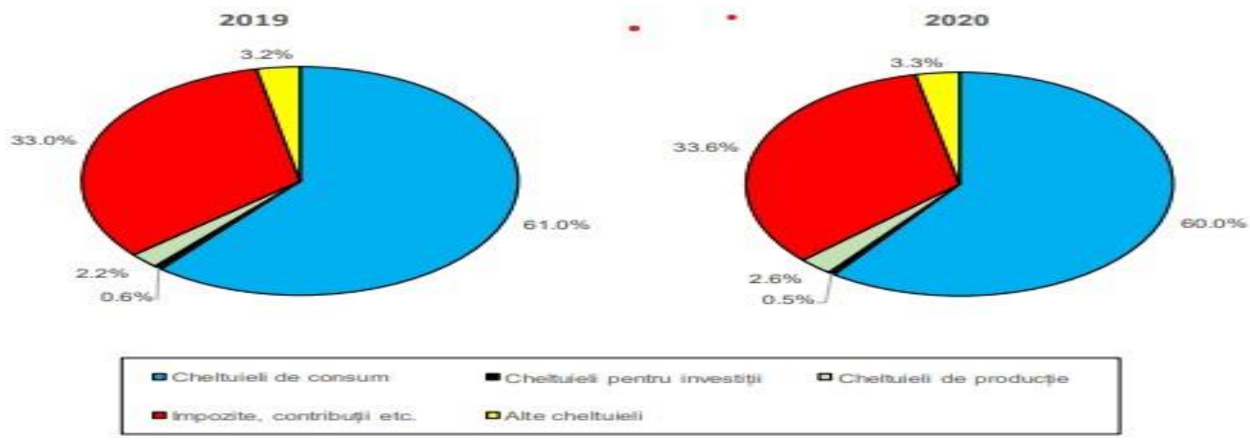
The structure of total household expenses	Year 2019		Year 2020		Year 2021	
	%	- lei -	%	-lei-	%	-lei-
Consumer spending	61.0	2497.11	60.0	2621.66	61.1	2979.29
Investment expenses	0.6	23.00	0.5	23.71	0.4	19.45
Production expenses	2.2	88.53	2.6	115.40	1.9	94.21
Taxes, contributions, etc.	33.0	1349.85	33.6	1467.93	33.2	1620.03
Other expenses	3.2	133.34	3.3	143.16	3,4	163.04
Total expenses	100.0	4091.83	100.0	4371.86	100.0	4876.02

Source: National Institute of Statistics - https://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2020r.pdf - Press release no. 140/7 June 2021 andhttps://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2021r.pdf- Press release no. 138/June 7, 2022

Figure XI.8 - Structure of total consumption expenditure of households by destination, 2019 - 2021 (%)



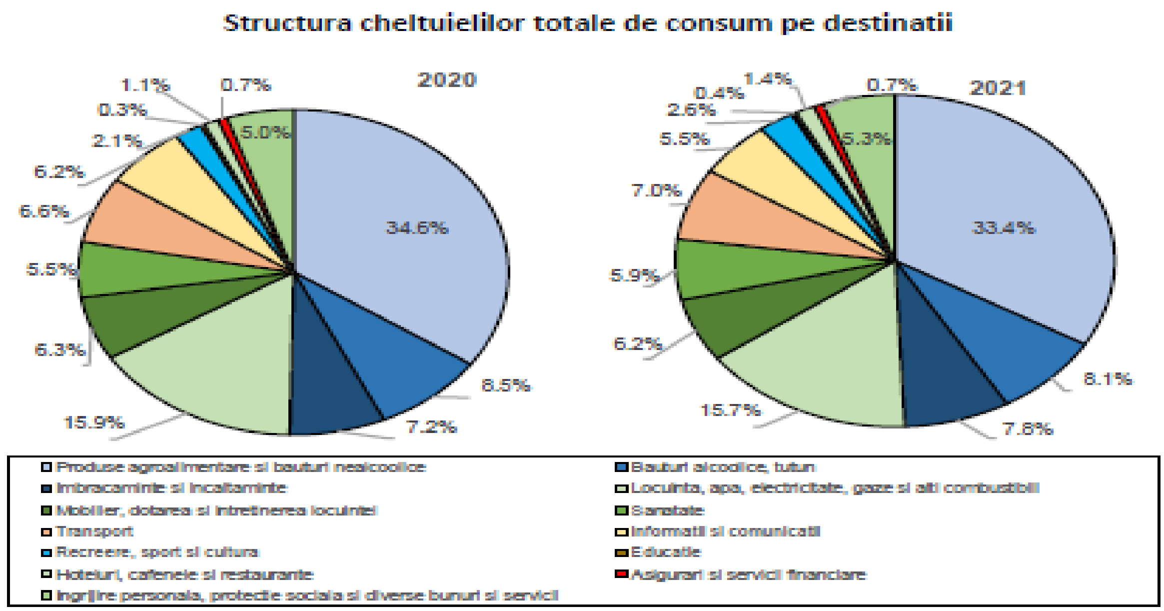
Source: National Institute of Statistics –https://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2021r.pdf- Press release no. 138/June 7, 2022



Source: National Institute of Statistics –https://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2020r.pdf- Press release no. 140/June 7, 2021

According to the standard classification by destination of consumption expenditure (COICOP) in 2021, food products and non-alcoholic beverages accounted for, on average, 33.4% of household consumption (34.6% in 2020 - figure XI.9).

Figure XI.9 – Structure of total consumption expenditure by destination, 2020 - 2021, % (*)



Note* :*Starting from 2020, the Classification of Individual Consumption by Destination - COICOP 2018 is used at the 5-digit level, which brings changes to the structure of certain indicators, in the sense of regrouping them, compared to previous years.Source: National Institute of Statistics –https://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2021r.pdf- Press release no. 138/June 7, 2022*

In 2021, the total incomes of the population, monthly averages per household, amounted to 5683 lei, while the total expenditures averaged 4876 lei per household monthly. Thus,:

- **The average total monthly income in 2021,** in nominal terms, amounted to 5683 lei per household and 2243 lei per person, representing an increase of 8.9% and 10.5%, respectively, compared to 2020.
- **The total expenditures** of the population in 2021 averaged 4876 lei per household (1925 lei per person), accounting for 85.8% of the total income. This marked an increase of 2.0 percentage points compared to 2020.

[*Source: National Institute of Statistics -https://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2021r.pdf- Press release no. 138/June 7, 2022 "Area: Standard of living"*]

Total incomes

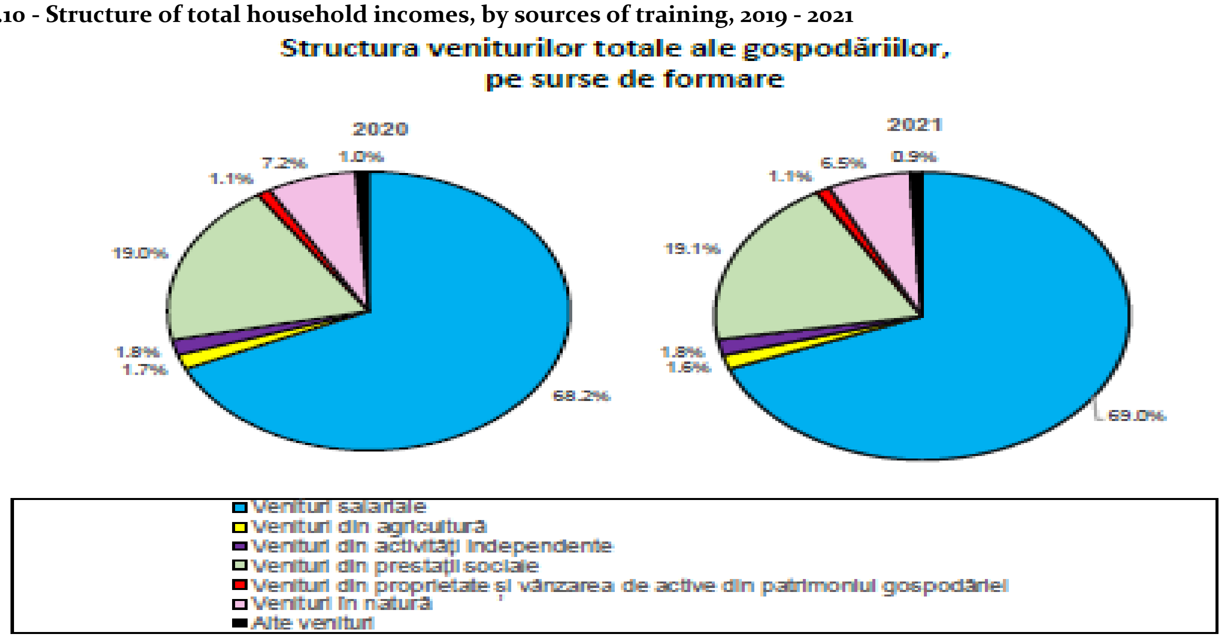
The total income includes all cash receipts from different sources of origin for which there is no obligation to return and income in kind (valued in lei)- to be seen *table XI.7 and figure XI.10*.

Table XI.7 - Level and structure of total household incomes, monthly averages per person, 2019 - 2021,[lei] /[%]

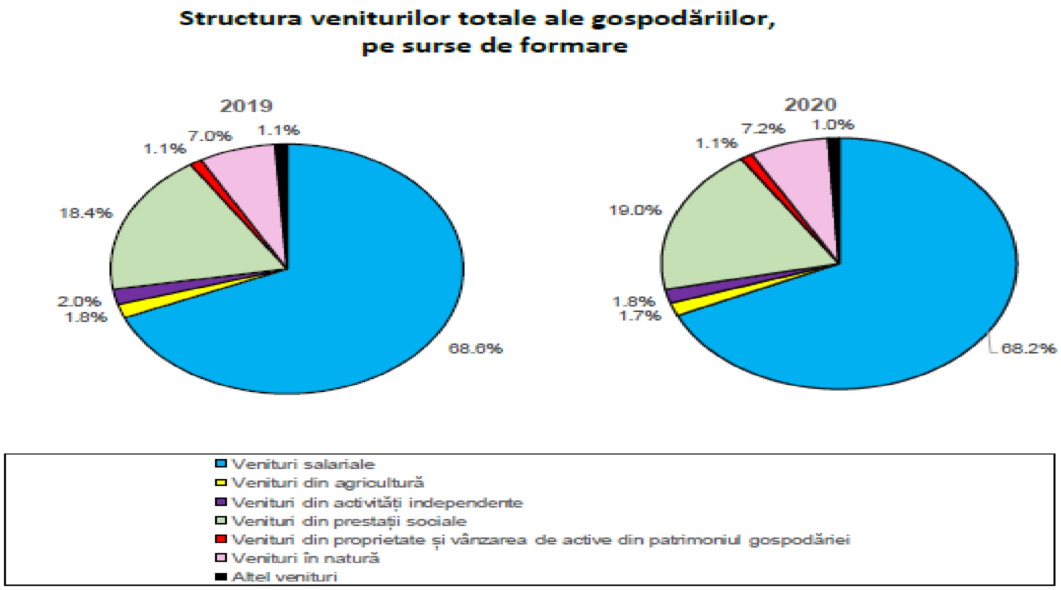
Years		Total income	% of total:							
			Cash income	from which:				Income in kind	from which:	
		monthly averages per person – lei -		Gross wages and other wage rights	Income from agriculture	Income from independent non-agricultural activities	Income from social benefits		Counter-value of income in kind obtained by employees and beneficiaries of social benefits	Counter-value of consumption of agro-food products from own resources
TOTAL	**2019**	**1852,73**	**93.0**	**68.6**	**1.8**	**2.0**	**18.4**	**7.0**	**1,2**	**5.8**
	2020	**2030.50**	**92.8**	**68.2**	**1.7**	**1.8**	**19.0**	**7.2**	**1.1**	**6.1**
	2021	**2243.43**	**93.5**	**69.0**	**1.6**	**1.8**	**19.1**	**6.5**	**1.1**	**5.4**
URBAN	**2019**	**2246.96**	**96.0**	**75.9**	**0.3**	**1.3**	**16.9**	**4.0**	**1.3**	**2.7**
	2020	**2426.89**	**95.8**	**75.3**	**0.2**	**1,2**	**17.6**	**4.2**	**1.3**	**2.9**
	2021	**2688.40**	**96.2**	**75.6**	**0.2**	**1,2**	**17.6**	**3.8**	**1,2**	**2.6**
RURAL	**2019**	**1393.14**	**87.3**	**55.0**	**4.8**	**3,4**	**21.2**	**12.7**	**1.1**	**11.6**
	2020	**1567.72**	**87.3**	**55.5**	**4.3**	**3.0**	**21.6**	**12.7**	**0.8**	**11.9**
	2021	**1724.57**	**88.6**	**56.8**	**4.2**	**2.9**	**21.9**	**11.4**	**0.9**	**10.5**

Source: National Institute of Statistics -https://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2021r.pdf- Press release no. 138/June 7, 2022 "Area: Standard of living"

Figure XI.10 - Structure of total household incomes, by sources of training, 2019 - 2021



Source: National Institute of Statistics -https://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2021r.pdf- Press release no. 138/June 7, 2022 "Area: Standard of living"



Source: National Institute of Statistics -https://insse.ro/cms/sites/default/files/com_presa/com_pdf/abf_2020r.pdf- Press release no. 140/June 7, 2021 "Area: Standard of living"

Cash income were in 2021, on average, of 5,313 lei per household per month (2,097 lei per person), up 9.8% compared to 2020, and **income in kind** of 370 lei per household per month (146 lei per person), down 1.7% compared to 2020**. Wages and other incomes associated with them** formed the most important source of income (69.0% of total household incomes, up 0.8 percentage points compared to 2020) . **Income from social benefits** (19.1% in 2021, respectively 19.0% in 2020), **income from independent non-agricultural activities** (1.8% both in 2021 and and in 2020)**, income from agriculture** (1.6% in 2021, respectively 1.7% in 2020) as well as **income in kind** (6.5% in 2021, respectively 7, 2% in 2020) mainly, the value of consumption of agri-food products from own resources (5.4% in 2021, respectively 6.1% in 2020). **The residence environment** influences the differences in level and, above all, in the structure between household incomes between urban and rural areas.

MOBILITY

Passenger transport

RO 35
Indicator code Romania: RO 35 EEA indicator code: CSI 35
TITLE: **PASSENGER TRANSPORT DEMAND**
DEFINITION: Passenger transport demand is defined as the sum of domestic passenger-kilometers traveled each year. Domestic passenger transport includes transportation by cars, buses, coaches, and trains.

The indicator presents data related solely to domestic transport, regardless of the nationality of the transport vehicle, for passenger transport by cars, buses and coaches, as well as trains (excluding metro and trams), over a period of at least 5 years. The variable is derived from the passenger-kilometer (pkm) indicator, defined as the transportation of one passenger over a distance of one kilometer. Figure XI.14 illustrates the proportion of passenger transport modes [thousand national passenger-kilometers] at the national level in the 2016 – 2021 interval. Table XI.8 shows the share of each transport mode in the total passenger-kilometers [%pkm] at the national level during the 2016 – 2021 interval. Notice the relatively different variations for the three transport modes: rail, road, and waterway, in the 2016 – 2021 interval. In 2021, a total of 341,811 thousand passengers were transported in interurban and international transport, while 1,374,994 thousand passengers were transported in local public transport (Figures XI.11 - XI.13). The highest number of passengers were recorded in local public transport with buses and minibuses, amounting to 781,934 thousand passengers.

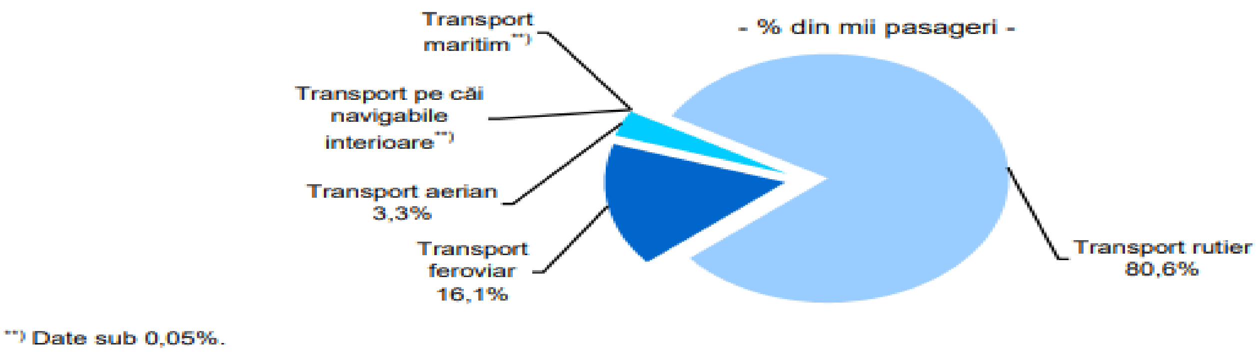
[Source: https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf]

Interurban and international passenger transport

In **2021**, **road passenger transport** held the largest share of the total (80.6%), followed by **rail transport** (16.1%). In international passenger transport, 11,126 thousand passengers were recorded, accounting for 3.3% of the total, of which 88.4% were transported by air. **Compared to 2020**, rail transport saw an increase of 8.7% in the number of passengers carried and a 14.8% increase in their distances traveled. Road passenger transport experienced a 0.8% increase in the number of passengers carried compared to 2020, while the distances they traveled increased by 8.0%.
In inland waterway transport, 146 thousand passengers were recorded, along with 7,352 thousand passenger-kilometers, exclusively in domestic transport. Both indicators saw increases compared to 2020, with a 9.0% growth in the number of passengers carried and a 9.7% increase in their distances traveled. In maritime transport, 57 cruise excursion passengers were recorded in international transport. Air transport exhibited the most significant growth among the modes of transport in terms of passenger numbers, with a 55.5% increase compared to 2020, transporting a total of 11,177 thousand passengers, of which 88.0% were on international flights.

Road transport - the main mode used for people's mobility in 2021

Figure XI.11 -Passengers transported in 2021



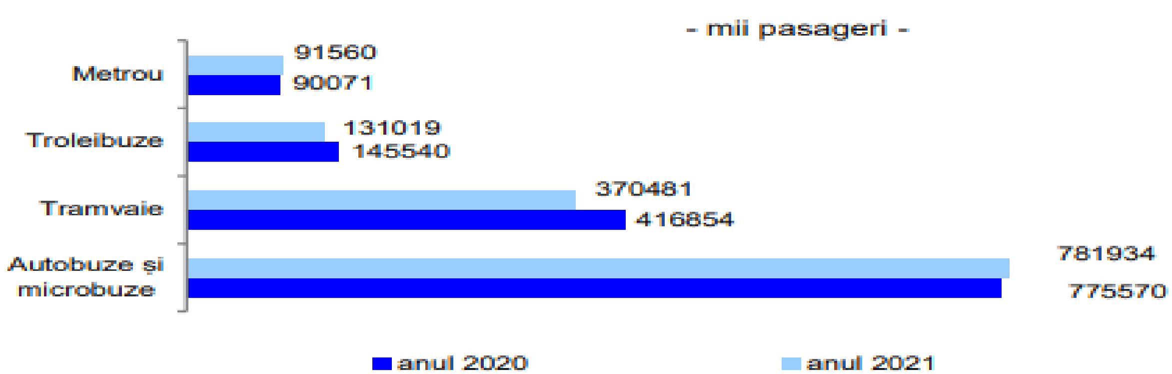
Source: https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

The average passenger travel distance was higher in 2021 compared to 2020 for all modes of transport, with a 7.3% increase in road transport, a 5.7% increase in rail transport, and a 0.8% increase in inland waterway transport.

Local public passenger transport, 2020 - 2021

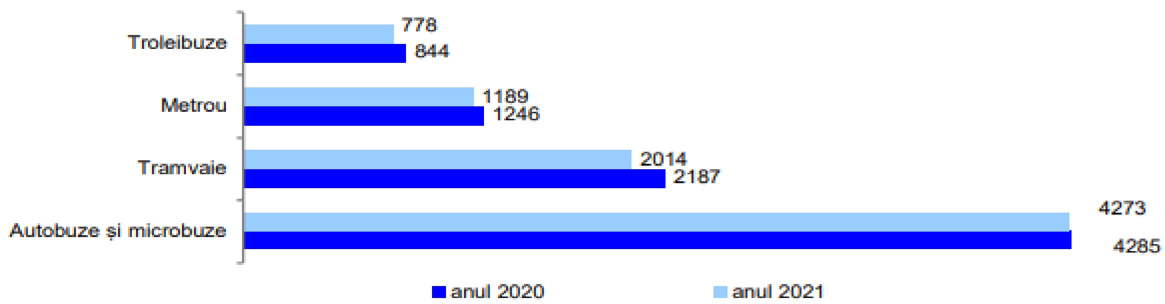
Increases in the number of passengers carried for metro transport, as well as for bus and minibus transport - Out of the total 1,374,994 thousand passengers recorded in local public transport, 56.9% traveled by buses and minibuses. The distance traveled by passengers amounted to 8,254 million passenger-kilometers, of which 4,273 million passenger-kilometers (51.8%) were recorded in bus and minibus transport.

Figure XI.12 -Passengers transported by local public transport, 2020 – 2021



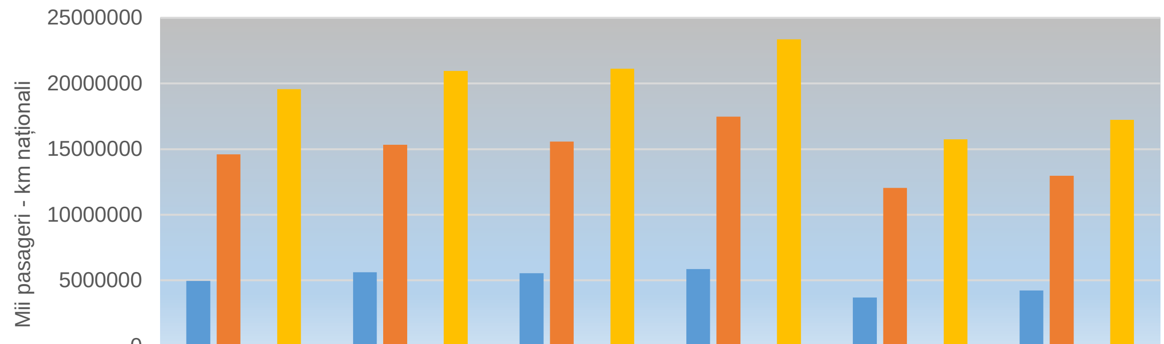
Source: https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

Figure XI.13 -The route of passengers in local public transport, 2020 - 2021



Source: https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

Figure XI.14 -Share of passenger transport modes [thousand passengers – national km] at national level, 2016 – 2021



	2016	2017	2018	2019	2020	2021
Feroviar	4952622	5629215	5542677	5866008	3700445	4239195
Rutier	14609472	15319994	15573425	17478123	12039970	12972769
Căi navigabile	7,650	7,650	6,000	5,572	6,699	7,352
Total	19569744	20956859	21122102	23349703	15747114	17219316

Feroviar Rutier Căi navigabile Total

Source:Ministry of Transport and Infrastructure,www.mt.ro

Share of each mode of transport in passenger transport

Table XI.8 - Share of each mode of transport in total passenger transport (% pkm), 2016 – 2021

%	2016	2017	2018	2019	2020	2021
Railway	17.50	17.41	15.49	16,28	23.49	24.61
Road	81.97	81.86	83,82	83.07	76.45	75.33
Waterways	0.04	0.04	0.03	0.03	0.04	0.04
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00

Source: Ministry of Transport and Infrastructure,www.mt.ro

Using public transport

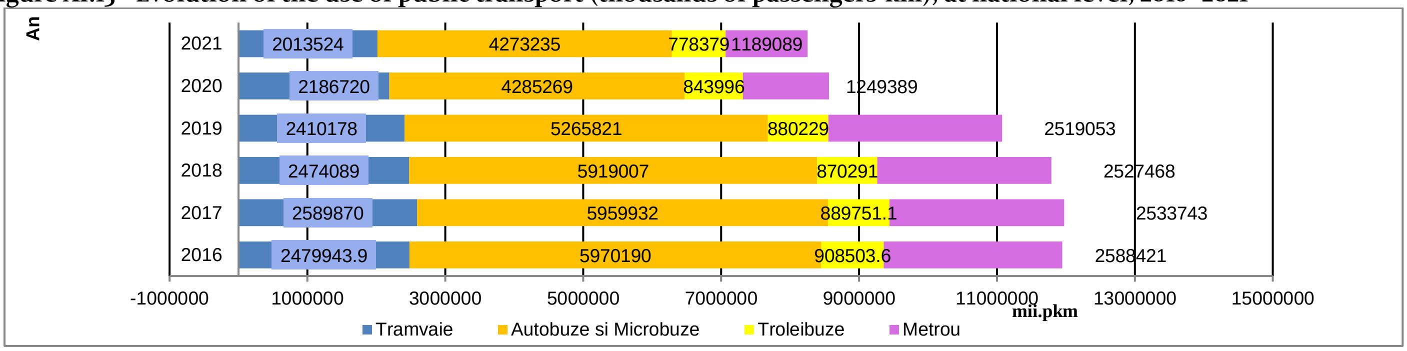
The volume of **local public passenger transport** refers to transport by bus and minibus, respectively by metro, trams and trolleybuses. Local public passenger transport includes transport within the administrative-territorial area of a locality, without exceeding its limits. The calculated variable is passenger-km (pkm), defined as the transport of one passenger over the distance of one kilometer. Analyzing the **evolution of the use of public transport** (tables XI.9, XI.10 and figure XI.15), a fluctuating trend can be observed between 2016-2021.

Table XI.9 - Evolution of the use of public transport (thousands of passengers-km), at national level, 2016 – 2021,thousand passenger-km

Using public transport	2016	2017	2018	2019	2020	2021
Trams	2479943.9	2589870.0	2474089	2410178	2186720	2013524
Buses, minibuses	5979190.0	5959932.0	5919007	5265821	4285269	4273235
Trolleys	908503.6	889751.1	870291	880229	843996	778379
Subway	2588421.0	2533743.0	2527468	2519053	1249389	1189089
TOTAL	11956059.2	11973296.0	11790855	11075281	8565374	8254227

Source: Ministry of Transport and Infrastructure,www.mt.ro
https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

Figure XI.15 - Evolution of the use of public transport (thousands of passengers-km), at national level, 2016 -2021



Source:: National Institute of Statistics
https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

Table XI.10 -Local public transport of passengers by macro-regions, development regions and means of transport, in 2021

	YEAR 2021, thousands of passengers	YEAR 2021, thousands of passengers - km
Local public transport - TOTAL	**1374994**	**8254227**
- trams	370481	2013524
- buses and minibuses	781934	4273235
- trolleybuses	131019	778379
- metro	91560	1189089
MACROREGION ONE	**304278**	**1872916**
- trams	22933	141902
- buses and minibuses	231956	1311730
- trolleybuses	49389	419284
NORTHWEST	**204220**	**1509135**
- trams	22933	141902
- buses and minibuses	137747	969339
- trolleybuses	43540	397894
CENTER	**100058**	**363781**
- buses and minibuses	94209	342391
- trolleybuses	5849	21390
MACROREGION TWO	**191493**	**1093543**
- trams	39173	218680
- buses and minibuses	151759	870584
- trolleybuses	561	4279
NORTH - EAST	**101112**	**623608**
- trams	30814	200291
- buses and minibuses	70298	423317
SOUTH EAST	**90381**	**469935**

- trams	8359	18389
- buses and minibuses	81461	447267
- trolleybuses	561	4279
MACROREGION THREE	**716296**	**4479046**
- trams	251019	1377392
- buses and minibuses	312420	1621001
- trolleybuses	61297	291564
- metro	91560	1189089
SOUTH - MUNTENIA	**91569**	**454339**
- trams	11211	56055
- buses and minibuses	72351	358249
- trolleybuses	8007	40035
BUCHAREST - ILFOV	**624727**	**4024707**
- trams	239808	1321337
- buses and minibuses	240069	1262752
- trolleybuses	53290	251529
- metro	91560	1189089
MACROREGION FOUR	**162927**	**808722**
- trams	57356	275550
- buses and minibuses	85799	469920
- trolleybuses	19772	63252
SOUTH-WEST OLTENIA	**57650**	**342676**
- trams	11665	76289
- buses and minibuses	45001	259499
- trolleybuses	984	6888
WEST	**105277**	**466046**
- trams	45691	199261
- buses and minibuses	40798	210421
- trolleybuses	18788	56364

sourceto:: National Institute of Statistics
https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

Land passenger transport capacity in 2021

The seat-kilometer utilization index was 25.5% for local public passenger transport and 30.8% for passenger transport by rail in the year 2021. In 2021, the vehicle capacity for local public passenger transport was 32,415 million seat-kilometers offered, with the highest share, 43.9%, represented by bus and minibus transport capacity. Regarding rail transport, the capacity of passenger vehicles amounted to 13,868 million seat-kilometers offered.

Source: https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

Freight transport

RO 36

Indicator code Romania: RO 36
EEA indicator code: CSI 36

TITLE: **FREIGHT TRANSPORT DEMAND**

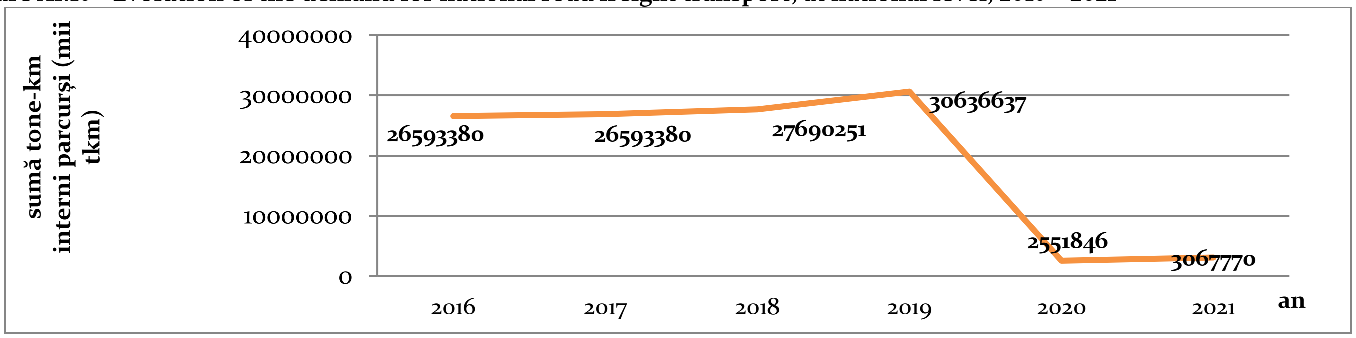
DEFINITION: The freight transport demand is defined as the sum of internal tonne-kilometers traveled annually. According to the most recent metadata, domestic maritime transport includes road, rail, and inland waterway transport : inland waterways and rail transport are based on movements within the national territory (the 'territoriality principle'), regardless of the nationality of the vehicle or vessel. Road transport is based on all vehicle movements recorded within the reporting country.

Road freight transport encompasses the transportation using vehicles registered within the reporting country, while rail transport and inland waterway transport include movements within the national territory, regardless of the nationality of the transport vehicle, registered for a minimum period of 5 years. The variable is calculated from the tonne-kilometer (tkm) indicator, defined as the transport of one tonne of goods over a distance of one kilometer.

Upward trend in the volume of transported goods and their distance covered in both rail and road transport.

Source: *https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021*.pdf

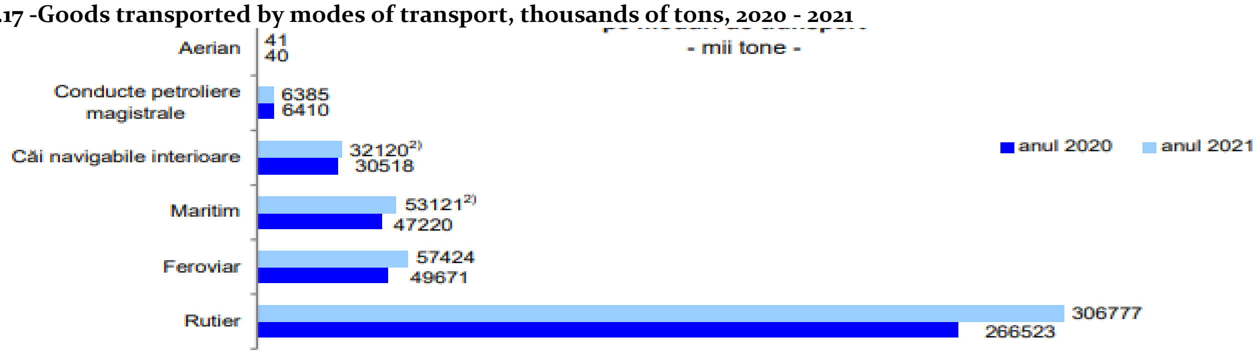
Figure XI.16 - Evolution of the demand for national road freight transport, at national level, 2016 – 2021



Source: National Institute of Statistics

Source: *https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf*

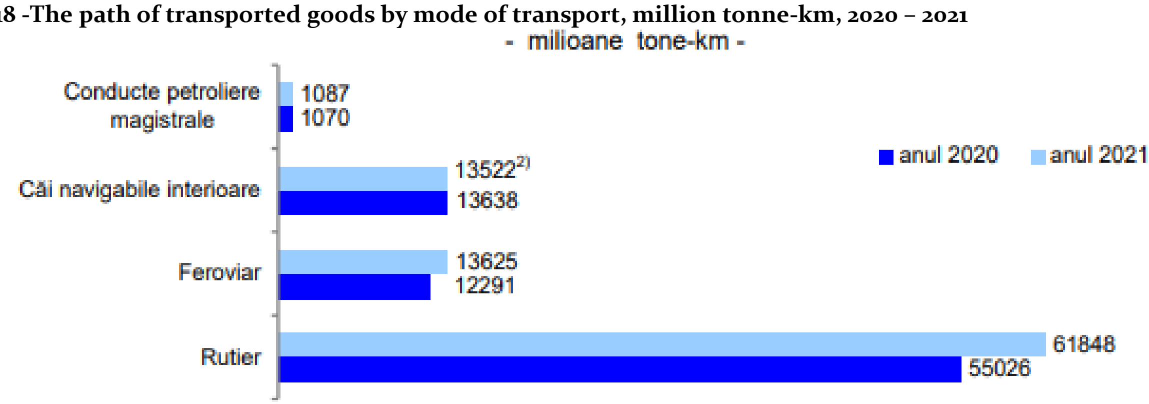
Figure XI.17 -Goods transported by modes of transport, thousands of tons, 2020 - 2021



Note: 2) Includes data for Q3 2021, corrected from previously published data

Source: https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

Figure XI.18 -The path of transported goods by mode of transport, million tonne-km, 2020 – 2021



Note: 2) Includes data for third quarter 2021, corrected from previously published data

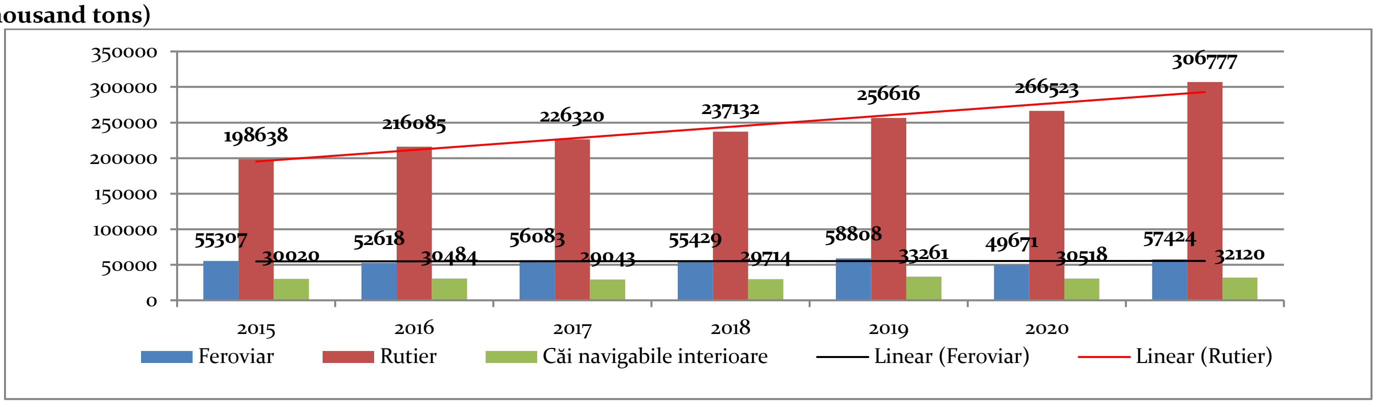
Source: *https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf*

In the year 2021, in national road transport, 64.4% of the goods volume was transported over distances between 1-49 km, 19.8% over distances between 50-149 km, and 12.7% over distances between 150-499 km. In national inland waterway transport, 55.3% of the goods volume was transported over distances ranging from 150-299 km.

The share of each mode of transport in the freight transport

The modes of transport considered are: a) road, b) railway and c) inland waterways. Road transport of goods includes transport on vehicles registered in the reporting country, and rail and inland waterway transport includes transport on national territory, regardless of the nationality of the transport vehicle. The weight is calculated from *the ton-km (tkm) indicator*, defined as the transport of one ton of goods over the distance of one kilometer. It is observed that both in the case of the demand for passenger transport and that of freight transport, road transport has an overwhelming weight to the detriment of the other modes of transport. At the same time, *the objectives of sustainable mobility* requires the transfer of an increasingly large volume of passenger and freight transport from the road to the railway. *Figure XI.19 shows the volume of goods transported in Romania, by rail, road and inland waterways, in the period 2015 – 2021, in thousands of tons. In figures XI.20 – XI.23 the types of transport by division of goods transported in 2021. In tables XI.11 and XI.12* the evolution for the year 2021 compared to the year 2020 for the goods transported and their course by means of transport is presented ; and in figure XI.24 the share of each mode of transport in the freight transport (tkm), at national level, for the period 2015 – 2019.

Figure XI.19 - The volume of goods transported in Romania, by rail, road and inland waterways, in the period 2015 – 2021 (thousand tons)



Source: National Institute of Statistics ,Ministry of Transport and Infrastructure

Figure XI.20 -Road transport by divisions of transported goods, in 2021 (% of thousands of tons)

Source: *https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf*

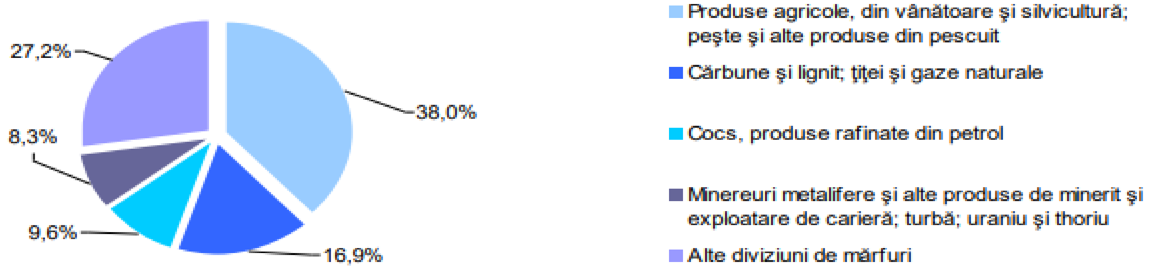
In road transport, the commodity divisions with the highest shares in the total transported goods (Figure XI.20) were: metal ores and other mining and quarrying products; peat; uranium and thorium (31.1%) and other non-metallic mineral products (20.2%). As for the distance covered by goods, the divisions that held the highest shares in the total distance were: goods grouped: a mixture of types of goods transported together (29.8%) and food, beverages, and tobacco products (16.8%).

Figure XI.21 -Rail transport by divisions of transported goods, in 2021 (% of thousands of tons)

Source: *https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf*

In rail transport, significant shares in the total volume of transported goods (Figure XI.21) were recorded for the divisions: coke, refined petroleum products (22.3%), and coal and lignite; oil and natural gas (19.4%). As for the journey of goods, 28.9% of the total is represented by the division of coke, refined petroleum products, and 20.4% by agricultural, hunting and forestry products; fish and other fishing products.

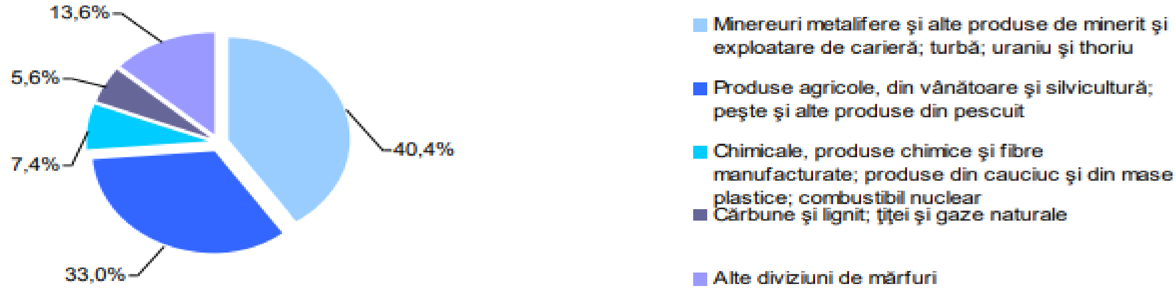
Figure XI.22 -Maritime transport by divisions of transported goods, in 2021 (% of thousands of tons)



Source: *https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf*

In maritime transport, the most significant shares of the total transported goods (Figure XI.22) were recorded in the divisions of agricultural, hunting, and forestry products; fish and other fishing products (38.0%), and coal and lignite; oil and natural gas (16.9%).

Figure XI.23 -Transport on inland waterways by division of transported goods, in 2021 (% of thousands of tons)



Source: *https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf*

In the transport on inland waterways, significant shares of the total transported goods (figure XI.23) were recorded in the metal ores and other mining and quarrying products divisions; peat; uranium and thorium (40.4%) and agricultural products, from hunting and forestry; fish and other fishery products (33.0%).

In the year 2021, in road freight transport, goods transported on own account represented 55.8% of the total, and with regards to destination, 17.8% of the total goods were recorded in international transport. Out of the total goods in international road transport, which amounted to 54,620 thousand tons, transport between third countries accounted for 46.7%, cabotage for 23.2%, and loaded goods for 17.1%.

In international road freight transport, 93.2% of the total unloaded goods originated from European Union Member States, and 95.5% of the total loaded goods were destined for European Union Member States. The largest quantities of goods originated from Germany (21.1%), Hungary (15.9%), and Italy (11.3%). As for the loaded goods, 18.5% of the volume went to Germany, 16.3% to Italy, and 14.9% to Hungary.

Table XI.11 -Freight transport, by modes of transport and destinations, thousands of tons, in 2021 compared to 2020

	Trimestrul IV	Anul 2021	Trimestrul IV 2021 în % față de trimestrul IV 2020	Anul 2021 în % față de anul 2020
A	1	2	3	4
TRANSPORT FEROVIAR - mii tone -	**14393**	**57424**	**108,7**	**115,6**
- transport naţional	11741	46965	110,4	113,3
- transport internaţional	2356	9352	99,7	128,6
- tranzit	296	1107	120,8	117,3
TRANSPORT RUTIER - mii tone -	**83715**	**306777**	**114,2**	**115,1**
- transport naţional	69434	252157	115,0	116,1
- transport internaţional[1)]	14281	54620	110,4	110,7
TRANSPORT MARITIM - mii tone -	**13220**	**53121[2)]**	**109,9**	**112,5**
- transport naţional	-	-	-	-
- transport internaţional	13220	53121[2)]	109,9	112,5
TRANSPORT PE CĂI NAVIGABILE INTERIOARE[3)] - mii tone -	**7710**	**32120[2)]**	**100,5**	**105,2**
- transport naţional	4177	16133[2)]	131,9	115,4
- transport internaţional	2347	12324[2)]	63,6	92,5
- tranzit	1186	3663[2)]	144,8	114,1
din total, pe tipuri de nave				
- barje auto-propulsate	1131	4451	147,3	130,6
- barje fără auto-propulsie	6227	26093	95,1	101,1
- barje-cisternă auto-propulsate	276	1182	111,7	130,8
- barje-cisternă fără autopropulsie	75	391	69,4	100,8
- alte tipuri de nave de navigaţie interioară	-	2	-	22,2
- nave maritime	1	1	-	-
Mărfuri transportate prin canale navigabile - mii tone -	**3732**	**17289**	**85,0**	**104,7**
Trafic prin canale navigabile interioare				
- număr total de nave, din care:	5872	25088	90,2	101,7
- nave străine	1902	8395	75,6	97,0
TRANSPORT AERIAN[4)] - mii tone -	**12**	**41**	**115,8**	**101,9**
- transport naţional	*)	2	90,5	149,3
- transport internaţional	12	39	117,0	100,3

1) Conform legislaţiei şi metodologiei Eurostat, include date de transport între state terţe şi cabotaj.
2) Include date pentru trimestrul III 2021, rectificate faţă de cele publicate anterior.
3) Include date de transport între porturi din Bulgaria, echivalent cu transport de tranzit pentru România (vezi Nota metodologică).
4) Evoluţia în procente, faţă de perioadele similare ale anului 2020, este calculată din valori exprimate în "tone".
*) Date sub 0,5 mii tone.

	Trimestrul IV	Anul 2021	Trimestrul IV 2021 în % față de trimestrul IV 2020	Anul 2021 în % față de anul 2020
A	1	2	3	4
TRANSPORT PRIN CONDUCTE PETROLIERE MAGISTRALE - mii tone -	**1472**	**6385**	**89,8**	**99,6**
- transport naţional	752	3039	95,2	94,3
- transport internaţional	720	3346	84,7	105,0
Transportul ţiţeiului	1446	6280	89,4	99,4
- transport naţional	726	2934	94,7	93,8
- transport internaţional	720	3346	84,7	105,0
Transportul produselor derivate din ţiţei	26	105	113,0	110,5
- transport naţional	26	105	113,0	110,5

Source:*https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf*

Table XI.12 - The route of goods, by means of transport and destinations, in 2021 compared to 2020

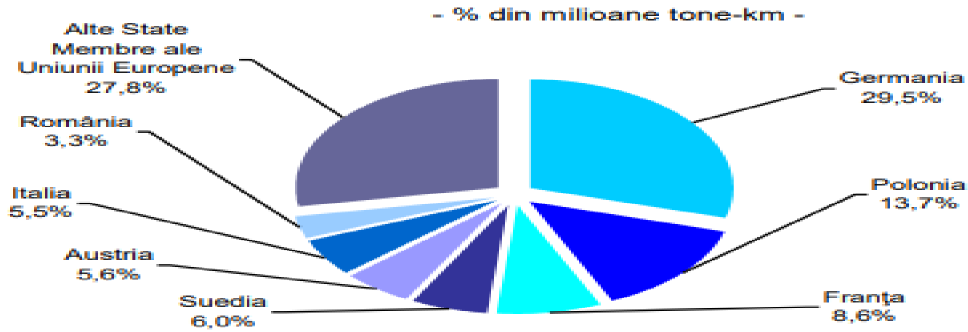
	Trimestrul IV	Anul 2021	Trimestrul IV 2021 în % faţă de trimestrul IV 2020	Anul 2021 în % faţă de anul 2020
A	1	2	3	4
PARCURSUL TARIFAR AL MĂRFURILOR ÎN TRANSPORTUL FEROVIAR - mii tone-km -	**3255228**	**13624973**	**100,0**	**110,9**
- transport naţional	2530046	10525005	105,8	110,4
- transport internaţional	587198	2565678	79,2	114,5
- tranzit	137984	534290	112,8	103,9
TRANSPORT RUTIER - mii tone-km -	**16747270**	**61848339**	**115,4**	**112,4**
- transport naţional	5638917	20457176	126,3	118,4
- transport internaţional[1)]	11108353	41391163	110,5	109,7
TRANSPORT PE CĂI NAVIGABILE INTERIOARE[2)] - mii tone-km -	**3016969**	**13521736[3)]**	**85,1**	**99,1**
- transport naţional	903356	3650753[3)]	135,0	118,3
- transport internaţional	1294572	7487567[3)]	54,8	87,5
- tranzit	819041	2383416[3)]	159,2	119,5
din total, pe tipuri de nave				
- barje auto-propulsate	368405	1708487	93,9	112,0
- barje fără auto-propulsie	2534500	11268721	83,8	96,9
- barje-cisternă auto-propulsate	87170	410425	103,9	128,2
- barje-cisternă fără autopropulsie	26164	132806	61,4	84,6
- alte tipuri de nave de navigaţie interioară	-	567	-	23,5
- nave maritime	730	730	-	-
TRANSPORT PRIN CONDUCTE PETROLIERE MAGISTRALE - mii tone-km -	**229713**	**1087390**	**80,9**	**101,6**
- transport naţional	62416	252027	95,0	91,0
- transport internaţional	167297	835363	76,6	105,3
Parcursul ţiţeiului	227201	1077331	80,5	101,5
- transport naţional	59903	241967	93,7	90,1
- transport internaţional	167298	835364	76,6	105,3
Parcursul produselor derivate din ţiţei	2512	10059	140,5	117,8
- transport naţional	2512	10059	140,5	117,8
PARCURSUL DE EXPLOATARE FEROVIAR NET AL MĂRFURILOR - TOTAL - mii tone-km -	**3094665**	**12915281**	**100,0**	**110,7**
PARCURSUL DE EXPLOATARE FEROVIAR BRUT AL MĂRFURILOR - TOTAL - mii tone-km bruto -	**6549208**	**26166131**	**94,1**	**104,4**
din care: - cu tracţiune diesel	994215	4063188	80,5	96,5
- cu tracţiune electrică	5554993	22102943	97,0	106,0
PARCURSUL VEHICULELOR RUTIERE PENTRU TRANSPORTUL MĂRFURILOR[4)] - mii vehicule-km	**1378480**	**5189131**	**109,4**	**110,3**

[1)] Conform legislaţiei şi metodologiei Eurostat, include date de transport între state terţe şi cabotaj.
[2)] Include date de transport între porturi din Bulgaria, echivalent cu transport de tranzit pentru România (vezi Nota metodologică).
[3)] Include date pentru trimestrul III 2021, rectificate faţă de cele publicate anterior.
[4)] Include parcursul vehiculelor rutiere fără încărcătură.

Source:*https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf*

According to statistical data published by the European Commission - Eurostat3), in the year 2020, three Member States, namely Germany, Poland, and France, accounted for 51.8% of the total freight transport value by rail, among the European Union member countries, (Figure XI.24).

Figure XI.24 -The route of goods in rail transport, in the Member States of the European Union, % of million tonne-km, in the year 2020



Source: European Commission - Eurostat, Database

FACTORS THAT INFLUENCE CONSUMPTION

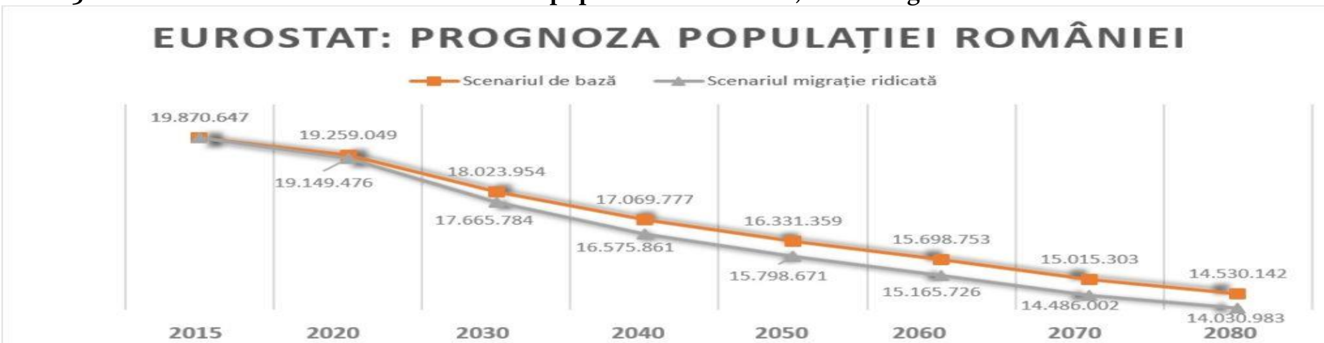
Some of the most significant factors influencing consumption include: demographic factors, social and psychological factors, income and prices, trade, globalization, technologies, supply of goods and services, and how they are marketed. Other factors influencing consumption include information about products and services, policies, housing, and infrastructure. At the microeconomic level, consumer income is the essential factor, which, in terms of form, amount, dynamics, distribution over time, and destination, forms the material basis of consumer behavior and the main constraint imposed on it. ***According to the Organisation for Economic Co-operation and Development (OECD), "the most important economic factor influencing consumption patterns is the level of disposable income per household." Integrating sustainable development goals into economic activities also entails changing production and consumption patterns. Such changes can be achieved through regulations, taxation, legal decisions, public demands, and more.***

In the context of Sustainable Production and Consumption (SPC), to achieve or move towards EU objectives, it is crucial to emphasize the responsibility of the business environment, alongside raising awareness in civil society. In this regard, the Government of Romania and state institutions play a particularly important role in incorporating the concept of "Sustainable Production and Consumption" into their policies and strategies. Consumption is also influenced by factors such as population size, its distribution by age groups, the number of people per household, and available living space per person. Prices always have a direct effect on consumption, along with declining population numbers, population aging in developed countries, decreasing raw materials, internet access, and technological development. Among the effects of these factors, we find an increase in the retirement age, encouragement for people to establish alternative pension systems, responsible consumption, and greater attention to what they consume.

The trend of population aging has a profound impact on all future generations and on various economic and social sectors, including the labor market, social protection, education, culture, and more**. Scenarios considered by Eurostat** indicate that the difference between the baseline forecast and the one with intense migration would be around 500 thousand people by the year 2080. In both scenarios, within the next 15 years (by 2030), Romania is projected to lose between 1.8 and 2.2 million inhabitants compared to the year 2015. Looking ahead to 2080, the loss could range from 5.3 to 5.8 million inhabitants.

According to Eurostat data, the population aged up to one year (i.e., newborns) is expected to decrease from 191,867 individuals in 2015 to 151,253 individuals in 2080. This represents a decline of 21%.

Figure XI.25 – Forecast of the evolution of Romania's population until 2080, according to EUROSTAT



Source:www.edupedu.ro

The resident population of Romania in the period 2019 – 2021

Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

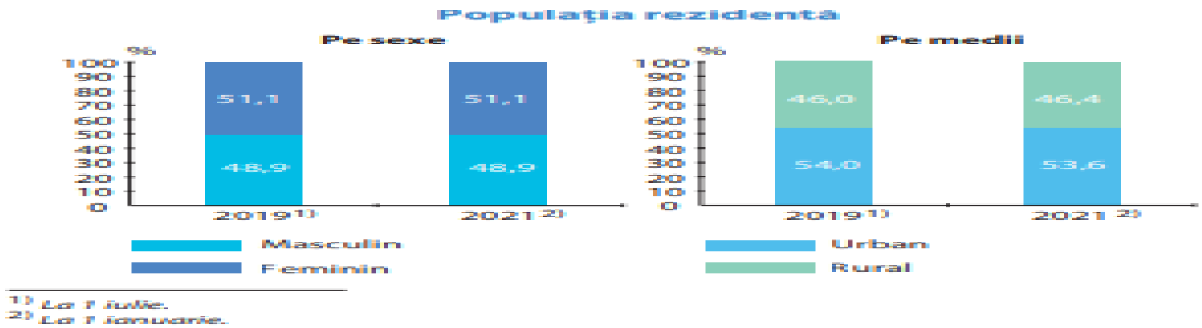
On January 1, 2021, the resident population of Romania was 19,201.7 thousand inhabitants, of which 9.8 million were females (51.1%). Negative natural growth rates combined with the international migration balance resulted in a decrease in the country's resident population by 174.2 thousand individuals between July 1, 2019, and January 1, 2021. The age structure of the resident population reflects the specific characteristics of a demographic aging process, primarily marked by a decrease in birth rates. This has led to an absolute decline in the young population (0-14 years old), although there is a slight increase in its proportion from 15.7% to 15.8%. At the same time, although the elderly population (60 years and over) experiences a slight decline in absolute numbers (by 16.4 thousand individuals), its proportion increased from 25.5% to 25.7% on January 1, 2021, compared to July 1, 2019. The adult resident population (15-59 years old) represented 58.5% of the total on January 1, 2021, showing a decrease by 147.2 thousand individuals compared to July 1, 2019. Within the adult population, the proportion of the age group 50-54 increased, while those of the age groups 25-29, 30-34, 35-39, 40-44, and 55-59 decreased. The proportions of the age groups 15-19, 20-24, and 45-49 remained relatively constant-see table XI.13**. *On January 1, 2021, the resident population in urban areas numbered 10.3 million people, accounting for 53.6% of the country's population*.**

Table XI.13- The resident population, by gender, age groups and regions, 2019 - 2021

people

	2019	2020	2021[1])
Total	**19375835**	**19269469**	**19201662**
By gender			
Male	9482661	9426244	9387590
Female	9893174	9843225	9814072
By age groups			
0-14 years	3037445	3029770	3026943
15-59 years	11388824	11291871	11241585
60 years and over	4949566	4947828	4933134
By regions			
Urban	10458061	10378580	10296393
Rural	8917774	8890889	8905269

1) The data refers to January 1, 2021.

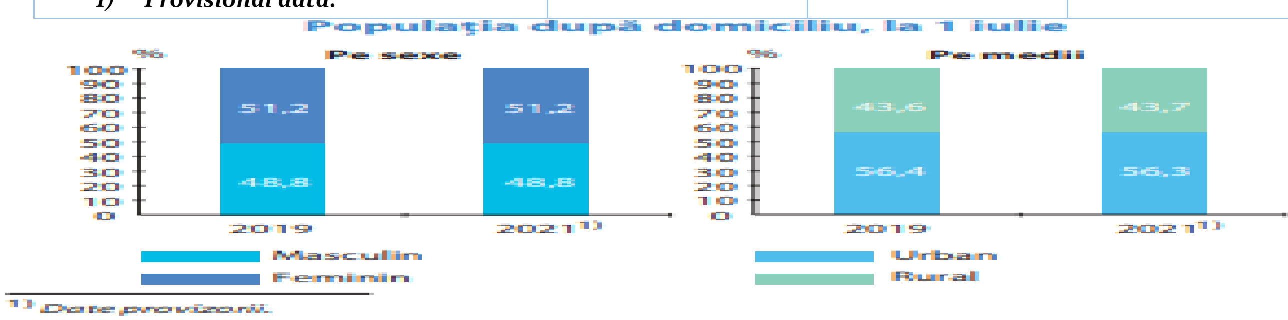


Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

On July 1, 2021, the population of Romania by place of residence was 22,046.9 thousand people, which is a decrease compared to July 1, 2019, by 146.4 thousand people. This decline was primarily caused by the negative natural growth rate of the population. Comparing July 1, 2021, to July 1, 2019, there is a decrease in the proportion of the young population (0-14 years old) from 14.8% to 14.6%, and an increase in the proportion of the elderly population (60 years and over) from 23.2% to 23.5%. The adult population (15-59 years old) represents 61.9% of the total, showing a decrease of 108.7 thousand individuals compared to July 1, 2019. On July 1, 2021, the population by place of residence in urban areas numbered 12.4 million people, accounting for 56.3% of the country's total population. See table XI.14. (*Note: Population by place of residence on July 1, 2021 - provisional data).*

Table XI.14- Population by residence, by gender, age groups and regions , 2019 - 2021

			people
	2019	**2020**	**2021 1)**
Total	**22193286**	**22178685**	**22046917**
By gender			
Male	10840820	10832579	10760954
Female	11352466	11346106	11285963
By age groups			
0-14 years	3274638	3263605	3214123
15-59 years	13770425	13721748	13661678
60 years and over	5148223	5193332	5171116
By regions			
Urban	12521494	12513481	12416732
Rural	9671792	9665204	9630185
1) Provisional data.			



Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

Table XI.15- The evolution of birth rates, death rates, marriage rates, divorce rates, and the natural population growth rate, 2019 - 2021

	20191)	**20201)**	**2021**
	Natural population movement (absolute data)		
Live births	199720	198302	177622
Deaths	259889	298258	334354

- Deaths under the age of 1 year	1151	1104	1001
The natural growth	-60169	-99956	-156732
Marriages	128610	81343	114189
Divorces	30197	22785	25313
	Rates (per 1000 inhabitants)		
Live births	10.3	10.3	9.3
Deaths	13.4	15.5	17.4
- Deaths under the age of 1 year3)	5.8	5.6	5.6
The natural growth	-3.1	-5.2	-8.1
Marriages	5.8	3.7	5.2
Divorces	1.4	1.0	1.1
Note: The following individuals are included in the mentioned rates: live births of mothers who, at the time of birth, had their usual residence in Romania and whose births were registered with the civil registry offices in Romania; deaths under 1 year of age; deaths of individuals with usual residence in Romania. For calculating birth and death rates for the years 2019 and 2020, the resident population on July 1 of each year was used, and for the year 2021, the resident population on January 1 was used. The latter was estimated in conditions of comparability with the definitive results of the 2011 Population and Housing Census. For calculating marriage and divorce rates, the population by place of residence on July 1 of each year was used.			
1)Definitive data. 2) Semi-definitive data. 3) Provisional data.			
4)The infant mortality rate is calculated by reporting the number of deceased persons under the age of 1, who had their usual residence in Romania, per 1000 live births with their usual residence in Romania.			
Source: INS-Statistical research in the field of demography.			

Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

According to the data presented in Table XI.15, **birth rate**, the first component of natural population movement, experienced a decrease in 2021 compared to the previous year and compared to 2019. In the context of the COVID-19 pandemic, mortality increased in comparison to the last two years. In the year 20211), the number of live births with usual residence in Romania was 177.6 thousand people, a decrease of 20.7 thousand people compared to 2020 and 22.1 thousand people compared to 2019. **Mortality** - the second component of natural population movement - increased notably, especially in the context of the COVID-19 pandemic, and considering the decline in birth rates. In the short and medium term, this signifies the continuation of demographic decline. ***The significant increase in this component should be considered in Romania's demographic perspective***. The number of deaths with usual residence in Romania in the year 20211) was 334.4 thousand people, an increase of 36.1 thousand people (12.1%) compared to 2020 and 74.5 thousand people (28.7%) compared to 2019. The number of deaths under 1 year of age for children with usual residence in Romania, registered in the year 20211), was 1001 deaths under 1 year, which is 103 deaths under 1 year less than in 2020, and 150 deaths under 1 year less than in 2019.
In the year 20211), there were 114.2 thousand **marriages** registered. Compared to 2020, the number of marriages increased by 32.8 thousand (40.4%), but decreased by 14.4 thousand (-11.2%) compared to 2019. The number of **divorces** registered in the year 20211) was 25.3 thousand divorces, an increase of 2.5 thousand divorces (11.1%) compared to 2020 and a decrease of 4.9 thousand divorces (-16.2%) compared to 2019.1)*Provisional data*

Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

Table XI.16- The first ten cities of the country, according to the number of people with residence in Romania, on July 1, 2021 1)			
No. crt.	**City2)**	**Number of people**	
1.	**Bucharest**		**2161347**
2.	Iași		391024
3.	Cluj-Napoca		328316
4.	Timisoara		318296
5.	Constanța		306607
6.	Galați		304957
7.	Craiova		295260

8.	Brașov		287432
9.	Ploiesti		221689
10.	Oradea		219554
[1)]***Provisional data.***			
[2)]***The municipality (county seat).***			

Source: *https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf*

On July 1, 2021, 12.4 million people lived in the urban environment, representing more than half of the country's population. Of the 319 municipalities and cities, 86.2% had a population below 50 thousand inhabitants, representing 18.4% of the country's population and 32.6% of the urban population. Large cities (with over 100,000 inhabitants) hold 31.6% of the country's population and 56.2% of the urban population. On July 1, 2020, 9.6 million people lived in rural areas, representing 46.4% of the country's population. The communes with a population between 1000 and 5000 inhabitants are the majority in the total number of communes (79.4%) and their population represents 27.7% of the country's population and 63.4% of the rural population.

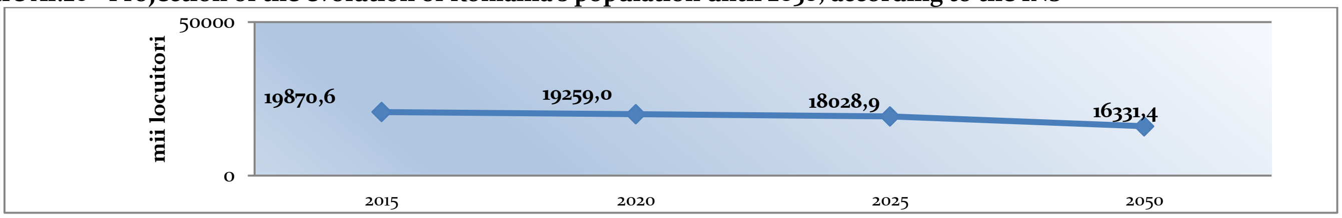
Table XI.17- Grouping of counties and localities according to the number of people resident in Romania, on July 1, 2021

1) Provisional data.			
	2019	**2020**	**2021[1)]**
Counties - total	**42**	**42**	**42**
Under 300000	6	6	6
300000 - 499999	18	18	18
500000 - 699999	10	10	10
700,000 and over	8	8	8
Municipalities and cities - total	**319**	**319**	**319**
Under 5000	24	25	25
5000 - 19999	189	188	190
20000 - 49999	61	61	60
50000 - 99999	20	20	19
100000 - 199999	14	15	15
200000 - 999999	10	9	9
1000000 and above	1	1	1
Communes - total	**2862**	**2862**	**2862**
Under 1000	108	114	117
1000 - 1999	642	662	679
2000 - 4999	1630	1602	1592
5000 - 9999	434	432	424
10000 and above	48	52	50

Source: *https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf*

The projection of the demographic evolution of Romania until the year 2050, according to the National Institute of Statistics, (figure XI.26), it is presented as follows: the decline in 2016 is greater than that recorded in 2015, when the resident population in Romania decreased by 110,700 people; at the level of 2017 in Romania there were 19.63 million people, down by 122,000 people compared to January 1, 2016, with the main cause of the decrease being the negative natural increase (the number of deceased people exceeding the number of live births by 68,061 people) and the demographic aging that intensified in 2018 (the elderly population over 65 exceeding with over 434,000 people the young population aged 0-14). **On January 1, 2019** the elderly population numbered 3.674 million people while the young population was represented by 3.240 million people. According to the National Institute of Statistics, in the year 2019, "*The demographic aging process intensified compared to January 1, 2018, with a slight decrease in the proportion of young people (0-14 years old) and, at the same time, an* increase (by 0.3 percentage points) in the proportion of elderly people (65 years and over). The demographic aging index increased from 110.0 (on January 1, 2018) to 113.4 elderly persons per 100 young persons (on January 1, 2019)." ***In the years 2019 and 2020, the population of Romania decreased by 0.42% compared to the year 2018 and 2019, respectively. In 2021, the population of Romania decreased by 0.58% compared to 2020***. **In the coming decades, a deepening of Romania's demographic decline is expected. Consequently, Romania's population is projected to reach around 16.5 million inhabitants by the year 2050, according to a report by the United Nations (UN) published in July 2015**. The population decline will be due to maintaining a birth deficit compared to the number of deaths, along with the cumulative balance of internal and external migration.

Figure XI.26 - Projection of the evolution of Romania's population until 2050, according to the INS



Source: National Institute of Statistics

According to the report "*World Population Prospects: The 2017 Revision" from 2017, prepared by the Population Division of the Department of Economic and Social Affairs of the UNO*, the estimated world population will be, in 2050, almost 9.8 billion people, and in the year 2100 it is predicted that it will reach 11.2 billion inhabitants. The world population will increase annually, on average, by approximately 43.8 million inhabitants. Half of the population growth by 2050 will come from nine countries: India, Nigeria, Democratic Republic of Congo, Pakistan, Ethiopia, Tanzania, USA, Uganda and Indonesia. By 2050, seven African countries will be part of the top 20 countries with the most inhabitants. *The UNO report mentions that European countries, as a result of maintaining fertility rates below the replacement level (of about 2.1 live births per woman), will register decreases in the number of the population. Eastern Europe will be the most affected by this demographic trend, the number of inhabitants may decrease by more than 15% in Bulgaria, Croatia, Latvia, Lithuania, Poland, the Republic of Moldova, Romania, Serbia and Ukraine*. The growth of the world population is accompanied by a change in the age structure of the population. The global reduction of the birth rate and the decrease in the number of children, in parallel with the constant increase in the number of the elderly, lead to a change in the balance between generations. ***The demographic projection conducted by the Population Division within the Department of Economic and Social Affairs of the United Nations foresees that, under the medium variant, Romania's population will be approximately 16.4 million inhabitants by the year 2050 and around 12.1 million inhabitants by the year 2100***

Demographic projections at the level of EU member countries made by Eurostat in 2016, based on the analysis of fertility, mortality and international migration, anticipates the probable evolution of the population of the member countries until the horizon of 2080(table XI.18). *According to the demographic projections made by Eurostat, in the basic version, the population of the EU-28 will increase until the year 2050, when it will reach about 528.6 million inhabitants, after which the population will decrease until the year 2080 (518.8 million inhabitants*). In establishing the design assumptions, Eurostat took into account the socio-demographic differences between the member states and established the period of time when the fertility level and the life expectancy level in each state will converge, and the differences regarding the demographic phenomena between the states will fade.

Table XI.18 – The population registered in 2015 and projected for the period 2015 – 2080 at the level of the EU-28 and the member countries

Countries	Population registered in 2015	Projected population		
		2020	2050	2080
EU-28	508401084	515591288	528567808	518798375
Belgium	11208986	11580268	13273155	14189456
Bulgaria	7202198	6954254	5564146	4593415
Czech Republic	10538275	10652407	10478190	9777734
Denmark	5659715	5887449	6685016	6858258
Germany	81197537	83751689	82686973	77793794
Estonia	1313271	1317940	1256975	1140304
Ireland	4628949	4852123	5693430	6220907
Greece	10858018	105560497	8918545	7264685
Spain	46449565	46562044	49257477	50988206
France	66415161	67818978	74376832	78688730

Croatia	4225316	4091559	3674791	3276481
Italy	60795612	60350475	58968137	53784578
Cyprus	847008	869041	984402	1004870
Latvia	1986096	1911668	1506005	1284285
Lithuania	1921262	2749762	1957377	1658478
Luxembourg	562958	628950	938416	1066377
Hungary	9855571	0789630	0287196	8691906
Malta	429344	452542	513081	517254
Netherlands	16900726	17410756	19253467	19728275
Austria	8576261	9005478	10247691	10072112
Poland	38005614	37930818	34372849	29044721
Portugal	10374822	10209628	9116350	7579557
Romania	19870647	19259049	16331359	14530142
Slovenia	2062874	2075778	2045090	1938449
Slovakia	5421349	5458718	5261609	4714770
Finland	5471753	5561792	5687527	5577757
Sweden	9747355	10293412	12681084	14388478
England	64875165	67236507	77568588	82424395
Norway	5166493	5403704	6568489	7166280

Source: Eurostat – http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_15npms&lang=en

Table XI.19 - EU population on January 1 "*International Statistics*" - "*Romania in figures 2022*", Statistical summary

Population on January 1 (millions of inhabitants)								
	Total				of which: women			
Country	**2000**	**2010**	**2015**	**2021**	**2000**	**2010**	**2015**	**2021**
EU-27	**428.5[1)]**	**440.7[1)]**	**443.7[1)]**	**447,2[2),3)]**	**219.9[1)]**	**225.8[1)]**	**227.4[1)]**	**228.7[2),3)]**
Austria	8.0	8.4	8.6	**8,9**	4.1	4.3	4.4	**4.5**
Belgium	10.2	10.8	11.2	**11.6**	5.2	5.5	5.7	**5.9**
Bulgaria	8.2	7.4	7.2	**6.9**	4.2	3.8	3.7	**3.6**
Czech Republic	10.3	10.5	10.5	**10.7**	5.3	5.3	5.4	**5.4**
Cyprus	0.7	0.8	0.8	**0.9**	0.4	0.4	0.4	**0.5**
Croatia	4.5[3)]	4.3	4.2	**4.0**	2.3[3)]	2.2	2.2	**2.1**
Denmark	5.3	5.5	5.7	**5.8**	2.7	2.8	2.8	**2.9**
Estonia	1.4	1.3	1.3[1)]	**1.3**	0.7	0.7	0.7[1)]	**0.7**
Finland	5.2	5.4	5.5	**5.5**	2.6	2.7	2.8	**2.8**
France	60.5	64.7	66.5	**67.7[2)]**	31.2	33.4	34.3	**34.9[2)]**
Germany	82.2	81.8	81.2	**83.2**	42.1	41.7	41.4	**42.1**
Greece	10.8	11.1	10.9	**10.7**	5.5	5.7	5,6	**5.5**
Ireland	3.8	4.5	4.7	**5.0**	1.9	2,3	2.4	**2.5**
Italy	56.9	59.2	60.8	**59.2**	29.4	30.5	31.3	**30.4**
Latvia	2.4	2.1	2.0	**1.9**	1.3	1.1	1.1	**1.0**
Lithuania	3.5	3.1	2.9	**2.8**	1.9	1.7	1.6	**1.5**
Luxembourg	0.4	0.5	0.6	**0.6**	0.2	0.3	0.3	**0.3**
Malta	0.4	0.4	0.4	**0.5**	0.2	0.2	0.2	**0.2**
Poland	38.3[1)]	38.0[1)]	38.0	**37.8[2),3)]**	19.7[1)]	19.6[1)]	19.6	**19.5[2),3)]**
Portugal	10.2	10.6	10.4	**10.3**	5.3	5.5	5.5	**5.4**
***Romania*[4)]**	***22.5[1)]***	***20.3***	***19.9***	***19.2***	***11.5[1)]***	***10.4***	***10.2***	***9.8***
Slovakia	5.4	5.4	5.4	**5.5**	2.8	2.8	2.8	**2.8**
Slovenia	2.0	2.0	2.1	**2.1**	1.0	1.0	1.0	**1.0**
Spain	40.5	46.5	46.4	**47.4**	20.6	23.5	23.6	**24.2**
Sweden	8,9	9.3	9.7	**10.4**	4.5	4.7	4.9	**5.2**
Lower Countries	15.9	16.6	16.9	**17.5**	8.0	8.4	8.5	**8.8**
Hungary	10.2	10.0	9.9	**9.7**	5.4	5.3	5.2	**5.1**
[1)]***Broken streak.***	[2)]*Provisional data.*	[3)]*Estimates.*						

[4)]The data for the years 2010, 2015, 2021 refer to the resident population calculated in accordance with international requirements and regulations.
Source: Eurostat, NIS

	Gross Domestic Product/capita (in SPP)				GDP growth rate (%) (previous year =100)			
Country	**2000**	**2010**	**2015**	**2021[1])**	**2000**	**2010**	**2015**	**2021**
EU-27	**18400**	**24900**	**27500**	**32300**	**3.9**	**2.2**	**2,3**	**5.3**
Austria	24400	31800	35900	39000	3,4	1.8	1.0	4.5
Belgium	23100	30200	33200	39400	3.7	2.9	2.0	6.2[1])
Bulgaria	5300	11000	13200	17900	4.6	1.5	3,4	4.2[1])
Czech Republic	13500	21000	24400	29600	4.0	2.4	5.4	3.3
CYPRUS	17700	25300	22900	28300	6.0	2.0	3,4	5.5[1])
Croatia	9200	15100	16700	22600	2.9	-1.3	2.5	10.2[1])
Denmark	23800	32500	35300	43000	3.7	1.9	2,3	4.7
Estonia	7800	16300	21000	28200	10.1	2.4	1.9	8.3
Finland	22200	29500	30500	36600	5.8	3.2	0.5	3.5
France	21700	27200	29400	33600	3.9	1.9	1.1	7.0[1])
Germany	22800	30000	34200	38600	2.9	4.2	1.5	2.9[1])
Greece	16200	21100	19200	20900	3.9	-5.5[2])	-0.2	8.3[1])
Ireland	25100	32700	49700	71200	9.4	1.8	25.2	13.5
Italy	22500	26400	26700	30700	3.8	1.7	0.8	6.6
Latvia	6700	13400	18000	23100	5.7	-4.5	3.9	4.5
Lithuania	7000	15200	20700	28500	3.7	1.7	2.0	5.0
Luxembourg	45700	68300	77600	89500	6.9	3.8	2,3	6.9
Malta	15300	21700	26900	31600	...	5.5	9.6	9.4
Poland	8900	15800	19100	24800	4.6	3.7	4.2	5.9
Portugal	15700	20600	21300	23900	3.8	1.7	1.8	4.9[1])
Romania	***4900***	***12800***	***15500***	***23500***	**2.5**	**-3.9**	**3.0**	***5.9[1])***
Slovakia	9400	19000	21500	22000	1,2	6.3	5.2	3.0
Slovenia	14900	21100	22700	29100	3.7	1.3	2.2	8.1
Spain	17900	24000	25100	27200	5.2	0.2	3.8	5.1[1])
Sweden	24600	32000	35300	39700	4.8	6.0	4.5	4.8
Lower Countries	26500	34100	36200	42500	4.2	1.3	2.0	5.0[1])
Hungary	9800	16500	19300	24400	4.5	1.1	3.7	7,1[1])

Note: SPP = Standard Purchasing Power: represents the reference currency established at the level of the Union
European to express the results of the European Comparison Program and is a currency unit
conventional that excludes the influence of differences between the price levels between countries.
[1)]Provisional data.
[2)]Broken streak.
... = Missing data.

Source: *Eurostat,NIS*

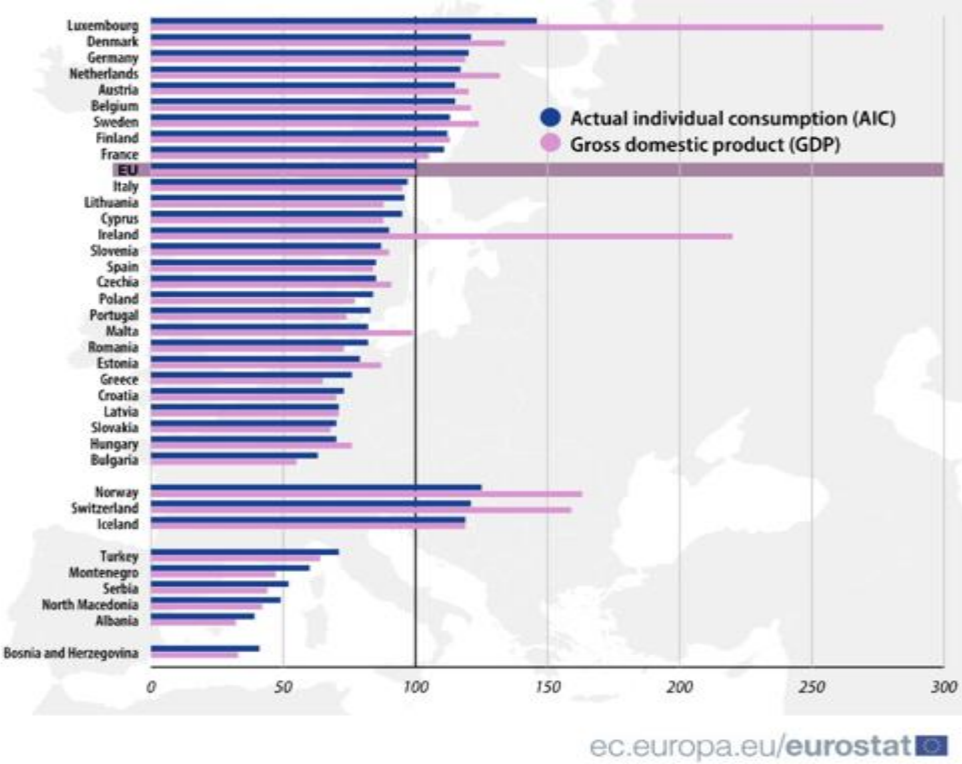
Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

On January 1, 2021, the European Union (EU) had a population of 447.0 million people. The most populous EU member state was Germany (83.2 million, 19% of the EU total), followed by France (67.4 million, 15%), Italy (59.3 million, 13%), Spain (47.4 million, 11%), and Poland (37.8 million, 9%). In total, the population of these five member states represented two-thirds of the EU population. At the other end of the spectrum, the least populous EU member states were Malta (500 thousand people, corresponding to 0.1% of the EU total), Luxembourg (600 thousand, 0.1%), and Cyprus (900 thousand, 0.2%). Between 2001 and 2020, the population of the EU (EU27) grew from 429 million to 447 million, a 4% increase. Seventeen member states recorded population growth during this period, while the other ten experienced declines. Growth was observed in Luxembourg, Malta, Ireland, and Cyprus, all exceeding 20%, while the largest declines were observed in Lithuania and Latvia, both with approximately 20% decreases. However, between January 1, 2020, and January 1, 2021, the EU population decreased by 312 thousand people. In absolute terms, the largest decrease was observed in Italy (-384 thousand, equivalent to -0.6% of its population), followed by Romania (-143 thousand, -0.7%) and Poland (-118 thousand, -0.3%). Overall, nine countries saw population declines in the last year, while the remaining eighteen experienced growth. France recorded the largest increase (+119 thousand, +0.2%). According to EUROSTAT, **on January 1, 2022, there were 446.8 million people living within the EU**, ***indicating that the population of the 27 countries comprising the bloc decreased by nearly 172,000 people compared to January 2021 and over 656,000 people compared to January 2020***. The largest population declines were in Italy, Poland, and Romania, while the largest demographic growth occurred in France, the Netherlands, and Sweden. In 2020 and 2021, positive net migration no longer offset the natural population decline in the EU. According to EUROSTAT, the number of deaths began to exceed the number of births in the EU a decade ago, but migration from outside the bloc helped offset the gap until the first year of the pandemic. EUROSTAT estimates the continued declining population trend in the European Union, given the pandemic, aging population, relatively low fertility rates, and Europe's dependence on migration within the EU – *Source*: https://insse.ro/cms/demography-in-europe/bloc-1a.html?lang=ro

Individual consumption, expressed in terms of the standard purchasing power parity (PPP), varied in 2021 across Europe between 63% and 146% of the EU average in the 27 member states. Romania positioned itself at 82% of the EU average, surpassing Greece (76%) and coming close to Portugal (83%), Poland (84%), Spain, and the Czech Republic (85%), according to EUROSTAT data. ***In terms of GDP per capita, Romania in 2021 surpassed Estonia, Greece, Croatia, Latvia, Slovakia, Hungary, and Bulgaria.***

Gross Domestic Product per capita expressed in standard purchasing power parity (PPP) varied in 2021 between 55% of the European Union average in Bulgaria and 277% in Luxembourg. Ten EU member states had this indicator above the EU bloc average, according to EUROSTAT**.** In terms of **GDP per capita in 2021** (the value of Gross Domestic Product per capita expressed in standard purchasing power parity - PPP)**,** ***Romania stood at 73% of the European Union average,*** closely followed by Portugal at 74% of the EU average, Hungary at 76%, and Poland at 77% - see Figure XI.27. According to Eurostat, Romania's GDP per capita was higher in 2021 than Latvia, which was at 71% of the EU average, Croatia at 70%, Slovakia at 68%, Greece at 65%, and Bulgaria at 55%. In 2021, actual individual consumption per capita, expressed in standard purchasing power parity (PPP) varied between 63% of the EU average in Bulgaria and 146% of the EU average in Luxembourg. Nine EU member states had a per capita consumption in 2021 higher than the EU average, with Luxembourg being the only member state with per capita actual individual consumption at 25% or more above the EU average. In Denmark, Germany, the Netherlands, Belgium, Austria, Sweden, Finland, and France, the level was 10% or more above the EU average. In 13 member states, per capita consumption in 2021 was up to 25% below the EU average: Italy, Lithuania, Cyprus, and Ireland (up to 10% below the EU average), Slovenia, Spain, the Czech Republic, Poland, Portugal, Malta, and Romania were between 11% and 20% below the EU average. Estonia and Greece were between 21% and 23% below the EU average. In Croatia, Latvia, Hungary, and Slovakia, per capita consumption in 2021 was between 27% and 30% below the European Union average**.** *In 2022, the European Commission revised down its economic growth outlook for the European Union due to the war initiated by Russia in Ukraine, which has raised new challenges and pressures on commodity prices, leading to supply disruptions, increasing uncertainty, and exacerbating pre-existing obstacles to economic growth. Hopes of a reduction in these obstacles existed before the outbreak of the war. In this context, the European Commission anticipates a slowdown in economic growth for Romania of up to 2.6% in 2022.*

Figure XI.27 – Volume indices of EIC and GDP per capita (in PPS, 2021) *Source: EUROSTAT*
EIC = Effective individual consumption/capita GDP = Gross domestic product/capita PPS = Standard purchasing power parity



The "GfK Purchasing Power in Europe 2021" study provides a detailed assessment of the distribution of purchasing power in 42 European countries (Table XI.20). Europeans had an average purchasing power per capita of EUR 15,055 in 2021 compared to EUR 13,894 in 2020. However, the net disposable income in the 42 countries studied varies significantly. Liechtenstein, Switzerland, and Luxembourg have the highest net disposable income, while Kosovo, Moldova, and Ukraine have the lowest income. Liechtenstein residents have an average purchasing power over 34 times higher compared to Ukrainians. In 2021, Europeans had approximately EUR 10.2 trillion to spend on food, housing, services, energy costs, private pensions, insurance, holidays, mobility, and consumer purchases, which corresponded to an average purchasing power per capita of EUR 15,055. Thus, per capita purchasing power in 2021 recorded a nominal growth of 1.9% compared to 2020 but varies considerably from one country to another, as seen in Table XI.17, which analyzes the top 10 countries and several Eastern European states. As in the previous year, Liechtenstein once again occupies the first place with a purchasing power 4.3 times higher than the European average. Switzerland, with a per capita purchasing power 2.7 times the European average, and Luxembourg, with a per capita purchasing power 2.3 times the European average, maintain their second and third positions as in 2020. All the other countries in the top 10 also have very high per capita purchasing power, with at least 55% more than the European average. In general, 16 out of the 42 surveyed countries are above the European average, in contrast to 26 countries whose per capita purchasing power is below the European average.

Table XI.20 – Top 10 countries in Europe regarding the distribution of purchasing power, respectively Romania,the year 2021

Top year 2021 (Top year 2020)	Country	No. PEOPLE	Purchasing power per capita in Euros in 2021	Europe purchasing power index*
1 (1)	Liechtenstein	38,747	64,629	429.3
2 (2)	Switzerland	8,606,033	40,739	270.6
3 (3)	Luxembourg	634,730	35,096	233.1
4 (4)	Iceland	368,792	29,510	196.0
5 (5)	Norway	5,391,369	29,252	194.3
6 (6)	Denmark	5,840,045	27,621	183.5
7(7)	Austria	8,901,064	24,232	161.0
8 (8)	Germany	83,166,711	23,637	157.0
9 (10)	Sweden	10,379,295	23,557	156.5
10 (12)	UK	67,081,234	23,438	155.7
14 (14)	Netherlands	17,407,585	21,510	142.9

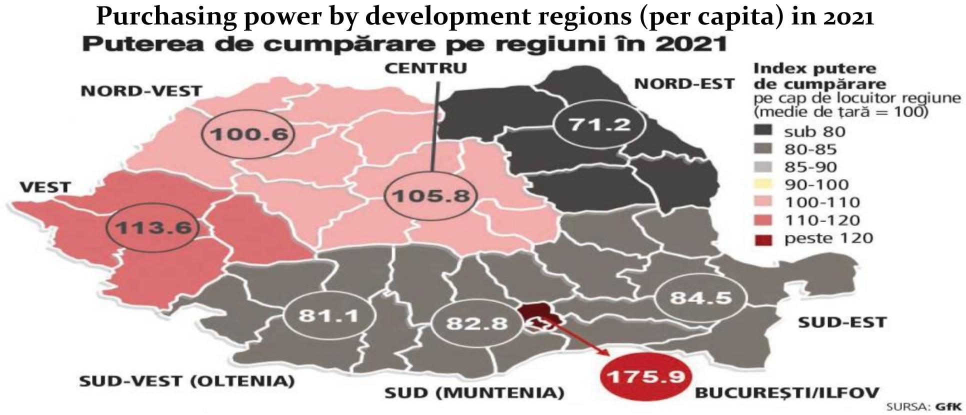
15 (15)	France	64,844,037	20,662	137.2
16 (16)	Italy	59,257,566	17,242	114.5
17 (17)	Spain	47,450,795	14,709	97.7
24 (25)	Czech Republic	10,701,777	10,667	70.9
28 (28)	Poland	38,265,013	8,294	55.1
30 (30)	Hungary	9,730,772	7,643	50.8
31 (31)	**Romania**	**19,328,838**	**7,453**	**49.5**
	EUROPE (total)	678,426,283	15,055	100.0

*Source: GfK Purchasing power Europe 2021 *index per inhabitant: European average = 100*

Romania ranks 31st out of the 42 countries included in the European purchasing power ranking, below Hungary, just like in 2020, with a purchasing power in 2021 that is 50% lower than the European average. *Purchasing power by development regions is presented in Figure XI.28***.** In Romania, the capital, Bucharest, is the leader with an average per capita purchasing power nearly 86% above the national average but 8% below the European average. Bucharesters have an average purchasing power over three times higher compared to residents of the least wealthy county, Vaslui, where net disposable income represents approximately 56% of the national average and just over 28% of the European average. In 2021, there were some changes in the Top 10 Romania regarding the fact that Sibiu and Brasov moved to the fifth and sixth places, while Alba surpassed Prahova and reached the ninth place. All the counties in the Top 10 Romania have significantly higher per capita purchasing power than the national average. Constanta, in 11th place, has a per capita purchasing power at approximately the same level as the national average, while all other counties have below-average purchasing power**.** *For Romania, data regarding purchasing power is available in detail down to the local level for each of the following categories: food products, non-alcoholic beverages, alcoholic beverages, tobacco products, health and hygiene products, clothing, footwear, leather products, furniture, household products, glass, porcelain, appliances, consumer electronics, IT&C, photography, watches, jewelry, books, and stationery, sports equipment, hobbies and leisure, home renovation items*.(*Source: "GfK Purchasing Power Europe 2021" - https://www.stone-ideas.com/90622/gfk-purchasing-power-europe-2021/).*

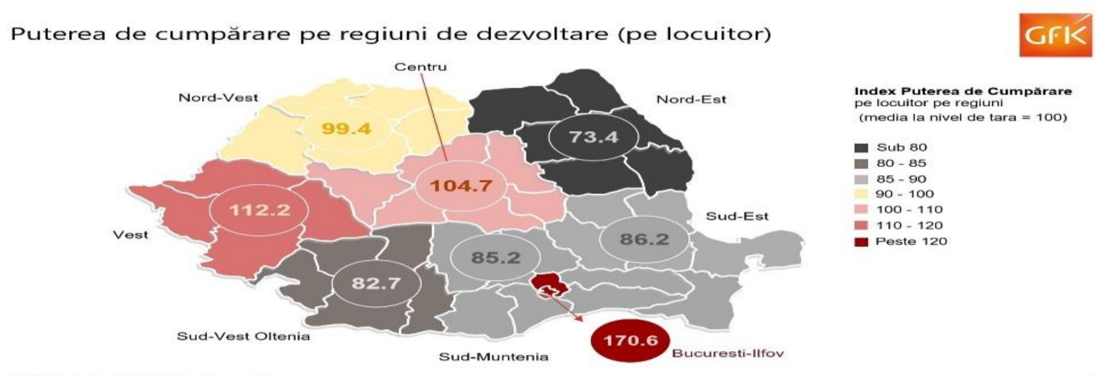
Figure XI.28 - The study *GfK Purchasing Power for Romania, 2021 / 2020*

Purchasing power by development regions (per capita) in 2021



Source:"GfK Purchasing Power Europe 2021"

Purchasing power by development region (per capita) in 2020



Source:"GfK Purchasing Power Europe 2020"

PRESSURES ON THE ENVIRONMENT CAUSED BY CONSUMPTION

Direct and indirect pressures on final domestic consumption are attributed to food and drink, housing use, infrastructure and mobility.

GREENHOUSE GAS EMISSIONS FROM THE RESIDENTIAL SECTOR

RO 10
Indicator code Romania: RO 10 EEA indicator code: CSI 10
TITLE: **THE TREND OF GREENHOUSE GAS EMISSIONS**
DEFINITION: The indicator represents the trends (total and by sector) of greenhouse gas emissions in relation to the member states' obligations to comply with the objectives of the Kyoto protocol. The emissions are presented according to their type and are analyzed according to their potential contribution to amplifying the phenomenon of global warming

Compared to the other sectors of greenhouse gas emissions (GHG) from the National Inventory of Greenhouse Gas Emissions (INEGES), namely Industrial Processes and Product Use (IPPU), Agriculture, Waste, as well as Land Use, Land Use Change and Forestry (LULUCF), the Energy sector represents the largest source of anthropogenic GHG emissions in Romania.

In 2020, the energy sector was responsible for approximately 66.25% of total GHG emissions (109,934.33 kt CO2 equivalent).

According to the IPCC, **the Energy sector** includes several subsectors:
- 1.A Combustion of fuels;
  - 1.A.1 Energy industry
  - 1.A.2 Manufacturing and Construction Industry;
  - 1.A.3. Transport;
  - 1.A.4 Other sectors (commercial/institutional, residential, agriculture/forestry/fisheries);
  - 1.A.5. Other (stationary, mobile);
- 1.B. Fugitive emissions from fuels.

The residential subsector includes the following quantities:
- provision of open flame systems for heating and cooking, including energy consumption for the living space of the owners and administration of economic agents;
- supply to the population to produce heat and hot water in central heating and the quantities of coal received by miners as direct allowances (payments) from mining companies;
- heat supplied to the population for heating and hot water, both from the public and from the car manufacturing sectors.

Between 1989 and 2020, total greenhouse gas emissions (table XI.21) showed a downward trend. In 2007 they increased by approximately 2.35% compared to the previous year. Between 2008 and 2020, greenhouse gas emissions from the residential and commercial sector increased by 9.55%.The share of total GHG emissions of category 1.A.4.b from sub-sector 1.A.4 (figure XI.29 and table XI.22) is approximately 59.34% for the base year 1989 and 69.27 % for the year 2020. The contribution of this category is approximately 8,366.1 kt CO2 equivalent in the year 2020. A main contribution of the use of natural gas as a fuel is observed in this activity category, throughout the time period 1989-2020.

Table XI.21 - Greenhouse gas emissions - subsector Other subsectors

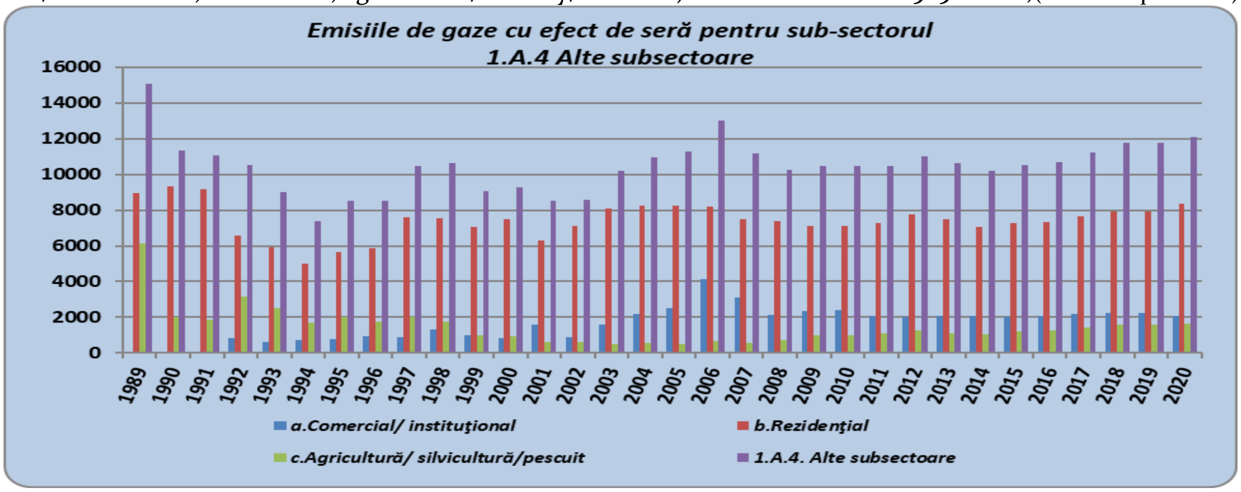
Greenhouse gas emissions for the sub-sector "Other sub-sectors" (kt CO2 equivalent)				
Year	**1.A.4. Other subsectors**			
	a. Commercial/ institutional	**b. Residential**	**c. Agriculture/ forestry/fishing**	**Total**
1989	0	8,953	6,136	15,088

1990	0	9,320	2,006	11,325
1991	0	9,188	1,873	11,061
1992	804	6,565	3,155	10,524
1993	617	5,905	2,492	9,014
1994	696	5,007	1,682	7,385
1995	800	5,652	2,048	8,499
1996	916	5,886	1,742	8,544
1997	891	7,587	1,995	10,472
1998	1,336	7,562	1,756	10,654
1999	976	7,056	1,010	9,041
2000	843	7,508	940	9,291
2001	1,592	6,315	634	8,541
2002	875	7,092	631	8,598
2003	1,600	8,060	528	10,188
2004	2,185	8,231	549	10,965
2005	2,521	8,263	515	11,299
2006	4,149	8,209	668	13,027
2007	3.122	7,476	563	11,161
2008	2,142	7,403	713	10,257
2009	2,348	7,126	1,008	10,482
2010	2,397	7,089	998	10,484
2011	2,091	7,280	1,122	10,493
2012	2,012	7,756	1,267	11,035
2013	2,066	7,471	1.102	10,639
2014	2,062	7,070	1,050	10,182
2015	2,013	7,284	1,215	10,512
2016	2,067	7,341	1,280	10,689
2017	2,174	7,668	1,404	11,246
2018	2,251	7,897	1,609	11,757
2019	2,251	7,946	1,586	11,783
2020	2,090	8,366	1,621	12,077

Source: NEPA

Note: The differences that appeared in the RSM associated with the year 2021 compared to the elements part of the RSM associated with the year 2020 are associated with the implementation of recalculations at the level of the National Inventory of Greenhouse Gas Emissions and the introduction of elements characteristic of the year 2020

Figure XI.29- Evolution of greenhouse gas emissions from the Energy sector – subsector 1.A.4 Other sectors (commercial/institutional, residential, agriculture/forestry/fisheries) for the time series 1989 – 2020,(kt CO2 equivalent)



Source: NEPA - National emissions reported under the Monitoring and Reporting Mechanism of Greenhouse Gas Emissions at the level of the European Union

Table XI.22 - Share of GHG emissions associated with categories at the subsector level "Other sub-sectors"

Year	Share (%)		
	a. Commercial/ institutional	**b. Residential**	**c. Agriculture/forestry/fishing**
1989	0.00	2.92	2.00
1990	0.00	3.73	0.80
1991	0.00	4.46	0.91
1992	0.42	3.45	1.66
1993	0.34	3.27	1.38
1994	0.39	2.82	0.95
1995	0.43	3.06	1.11
1996	0.49	3.13	0.93
1997	0.49	4.20	1.10
1998	0.82	4.62	1.07
1999	0.67	4.85	0.69
2000	0.61	5.40	0.68
2001	1.12	4.43	0.44
2002	0.61	4.92	0.44
2003	1.07	5.38	0.35
2004	1.47	5.56	0.37
2005	1.72	5.62	0.35
2006	2.80	5.53	0.45
2007	2.06	4.92	0.37
2008	1.45	5.00	0.48
2009	1.85	5.61	0.79
2010	1.95	5.77	0.81
2011	1.61	5.62	0.87
2012	1.58	6.08	0.99
2013	1.78	6.44	0.95
2014	1.79	6.13	0.91
2015	1.75	6.34	1.06
2016	1.82	6.47	1.13
2017	1.86	6.57	1.20
2018	1.91	6.72	1.37
2019	1.98	6.97	1.39
2020	1.90	7.61	1.47

Source: NEPA

Note: The differences that appeared in the RSM associated with the year 2021 compared to the elements part of the RSM associated with the year 2020 are associated with the implementation of recalculations at the level of the National Inventory of Greenhouse Gas Emissions and the introduction of elements characteristic of the year 2020

ENERGY CONSUMPTION PER CAPITA

RO 27
Indicator code Romania: RO 27
EEA indicator code: CSI 27
TITLE: FINAL ENERGY CONSUMPTION BY TYPE OF ACTIVITY SECTOR
DEFINITION: The final energy consumption covers the amounts of energy supplied to the final consumer for the most diverse energy purposes. It is calculated as the sum of the final energy consumption from all sectors of activity. They are structured to include industry, transport, households, services and agriculture

Total energy resources available in 2020 registered a decrease of 6.2% compared to those in 2019; compared to the previous year, primary energy production decreased by 8.9%, energy resource imports decreased by 11.9%, gross domestic energy consumption decreased by 2.6%, and final energy consumption decreased of 1.5%. Among primary energy resources, coal and crude oil resources registered significant variations, which decreased by 31.0% and 12.0%, respectively. The production of primary energy in 2020, of 22351 thousand toe, decreased by 2184 thousand toe compared to 2019, against the background of the decrease in production in all types of primary energy carriers. Significant is the decrease in the production of coal (-34.0%) and that of usable natural gas (-10.7%) (*see table XI.23*).

Table XI.23 - Energy resources, in structure and by main types

	Year 2019	Year 2020	Year 2020 versus the year 2019	
	thousand toe	**thousand toe**	**thousand toe (±)**	%
ENERGY RESOURCES - TOTAL	**44116**	**41389**	**-2727**	93.8
- Primary energy production (including recovered energy)	**24535**	**22351**	**-2184**	91.1
- Import	**15910**	**14014**	**-1896**	88.1
- Stock at the beginning of the year	**3671**	**5024**	**+1353**	136.9
• from primary energy resources:				
- coal (excluding coke)	4790	3304	-1486	**69.0**
- crude oil2)	12971	11413	-1558	**88.0**
- usable natural gas3)	11546	11394	-152	**98.7**
- imported coke	501	419	-82	**83.6**
- imported petroleum products	3263	3507	+244	**107.5**
- hydroelectric, wind, solar photovoltaic and nuclear heat	**4960**	**4986**	**+26**	**100.5**

1) Conventional fuel with a calorific value of 10,000 kcal/kg; 2) including gasoline and ethane from the extraction scaffolds; 3) exclusively gasoline and ethane from extraction scaffolds.

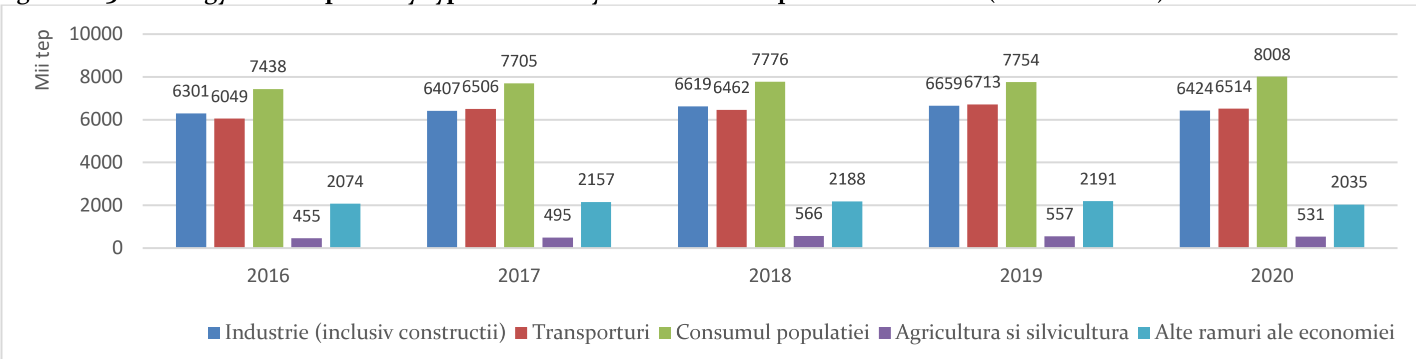
Source: National Institute of Statistics Energy balance 2020, https://insse.ro/cms/ro/tags/balanta-energetica-si-structura-utilajului-energetic

Primary energy resources in 2020 were 40,016 thousand tons of oil equivalent, reduced by 6.3% compared to the previous year.

Energy consumption

From *figure XI.30* regarding energy consumption by types of activity sectors in the period 2016-2020, it can be observed that the largest share is held by energy consumption in the residential sector, followed by industry activities and transport activities.

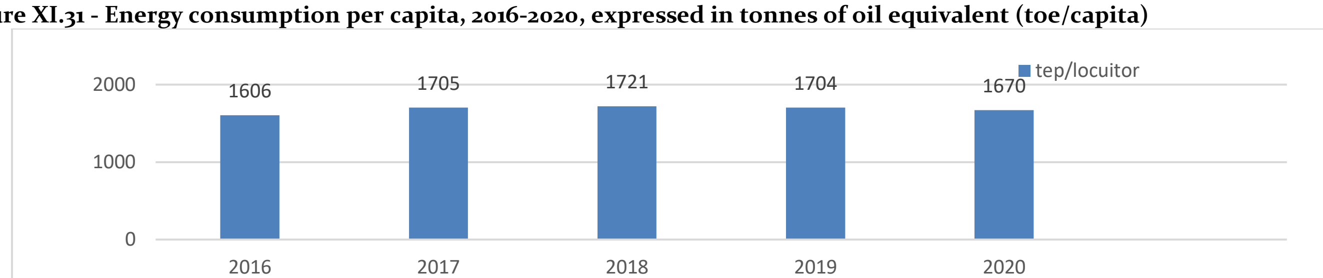
Figure XI.30 - Energy consumption by types of activity sectors for the period 2016 – 2020 (thousands toe)



Source: National Institute of Statistics http://www.insse.ro

Gross domestic energy consumption per inhabitantin 2020 it was 1670 kg oil equivalent, down 2.0% compared to 2019 - see *figure XI.31.*

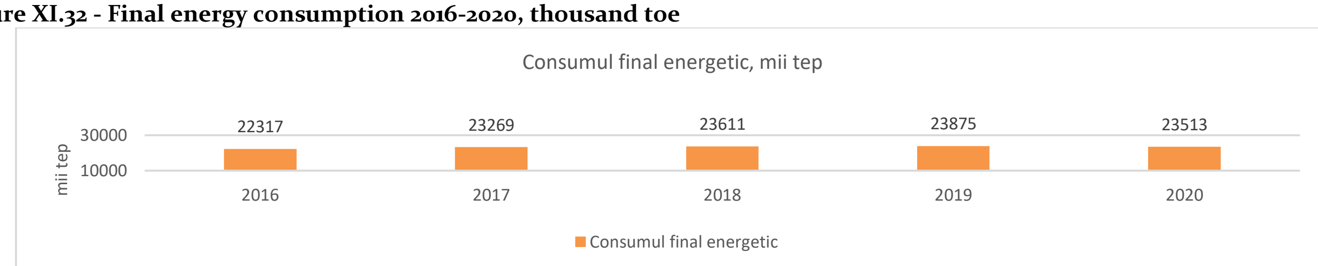
Figure XI.31 - Energy consumption per capita, 2016-2020, expressed in tonnes of oil equivalent (toe/capita)



Source: National Institute of Statistics http://www.insse.ro

Final energy consumption in 2020 decreased by 362 thousand toe (-1.5%) compared to 2019 – see *figure XI.32*.
Final energy consumption recorded decreases in almost all types of economic activities, except construction (+10.1%). The final energy consumption of the population increased compared to the previous year, both quantitatively (+254 thousand toe, representing 3.3%), and as a share in the total final energy consumption (34.0% in 2020, compared to 32.5 % in 2019).

Figure XI.32 - Final energy consumption 2016-2020, thousand toe



Source: National Institute of Statistics http://www.insse.ro

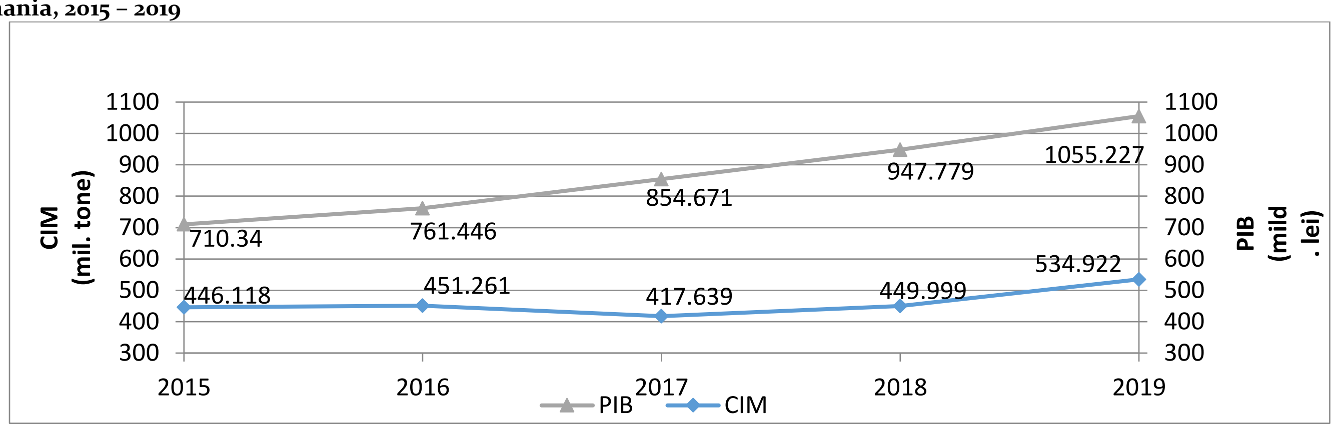
USE OF MATERIALS

Domestic Material Consumption (DMC) - includes the total quantity of materials used directly within the economy (domestic extraction used plus imports). The components of DMC are direct material inputs (DMI) and material exports. It provides the elements for calculating resource use decoupling indicators***. The Domestic Material Consumption indicator*** *(Figure XI.33)* exhibited fluctuating trends from year to year within the 2015-2018 interval and a significant increase in 2019 *(Source: National Institute of Statistics - data for the years 2020 and 2021 have not been processed as of the preparation of this report).*

Note: ***Quarterly Gross Domestic Product*** at market prices (PIBT), the primary macroeconomic aggregate of national accounts, represents the final result of the production activity of resident productive units over a specific period, namely a quarter; ***Material efficiency*** measures the inputs of materials into the economy in relation to GDP; ***Material productivity*** is the inverse of material intensity and is calculated as the ratio between GDP and material consumption.

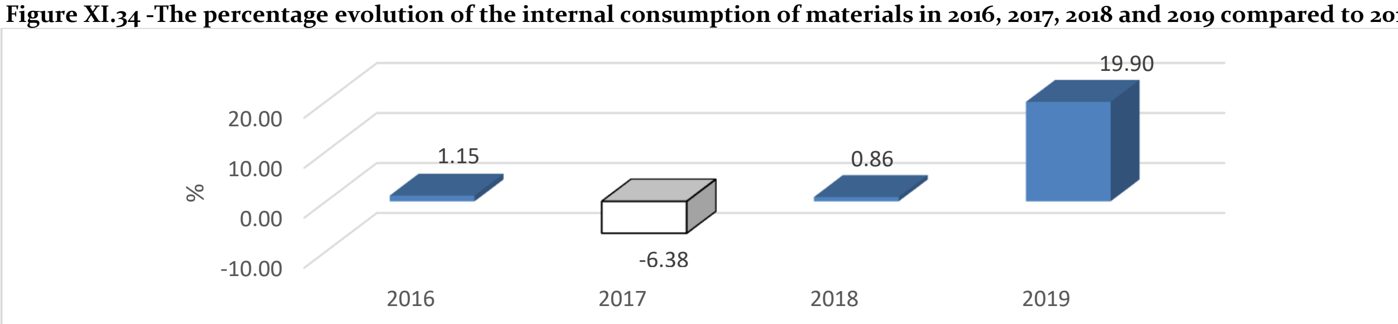
As can be seen from figures XI.33 - XI.35, in the analyzed period, efficiency and material productivity have a slight tendency to decrease, while GDP and domestic consumption of materials have a tendency to increase

Figure XI.33 - Evolution of domestic consumption of materials (million tons) and gross domestic product (billion lei) in Romania, 2015 – 2019



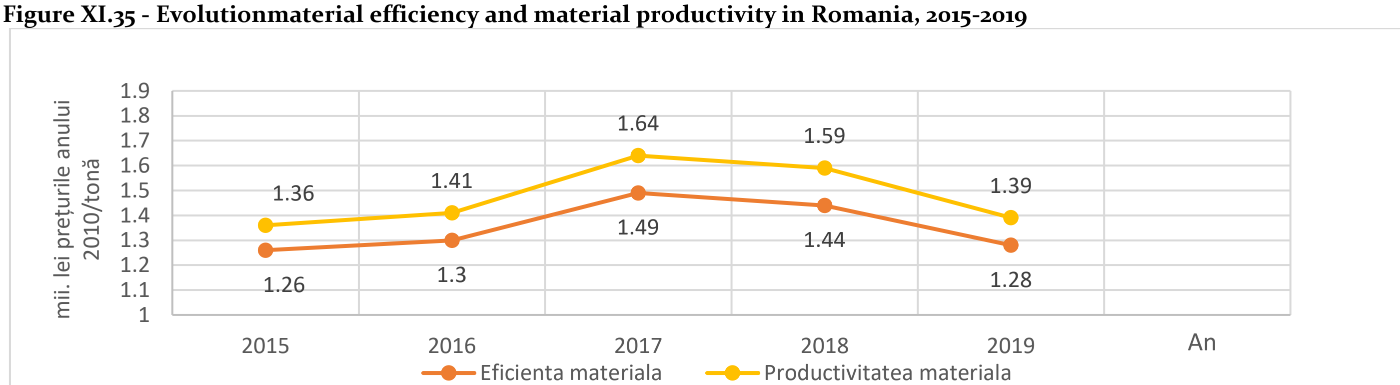
Source: National Institute of Statistics - 2022- data for the years 2020 and 2021 have not been processed as of the preparation of this report

Figure XI.34 -The percentage evolution of the internal consumption of materials in 2016, 2017, 2018 and 2019 compared to 2015



Source: National Institute of Statistics - 2022- data for the years 2020 and 2021 have not been processed as of the preparation of this report

Figure XI.35 - Evolutionmaterial efficiency and material productivity in Romania, 2015-2019



Source: National Institute of Statistics - 2022- data for the years 2020 and 2021 have not been processed as of the preparation of this report

THE GREEN ECONOMY

PUBLIC INSTITUTIONS AND COMMERCIAL COMPANIES REGISTERED IN EMAS

RO 70

Indicator code Romania: RO 70

EEA indicator code: SCP 033

TITLE: **THE NUMBER OF ORGANIZATIONS WITH ENVIRONMENTAL MANAGEMENT SYSTEMS REGISTERED IN ACCORDANCE WITH EMAS AND ISO 14001**

DEFINITION: The indicator presents the total number of organizations and the total number of locations registered within the EMAS environmental management and audit community system and the number of organizations certified in accordance with the international standard for Environmental Management Systems, ISO 14001

The EU Eco-Management and Audit Scheme (EMAS) *is a management tool developed by the European Commission for companies and other organizations to assess, report, and improve their environmental performance.*

EMAS is open to any type of organization willing to improve its environmental performance, and it applies across all economic sectors and services worldwide. With the revision of the annexes to the EMAS Regulation, it is easier for an organization that already complies with an environmental management system like ISO 14001 to transition to EMAS. In addition to the requirements of the ISO 14001 standard, EMAS places more emphasis on: compliance with environmental protection legislation; continuous improvement of environmental performance; external communication, by making the environmental statement available to the public; employee involvement. *EMAS is an operational environmental management system that leads to continuous improvement of environmental performance using the best available techniques at the time, alongside improved economic performance. From an economic perspective, EMAS means resource savings and lower costs, thus reducing expenses related to reactive management strategies such as remediation and penalties for non-compliance with regulations*.

EMAS means:

- *Performance:* EMAS supports organizations in finding the right tools to improve their environmental performance. Participating organizations voluntarily commit to assess and reduce their environmental impact.
- *Credibility:* Third-party verification of information ensures the external and independent nature of the registration process in EMAS.
- *Transparency:* Providing information to the public regarding an organization's environmental performance is an essential aspect of EMAS. Organizations achieve greater transparency both externally through the environmental statement and internally through active employee involvement.

With EMAS, the organization can reduce its environmental impact, enhance legal compliance and employee involvement, and save resources and money. Through the environmental statements that organizations must prepare for EMAS registration, they commit to achieving performance indicators, enabling evaluation during the annual update to determine if the organization has achieved environmental performance.

EMAS offers a number of benefits such as credibility, transparency and reputation through:

- ✓ Continuous improvement of environmental performance, verified and independently validated through the environmental statement, represents an opportunity to stand out, leading to increased business opportunities in markets that prioritize eco-friendly production processes, better relationships with customers, the local community, and regulatory authorities,
- ✓ Improvement of environmental risks and opportunity management, by ensuring full compliance with environmental regulations, reduced risk of penalties for non-compliance with environmental laws, exemption in certain situations from obtaining regulatory permits, as well as access to certain incentives and public contracts,
- ✓ Improved environmental and financial performance, high-quality environmental management, resource efficiency, and cost savings,
- ✓ Enhancing employees' skills and motivation by improving the work environment and fostering increased employee engagement in team development,
- ✓ the EMAS logo which is a good marketing tool.

At European level, organizations show an increased concern for achieving environmental performance by monitoring their own activities, products, or services. The systematic adoption and implementation of a set of environmental management techniques in line with ISO 14001 standards can contribute to optimal results for organizations. Given the *voluntary nature of this system* and its low level of awareness, ***the number of organizations at the national level applying for EMAS***

registration is relatively low. Organizations tend to prefer implementing and certifying an environmental management system according to ISO 14001 rather than registering for EMAS.

To support organizations, the European Commission, in consultation with EU member states and stakeholders from the relevant sectors, has developed two documents for each sector: a concise Sectoral Reference Document (SRD) and a detailed technical report on best environmental management practices ("best practice report"). These documents are for various sectors identified as priorities. ***The sectoral reference documents (SRDs)*** *on best environmental management practices provide guidance and inspiration to organizations in certain sectors on how to improve their environmental performance. Such documents have been developed for the following sectors: retail; tourism; food and beverage industry; automotive manufacturing; electrical and electronic equipment manufacturing; public administration; agriculture; waste management; metal product manufacturing; and telecommunications*. Reports on best practices have been completed for the *construction sector*, and SRDs are in progress. For other sectors, the development of best practice reports and SRDs is still ongoing.

The development of SRDs is led by the Joint Research Centre, the in-house science service of the European Commission. Documents for the *Metal Product Manufacturing and Telecommunications* sectors are available on the website of the Joint Research Centre of the Commission (JRC). The implementation of the best environmental management practices listed in the SRDs or meeting the criteria of excellence identified is not mandatory for organizations registered in EMAS. However, during their environmental audit, organizations must provide evidence of how they used the SRDs when developing and implementing their environmental management system.

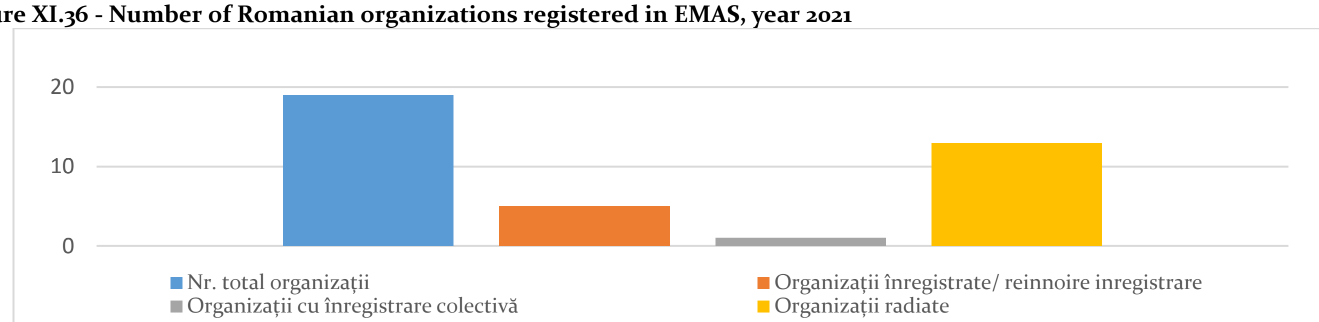
Through the environmental statements that organizations must prepare for EMAS registration, they commit to achieving performance indicators so that during the annual update, the indicators can be evaluated to determine if the organization has achieved environmental performance. Given the voluntary nature of this system and its low level of awareness, the number of organizations at the national level applying for EMAS registration is relatively low. Organizations tend to prefer implementing and certifying an environmental management system according to ISO 14001. *As of the end of 2021, there were 19 registered organizations in the EMAS National Register, but 13 of these have been deregistered, either due to requests from organizations resulting from a lack of funds needed for the verification and validation of the environmental statement, or due to non-compliance with the requirements of EMAS III Regulation. One organization has a collective registration at the EU level (Figure XI.36). The evolution of the number of organizations from Romania registered in EMAS in the 2013 - 2021 interval is presented in Table XI.24*.

Table XI.24 -The evolution of the number of Romanian organizations registered in EMAS, 2013 – 2021

	Year 2013	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	Year 2021
Total no. of organizations from the EMAS Register	9	11	15	15	16	17	17	18	19
Registered organizations / renewal of registration	5	6	10	11	11	7	7	5	5
Organizations with collective registration	1	1	1	1	1	1	1	1	1
Delisted organizations	3	4	4	3	4	9	9	12	13

Source: NEPA

Figure XI.36 - Number of Romanian organizations registered in EMAS, year 2021



Source: NEPA

At European level, through the LIFE program 2021-2027, projects aimed at promoting EMAS are targeted. EMAS and the EU LIFE program: B.R.A.V.E.R, Circular Economy, and Quality of Life subprogram explicitly mention the development, promotion, implementation, and/or harmonization of voluntary instruments and approaches, emphasizing their application by institutions that wish to reduce the environmental impact of their activities, products, and services.

PRODUCTS AND SERVICES LABELED WITH THE EUROPEAN ECOLOGICAL LABEL

RO 71
Indicator code Romania: RO 71
EEA indicator code: SCP
TITLE: **NUMBER OF PRODUCTS AND SERVICES LABELED WITH THE EUROPEAN ECOLOGICAL LABEL**
DEFINITION: The indicator presents the number of products and services for which the European ecological label was granted, year by year. The indicator does not provide information on the share of ecological products in the total range of consumer goods available to consumers

WHAT IS EUROPEAN LABELING?

The European Ecolabel is a *voluntary scheme designed to encourage businesses to market goods/services with a reduced environmental impact, making it easier to identify green products/services and providing clear evidence that the product/service offered meets their requirements and is in accordance with the quality and safety standards defined in the respective certification report. The purpose of introducing the European Ecolabel for products/services is to promote products/services that have a reduced environmental impact throughout their lifecycle compared to other products/services in the same group. The European Ecolabel* ***operates based on criteria for product/service groups*** (*ecological and performance criteria*). For all product/service groups, relevant ecological aspects and corresponding criteria have been identified based on ***comprehensive scientific studies on environmental aspects throughout the lifecycle of these products***. These criteria are validated through consultation within the European Union Ecolabel Committee.

THE SYMBOL OF THE EUROPEAN ECOLOGICAL LABEL

HOW DOES THE EUROPEAN ECOLOGICAL LABELING SCHEME WORK?

The European ecological labeling operates on the basis of certain criteria, on product groups. A company that wants to obtain the European ecological label for one or more of its products must apply to the competent authority - the Ministry of Environment, Water and Forests. Alongside the Ministry of Environment, Waters, and Forests, the EU Ecolabel Commission is established and operates as a non-legal personality advisory body responsible for evaluating the file for granting the EU Ecolabel. Within the National Environmental Protection Agency, the Technical Secretariat of the EU Ecolabel Commission operates. An individual product/service must meet all criteria to be eligible for the European Ecolabel. *Regardless of the product/service group, the environmental requirements pertain to air quality, water quality, soil protection, waste reduction, energy conservation, natural resource management, global warming prevention, ozone layer protection, environmental safety, noise, and biodiversity*. The criteria for granting the European Ecolabel encourage the application of best practices for environmental protection and public health. Products impact the environment during each stage of their lifecycle: Raw materials; Production process; Distribution (including packaging); Use/consumption; Reuse/recycle/disposal. The purpose of the Ecolabel is to limit the use of substances: With adverse effects on water, air, soil; With a high risk of producing carcinogenic, allergic, etc., effects.

CATEGORIES OF PRODUCTS/ SERVICES

The EU Ecolabel covers a wide range of product groups, from major manufacturing sectors to tourist accommodations. Key experts, in consultation with major stakeholders, develop criteria for each product group to reduce the main environmental impacts throughout the product's entire lifecycle. Since the lifecycle of each product and service is different, the criteria are tailored to address the unique characteristics of each product type. The environmental criteria for a product group are valid for a period ranging from 3 to 5 years. After this period, the criteria are revised to reflect technological innovation, such as advancements in materials, production processes, emission reductions, and market changes. The criteria for each product group can be found on the Ecolabel website: https://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html.

The European ecological label covers 24 groups of products from different sectors of activity and services, respectively:

- **HOUSEHOLD AND PROFESSIONAL CLEANING PRODUCTS AND SERVICES: Dishwasher detergents; Manual**

dishwashing detergents; Industrial and institutional dishwasher detergents; Laundry detergents; Industrial and institutional laundry detergents; Hard surface cleaning detergents.

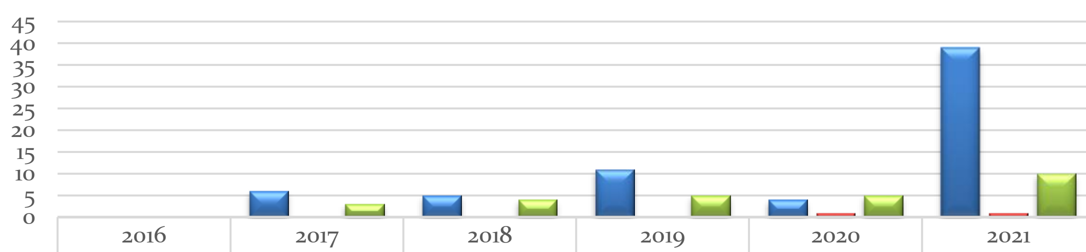
- **CLOTHING AND FOOTWEAR: Footwear; Textile products.**
- **COVER PRODUCTS: Products with hard coating (Resistant clothing); Flooring based on wood, cork and bamboo.**
- **INTERIOR AND EXTERIOR PAINTS AND VARNISHES**
- **ELECTRONIC DISPLAYS**
- **FURNITURE AND MATTRESSES: Furniture; Bed mattresses.**
- **PRODUCTS FOR THE GARDEN: Culture substrates, soil improvers and mulches.**
- **PAPER PRODUCTS: Graphic paper, tissue paper and tissue paper products; Printed paper, paper stationery and paper bags.**
- **PERSONAL AND PET CARE PRODUCTS: Cosmetics; Animal care products; Absorbent hygiene products.**
- **SERVICES: Tourist accommodation services; Interior cleaning services**
- **LUBRICANTS**

The European Ecolabel demonstrates that sustainable production is fully compatible with economic growth, creating more job opportunities, and that investing in compliance with the European Ecolabel is a business opportunity. *In national legislation, Government Decision no. 661/2011 is applicable concerning measures to ensure the national implementation of the provisions of Regulation (EC) No. 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel*.

ADVANTAGES OF THE EUROPEAN ECOLABEL: It has a European dimension; It covers the entire EU market; Promotes the design, marketing, and use of products with a reduced impact on the environment and human health; Certifies the quality of product use and its environmental quality; It is selective; Through its level of stringency, the criteria for the European Ecolabel ensure selectivity of products; Substantially enhances the market potential for the competitively labeled product; It is a collective mark for product quality certification; Improves the image of the manufacturer.

At European Union level, the decrease in the number of licenses granted over the past few years is mainly due to the implementation of new, more stringent criteria. Companies wishing to use the EU Ecolabel must demonstrate compliance with these criteria. However, for the year 2021, statistics show that the number of European Ecolabels awarded for products/services and the number of licenses increased gradually throughout the year for several product groups, primarily detergents, paints and varnishes, furniture, and tourist accommodation services. This situation is also observed in Romania for product groups such as detergents, rinse-off cosmetic products, and absorbent paper products.
The indicator presents the number of products and services labeled with the European Ecolabel, according to the minutes of the meetings of the EU Ecolabel Commission, and licenses granted during the period 2016 – 2021 (Figure XI.37). **In 2021**, during the meetings of the EU Ecolabel Commission, the EU Ecolabel was granted for 39 products (5 cosmetic products, 1 cleaning product - window detergent, 33 absorbent paper products - toilet paper, table napkins, paper towels). For these products/product groups, 9 licenses were granted by the Ministry of Environment, Waters, and Forests. Additionally, in 2021, a license was granted for a tourist accommodation establishment.

Figure XI.37 - The evolution of the number of products and services labeled with the European Ecolabel and the number of licenses granted in Romania, during the period 2016 – 2021



	2016	2017	2018	2019	2020	2021
Produse etichetate	0	6	5	11	4	39
Servicii etichetate	0	0	0	0	1	1
Licente acordate	0	3	4	5	5	10

Source: MEWF and NEPA

ENVIRONMENTAL EXPENSES AND TAXES

Environmental protection has become one of the priority concerns of the international community in recent years. The reason is that environmental degradation, as a result of a complex of factors including economic development, has caused and continues to cause huge losses to all countries and essentially influence the quality of life. At the European Union level, all environmental protection activities are integrated into the concept of sustainable development. Thus, ***the National Strategy for the Sustainable Development of Romania 2030 (SNDDR), revised in 2018***, represents an effective orientation tool for directing policies in the field of environmental taxation and supporting priority projects for environmental protection.

Expenditures for environmental protection

The situation with expenses for environmental protection in the period 2010 – 2021 is presented in *table XI.25 and figure XI.38*.

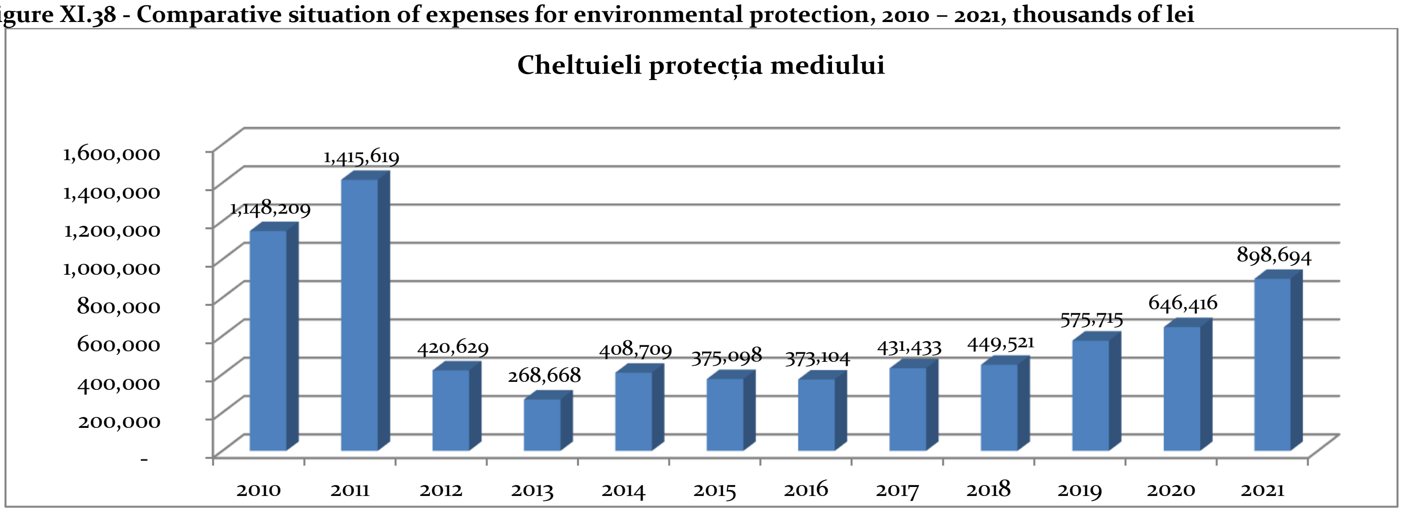
Table XI.25 - The situation of expenses for environmental protection 2010 – 2021

- thousands of lei–

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Environmental protection expenses	1,148,209	1,415,619	420,629	268,668	408,709	375,098	373.104	431,433	438,172	575,715	646,416	898,694

Source: EFA, 2022

Figure XI.38 - Comparative situation of expenses for environmental protection, 2010 – 2021, thousands of lei



Source: EFA, 2022

Financial support for environmental protection

The use of the Environmental Fund in the period 2010 – 2021 is presented in *table XI.26 and figures XI.39 a and XI.39 b*.

Table XI. 26 - Use of the environmental fund in the period 2010-2021

- thousands of lei -

No. crt	Program name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1	a) Reducing the impact on the atmosphere, water, soil, including air quality monitoring	33296	24825	907	0	0	0	0	0	2128	15797	12777	0
2	c) Waste management	42669	23141	2335	0	0	0	0	0	0	0	2694	29038

3	d) Protection of water resources, integrated water supply systems, treatment stations, sewerage and purification stations	16606	5780	33047	89022	170023	155248	161246	174454	91947	48411	19693	21626
4	f) Conservation of biodiversity and management of protected natural areas	864	423	0	149	64	166	0	0	0	0	0	0
5	g) Afforestation of degraded lands, ecological reconstruction and sustainable management of forests	10974	20402	12871	22899	21155	7941	4033	16908	9506	5447	4183	5982
6	h) Education and public awareness regarding environmental protection	4751	13812	9367	3197	290	116	0	0	0	0	0	0
7	i) Increasing energy production from renewable sources	64110	171975	56259	9629	20546	0	0	8746	5539	0	0	0
No. crt	**Program name**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
8	m) Carrying out monitoring, studies and research in the field of environmental protection and climate change regarding tasks derived from international agreements, European directives or other national or international regulations, as well as research - development in the field of climate change	0	426	0	1738	4122	0	448	1468	1522	2438	12294	5131
9	o) Closing the settling ponds in the mining sector	0	0	0	4117	13951	4039	656	0	0	0	0	0
10	p) Carrying out works aimed at preventing, removing and/or reducing the effects of extreme weather phenomena	267738	412594	42025	0	1053	0	0	0	0	0	0	0

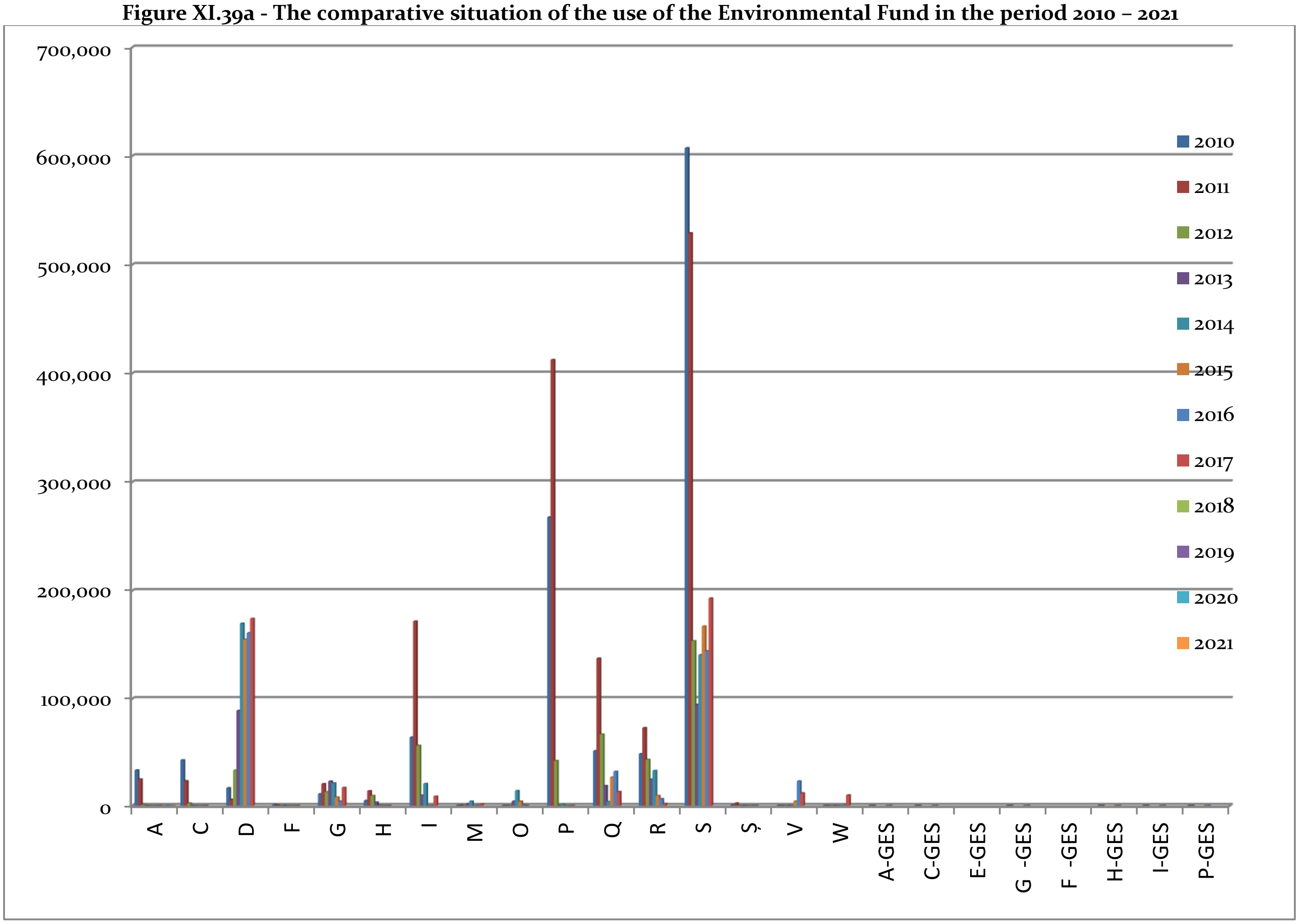
11	q) Installation of heating systems that use renewable energy, including the replacement or addition of classic heating systems	51229	137889	66810	18661	3695	26633	31980	13065	37672	302	26	344
12	r) The national program for improving the quality of the environment by creating green spaces in the urban environment	48554	72901	43120	24584	32784	9380	6403	1927	1223	0	0	30
13	s) Program to stimulate the renewal of the national car park	607418	529135	153888	94672	141014	167395	144645	193152	261625	414977	281437	405933
14	ș) Program to stimulate the renewal of the national park of tractors and self-propelled agricultural machines	802	2316	0	0	0	0	0	0	0	0	0	0
15	v) The program for the development and optimization of the National Air Quality Monitoring network	0	0	0	0	0	4180	22943	11823	10021	7469	13761	13281
No. crt	Program name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
16	w) Reduction of greenhouse gas emissions in transport, by promoting non-polluting road transport vehicles from an energy point of view	0	0	0	0	12	0	750	9890	16989	194	0	492
17	a) The program on improving air quality and reducing greenhouse gas emissions, using less polluting vehicles in local public transport of people - buses and electric/CNG trolleybuses--Annex 2b BVC	0	0	0	0	0	0	0	0	0	0	210 005	75000

18	c) The program regarding the reduction of greenhouse gas emissions in transport, by promoting the infrastructure for non-polluting road transport vehicles from an energy point of view: recharging stations for electric vehicles in county seat municipalities - Annex 2b BVC	0	0	0	0	0	0	0	0	0	0	41	1488
19	The program regarding the installation of photovoltaic panel systems for the production of electricity, in order to cover the consumption requirement and deliver the surplus to the national grid	-	-	-	-	-	-	-	-	-	-	-	17287
20	F -GHG f) The program regarding the reduction of greenhouse gas emissions in transport, by promoting non-polluting and energy-efficient road transport vehicles, 2017-2019 – lit. w) from art. 13, para. (1) from GEO no. 196/2005 regarding the Environmental Fund - Annex 2b BVC	0	0	0	0	0	0	0	0	11349	80680	69222	216993
21	f) The program regarding the installation of photovoltaic systems for isolated households not connected to the electricity distribution network	-	-	-	-	-	-	-	-	-	-	-	4266

22	h) The multi-annual investment financing program for the modernization, rehabilitation, re-technological and expansion or establishment of centralized thermal energy supply systems of localities - Annex 2b BVC	0	0	0	0	0	0	0	0	0	0	20 283	42756
2. 3	i) Program regarding public street lighting (LED lamps)	0	0	0	0	0	0	0	0	0	0	0	19093
24	p) The national program to replace used electrical and electronic equipment with more energy-efficient ones	0	0	0	0	0	0	0	0	0	0	0	39955
TOTAL		1149011	1415619	420629	268668	408709	375098	373104	431433	438172	575715	646416	898695

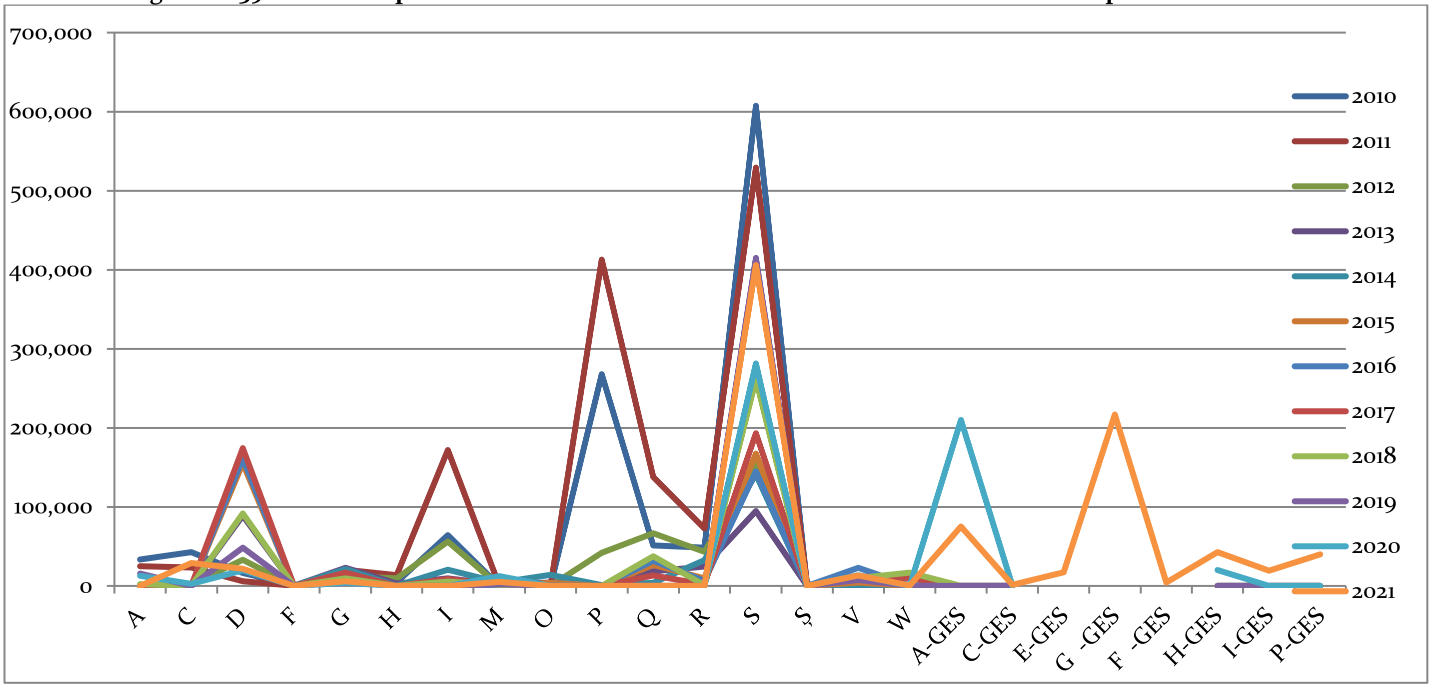
Source: EFA, 2022

Figure XI.39a - The comparative situation of the use of the Environmental Fund in the period 2010 – 2021



Source: EFA, 2022

Figure XI.39b - The comparative situation of the use of the Environmental Fund in the period 2010 – 2021



Source: EFA, 2022

Revenues from environmental taxes

The situation of receipts to the budget of the Environmental Fund in the period 2013 – 2020 is presented in *table XI.27 and figures XI.40 and XI.41.*

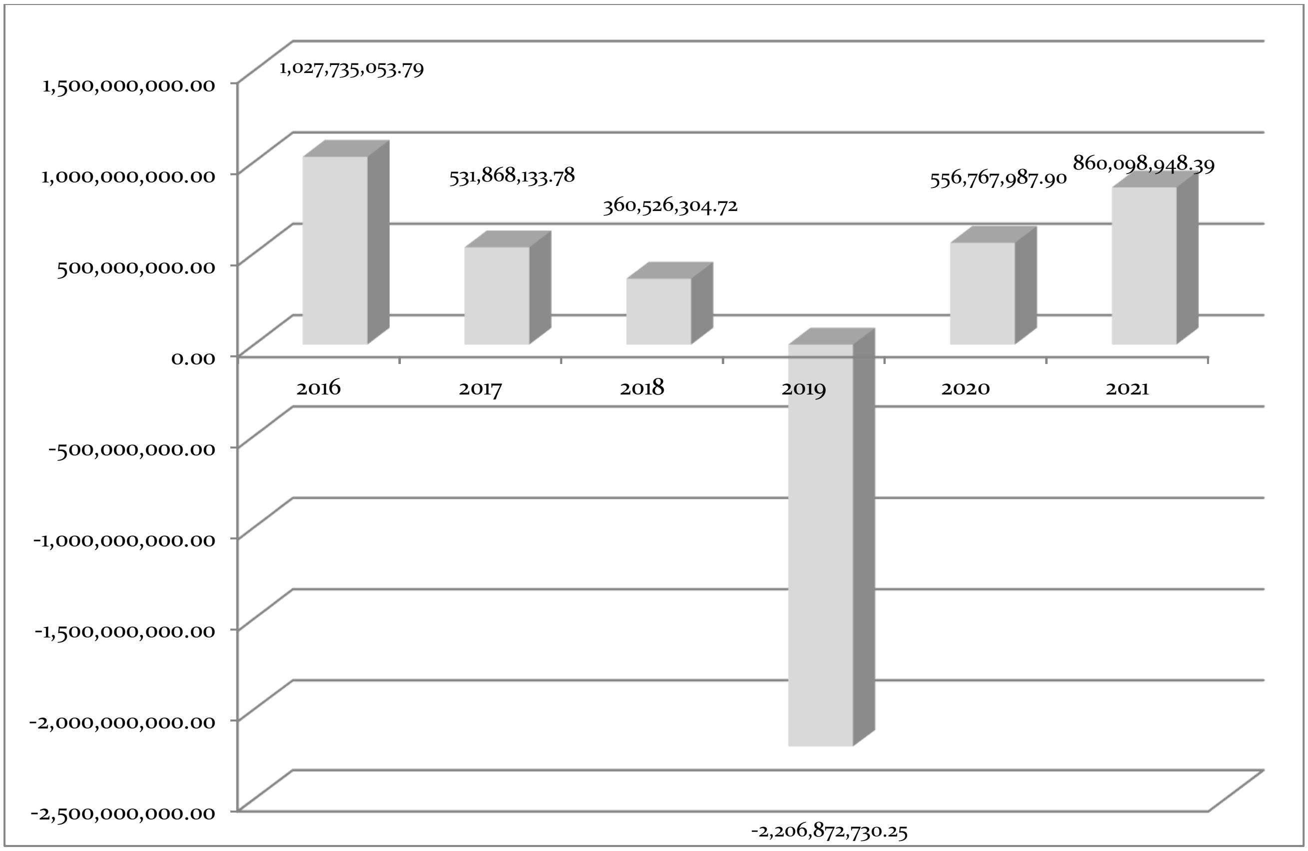
Table XI.27 - The situation of receipts to the budget of the Environmental Fund in the period 2013 – 2021

	Receipts to the budget of the Environmental Fund, from which:	1) pollution tax for motor vehicles/environmental stamp for motor vehicles	2) sources of income according to GEO 196/2005	3) interests	4) other amounts	5) Income from the sale of greenhouse gas emission certificates
2013	381 952 594.33	162 049 134.18	122 543 570.16	20 698 136.27	76 661 753.72	0.00
2014	844 262 422.45	589 493 316.09	140 910 377.45	10 693 158.23	103 165 570.68	0.00
2015	835 591 747.81	557 031 837.10	129 353 999.68	4 330 759.62	144 875 151.41	0.00
2016	1 027 735 053.79	522 203 567.89	547 352 769.26	5 715 232.10	-47 536 515.46	0.00
2017	531 868 133.78	31 279.44	326 945 581.32	6 775 709.11	198 115 563.91	0.00
2018	360 526 304.72	-1 251 190 080.52	305 632 380.56	5 349 154.93	49 544 769.23	679 000 000.00
2019	-2 206 872 730.25	-2 903 042 489.89[1]	389 025 361.61	2 937 316.94	30 510 131.09	273 696 950.00
2020	556 767 987.90	-5 358 400.99	458 058 202.59	2 989 186.61	101 078 999.69	0.00
2021	860 098 948.39	44 078 020.93	728 940 338.84	321 500.49	86 759 088.13	0.00

Source: EFA, 2022

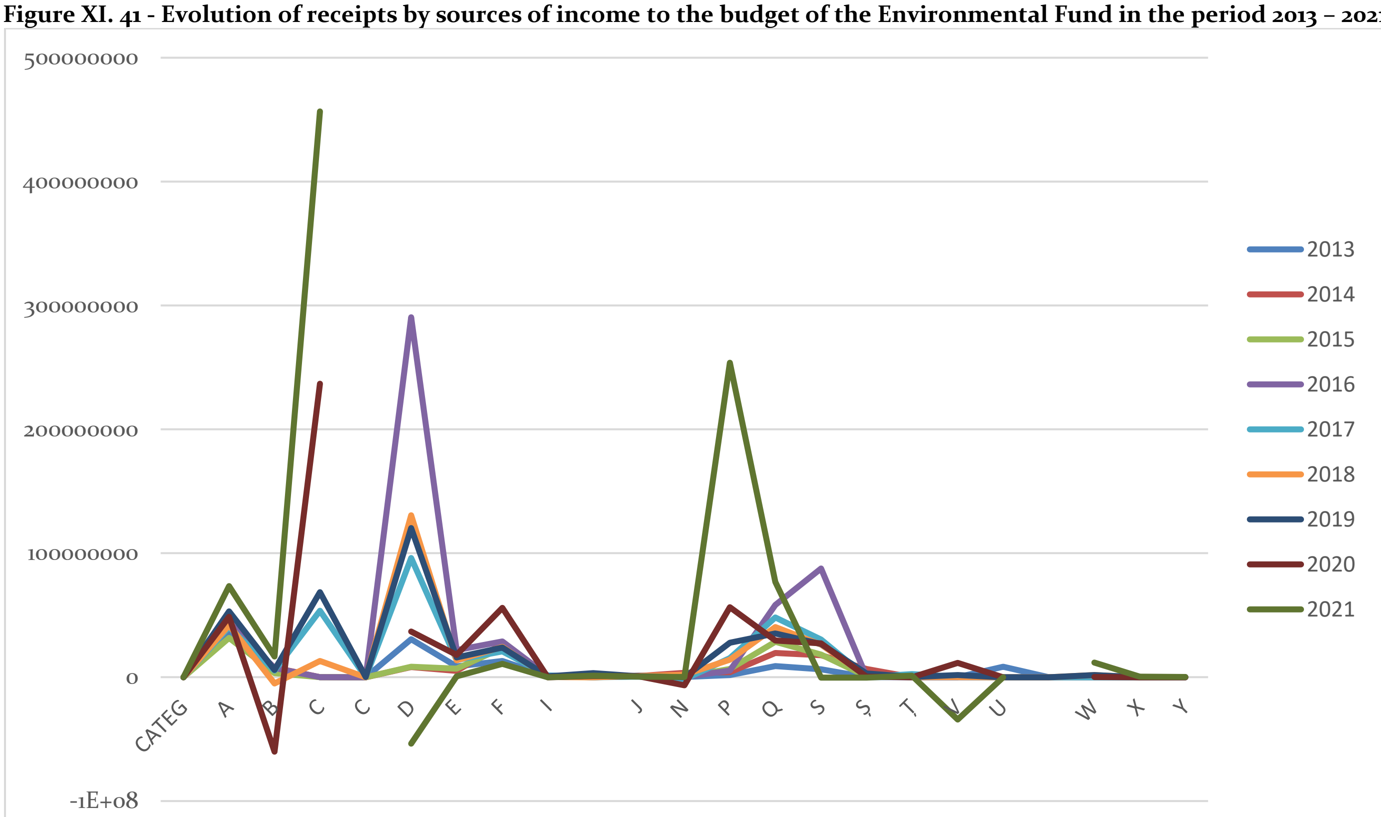
Figure XI. 40 - Evolution of receipts to the Environmental Fund budget in the period 2016 – 2021

[1] The amount of **-2,903,042,489.89 Romanian Lei** represents the value of *refunds for the special tax on cars and vehicles, pollution tax for vehicles, pollution emission tax for vehicles, and environmental stamp duty for vehicles, as provided by Emergency Ordinance no. 52/2017 regarding the reimbursement of amounts representing the special tax, pollution tax for vehicles, pollution emission tax for vehicles, and environmental stamp duty for vehicles*, approved through Government Decision no. 166/29.03.2019, GD no. 335/30.05.2019, GD no. 415/21.06.2019, and GD 458/08.07.2019.

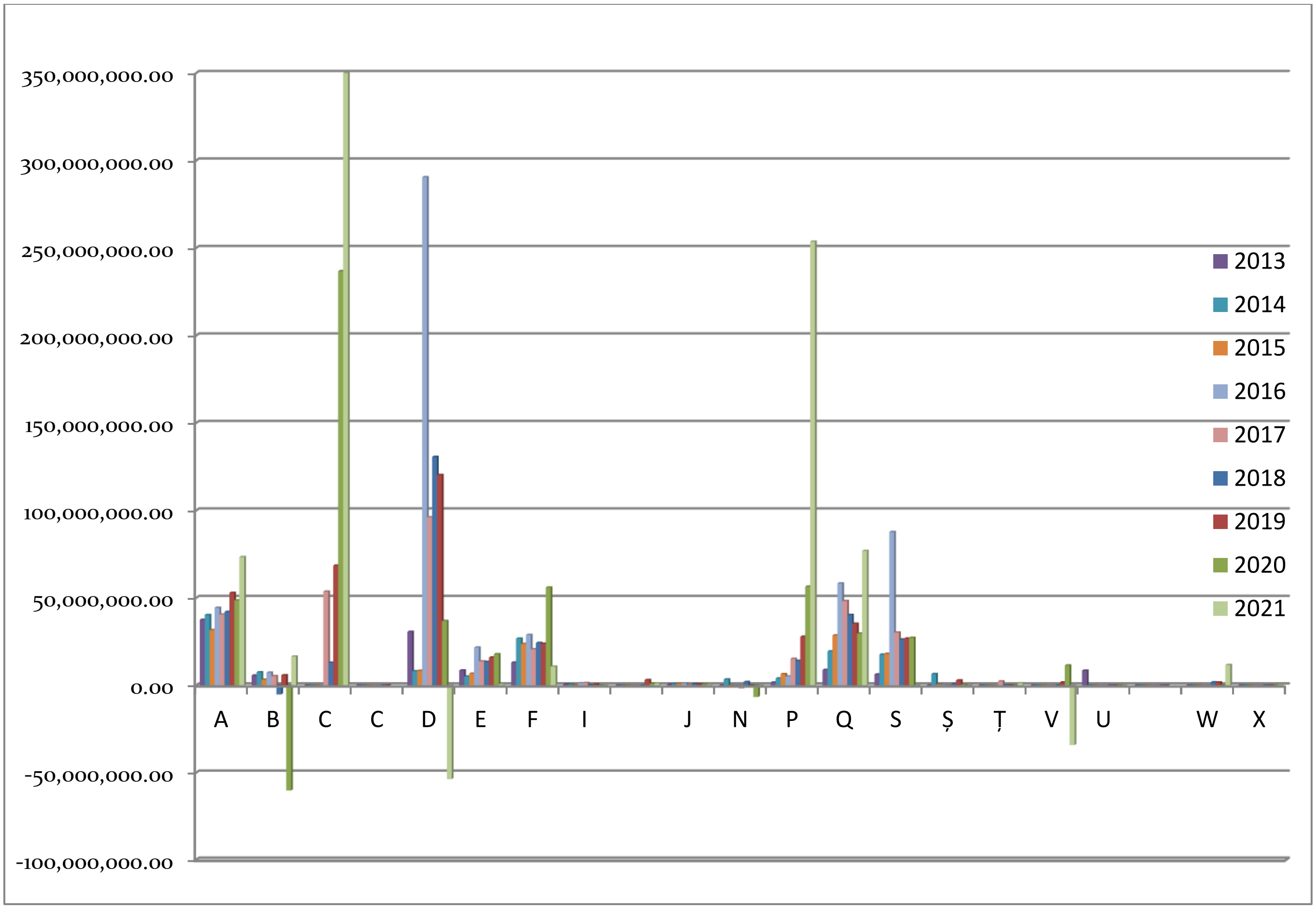


Source: EFA, 2022

Figure XI. 41 - Evolution of receipts by sources of income to the budget of the Environmental Fund in the period 2013 – 2021



Source: EFA, 2022



Source: EFA, 2022

Table XI.28 - Evolution of receipts by revenue sources, according to GEO 196/2005, to the budget of the Environmental Fund in the period 2013 – 2021

Crt No.	CATEGORY	2013	2014	2015	2016	2017	2018	2019	2020	2021	Sources of income according to GEO 196/2005
1	A	37 549 690.56	40 303 897.69	31 715 747.09	44 412 609.36	40 558 630.28	42 102 942.50	52 981 640.75	48 683 752.34	73 446 378.24	a contribution of 3% of the revenues obtained from the sale of ferrous and non-ferrous metal waste, including goods intended for dismantling, obtained by the waste generator, respectively the owner of the goods intended for dismantling, natural or legal person.
2	B	5 728 125.01	7 568 711.80	3 341 455.13	7 365 091.30	5 378 752.44	-5 097 414.19	5 873 329.93	-60 148 704.19	16 565 808.44	taxes for pollutant emissions into the atmosphere, owed by economic operators owning stationary sources whose use affects environmental factors;
3	C	0.00	0.00	0.00	0.00	53 701 466.77	13 096 641.26	68 536 681.77	236 860 131.92	456 650 866.54	the fees collected from the owners or, as the case may be, administrators of warehouses for inert and non-hazardous waste entrusted by third parties for final disposal or storage
4	C	9 691.50	3 006.00	1 232.00	8 893.68	6 315.95	1 044.80	150 128.96			the fees collected from the economic operators who use new lands for the storage of recyclable waste;
5	D	30 686 405.58	8 178 078.20	8 452 966.81	290 507 438.82	96 181 479.31	130 672 945.96	120 345 227.49	36 902 401.50	-53 670 240.34	a contribution of 2 lei/kg, due by economic operators who introduce retail packaging and packaged goods on the national market, for the difference between the quantities of packaging waste corresponding to the objectives of recovery or incineration in incineration facilities with energy recovery and recovery through recycling
6	E	8 638 163.18	5 129 703.79	6 783 569.40	21 721 788.10	13 786 669.18	13 557 160.41	16 024 930.14	17 924 573.73	716 015.67	a contribution of 2% of the value of substances classified by normative acts as dangerous for the environment, introduced on the national market by economic operators
7	F	13 132 813.58	26 814 613.58	23 765 386.93	28 910 828.41	20 711 850.96	24 361 323.10	23 899 151.12	55 993 936.90	10 849 677.81	a contribution of 2% of the income obtained from the sale of wood mass and/or wood materials obtained by the administrator, respectively the owner of the forest, with the exception of firewood, ornamental trees and shrubs, Christmas trees, wicker and saplings
8	I	665 459.29	561 854.00	267 101.00	1 314 064.69	1 475 372.30	248 874.39	672 703.47	0.00	0.00	Available from 1 leu/kg tire
9		0.00	0.00	0.00	0.00	0.00	198.00	3 160 986.24	1 020 996.83	1 174 886.39	a contribution of 2 lei/kg tyre, owed by economic operators who introduce new and/or used tires intended for reuse on the national market, for the difference between the quantities of tires corresponding to the annual management obligations stipulated in the legislation in force and the quantities actually managed

10	J	620 032.10	908 547.42	1 069 839.89	1 230 472.47	363 687.67	924 383.80	792 362.50	640 291.64	457 749.41	a contribution of 3% of the amount collected annually for the management of hunting funds, paid by the managers of hunting funds;
11	N	55 128.13	3 479 786.67	27 419.87	126 321.52	-1 738 935.90	2 033 275.66	-84 446.22	-6 554 458.98	69 176.57	the amount of fees for issuing environmental notices, agreements and authorizations
12	p	1 742 262.98	4 098 027.85	6 537 458.97	5 195 551.11	15 267 014.35	14 147 426.88	27 906 493.78	56 541 005.76	253 716 931.89	a contribution of 50 lei/tonne, owed by the administrative-territorial units or, as the case may be, the administrative-territorial subdivisions of the municipalities, in case of failure to meet the annual objective of reducing by 15% the quantities of waste eliminated by storage from municipal and assimilated waste, collected through the public sanitation service, payment being made for the difference between the amount corresponding to the annual reduction objective and the amount actually entrusted for recovery or incineration in incineration facilities with energy recovery;
13	Q	8 913 614.01	19 566 838.41	28 662 204.62	58 374 014.13	48 312 968.41	40 372 062.94	35 325 312.25	29 716 992.70	76 948 622.49	the ecotax, in the amount of 0.15 lei/piece, applied to bags and shopping bags, with an integrated or applied handle, manufactured from materials obtained from non-renewable resources defined according to Government Emergency Ordinance no. 195/2005 on environmental protection, approved with amendments and additions by Law no. 265/2006, with subsequent amendments and additions, collected from economic operators who introduce such retail packaging on the national market.
14	S	6 317 259.41	17 729 062.04	18 179 922.97	87 740 902.40	30 284 413.10	26 316 489.81	26 857 571.10	27 282 649.45	-411 367.81	a tax of 2 lei/l, applied to oils subject to Government Decision no. 235/2007 on the management of used oils, due starting from January 1, 2011 by the economic operators who introduce such products on the national market, for the difference between the quantities corresponding to the annual management obligations and the quantities of used oils managed
15	Ş	0.00	6 568 250.00	549 695.00	444 793.27	208 364.63	873 127.11	2 970 664.37	490 142.54	-254 831.83	the amounts collected as a result of the application of the penalty of 100 euros, equivalent in lei at the leu/euro exchange rate of the BNR valid on May 1 of the respective year, for each ton of equivalent carbon dioxide emitted, paid by the operator or operators of aircraft that did not return the greenhouse gas emissions certificates corresponding to the greenhouse gas emissions generated in the previous year, a penalty that increases annually in accordance with the European consumer price index, according to the legal provisions in force

16	Ț	0.00	0.00	0.00	0.00	2 401 311.13	154 462.93	65 574.74	5 561.51	1 308 304.88	sums representing the counter value of unpurchased green certificates, paid according to the provisions of art. 12 ali 2 Law n. 220/2008 for the establishment of the promotion system for production from renewable energy sources, republished, with subsequent amendments and additions
17	V	0.00	0.00	0.00	0.00	46 220.74	49 086.87	1 748 238.52	11 460 460.31	-34 078 031.67	a contribution of 2 lei/kg, owed by the authorized economic operators for taking over the annual obligations for the recovery of packaging waste, respectively for the management of used tires, the payment being made for the difference between the amounts of waste corresponding to the annual objectives, established by the legislation in force , and the amounts actually capitalized, respectively managed on behalf of the clients for whom they took over the obligations
18	U	8 484 924.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	the counter value in lei of the amount obtained following the auctioning, in accordance with the law, of the emission certificates remaining unused from the reserve for joint implementation type projects for Romania from the period 2008-2012 within the scheme of trading gas emission certificates with greenhouse effect, according to the provisions of GEO 115/2011, approved by Law 163/2012 with subsequent amendments and additions
19		0.00	0.00	0.00	0.00	0.00	2 802.04	*19 661.35*			*Contribution of pesticides*
20	W	0.00	0.00	0.00	0.00	0.00	*1 814 634.13*	*1 774 923.35*	209 095.82	11 734 782.23	*a contribution in the amount provided in annex no. 5, due to economic operators who introduce electrical and electronic equipment on the national market*
21	X	0.00	0.00	0.00	0.00	0.00	*1 110.16*	*4 226.00*	8 375.98	312 619.22	*a contribution of 4 lei/kg of portable batteries and accumulators, due by economic operators who introduce portable batteries and accumulators on the national market*

22	Y	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	162 078.86	*y) a contribution in the amount provided in annex no. 5, due by the authorized economic operators for taking over the annual obligations for the collection of electrical and electronic equipment waste, respectively a contribution of 4 lei/kg of portable batteries and accumulators, owed by the authorized economic operators for taking over the annual obligations for the collection of battery waste and portable batteries*
TOTAL SOURCES OF INCOME		122 543 570.16	140 910 377.45	129 353 999.68	547 352 769.26	326 945 581.32	305 632 578.56	389 025 361.61	457 037 205.76	815 699 426.97	

Source: EFA, 2022

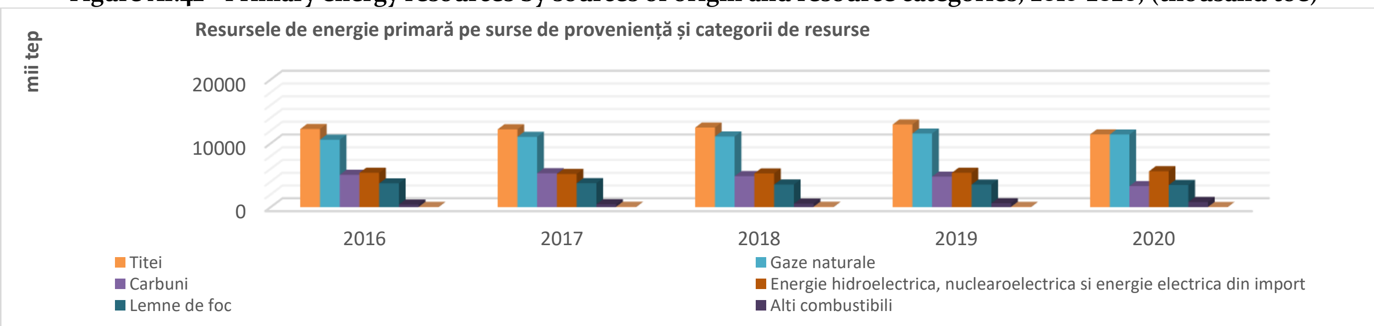
Energy

RO 29
Indicator code Romania: RO 29
EEA indicator code: CSI 29
TITLE: **PRIMARY ENERGY CONSUMPTION BY TYPE OF FUEL**
DEFINITION: The amount of energy required to satisfy gross domestic energy consumption, from solid fuels, crude oil, natural gas, firewood, nuclear and renewable sources and a smaller component of "other" sources (industrial waste and net electricity imports), of a country.

Primary energy resources and consumption by fuel type

The primary energy resources in the year 2020 amounted to 40,016 thousand metric tons of oil equivalent (ktoe), a decrease of 2,685 thousand toe (-6.7%) compared to the year 2019. *Figure XI.42* presents the evolution of primary energy resources for the following types of fuels: coal, natural gas, oil, firewood (including biomass), other fuels, energy, and energy from non-conventional sources. The predominant share of primary energy production is observed from oil and natural gas.

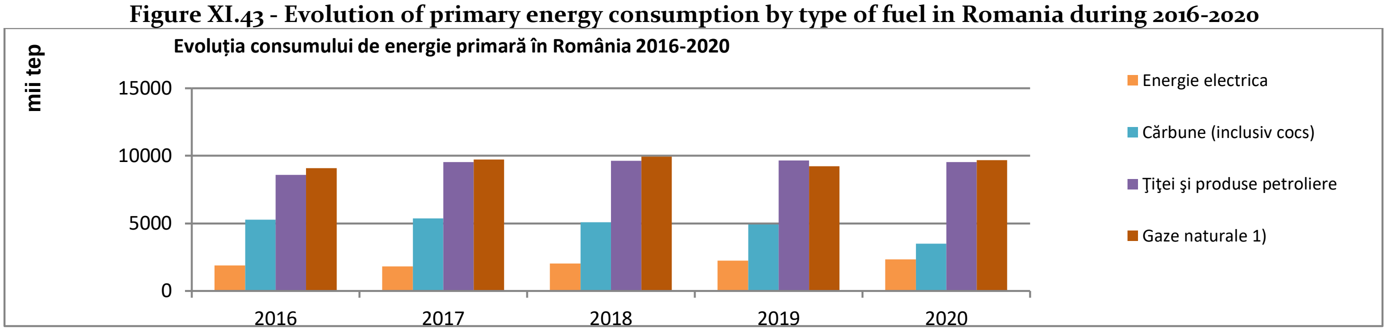
Figure XI.42 - Primary energy resources by sources of origin and resource categories, 2016-2020, (thousand toe)



Source :National Institute of Statistics -http://www.insse.ro *(TEMPO_IND107A_14_8_2021)*

Primary energy production in 2020, of 22351 thousand toe, decreased by 2184 thousand toe compared to 2019, against the background of the decrease in production of all types of primary energy carriers. Significant is the decrease in the production of coal (-34.0%) and that of usable natural gas (-10.7%). **The total gross domestic consumption** of primary energy was 32,171 thousand toe in 2020, down 2.5% compared to 2019 (-84 thousand toe) - *see figure XI.43*. (Source: *National Institute of Statistics* [http://www.insse.ro).](http://www.insse.ro)

Figure XI.43 - Evolution of primary energy consumption by type of fuel in Romania during 2016-2020



Source: National Institute of Statistics - http://www.insse.ro

y types of energy carriers, gross inland consumption increased for usable natural gas (+453 thousand toe) and electricity (+95 thousand toe), but decreased for coal (including coke) by 1,419 thousand toe and oil and petroleum products by (-116 thousand toe).

In the current context of challenges related to ensuring energy resources and the need to reduce CO2 emissions, as well as environmental protection, investments in energy efficiency, renewable energy, recovery of secondary energy resources, and *addressing energy poverty are a strategic priority for Romania.* In 2021, the production of primary energy decreased compared to the previous year (-2.1%), while imports increased (+9.0%), accounting for 37.0% of the total primary energy resource; oil imports accounted for 44.7%, and natural gas imports for 18.5% of the total imports (the latter increasing by 63.4% compared to 2020*) - see Table XI.29.*.

Table XI.29 -Primary energy

			thousand tons of oil equivalent1)
	2019	**2020**	**2021[2)]**
Resources	**42701**	**40016**	**41312**
from which:			
- production [3)]	24535	22351	21878
- import	15910	14014	15279
Production [3)]	**24535**	**22351**	**21878**
from which:			
- coals	3928	2592	3200
- crude oil	3490	3382	3250
- natural gas [4)]	8274	7391	7065
- hydroelectric power and nuclear heat [5)]	4960	4986	4962
Import	**15910**	**14014**	**15279**
from which:			
- coals	615	369	469
- crude oil	8662	7071	6823
- natural gases	2158	1726	2820
- electricity	440	654	698

[1)]Conventional fuel with a calorific value of 10,000 Kcal/kg.
[2)]Provisional data.
[3)]Including the energy products obtained and consumed in the households of the population.
[4)]Exclusively gasoline and ethane from extraction scaffolds, which are included in crude oil.
[5)]Including wind and solar photovoltaic energy.

Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

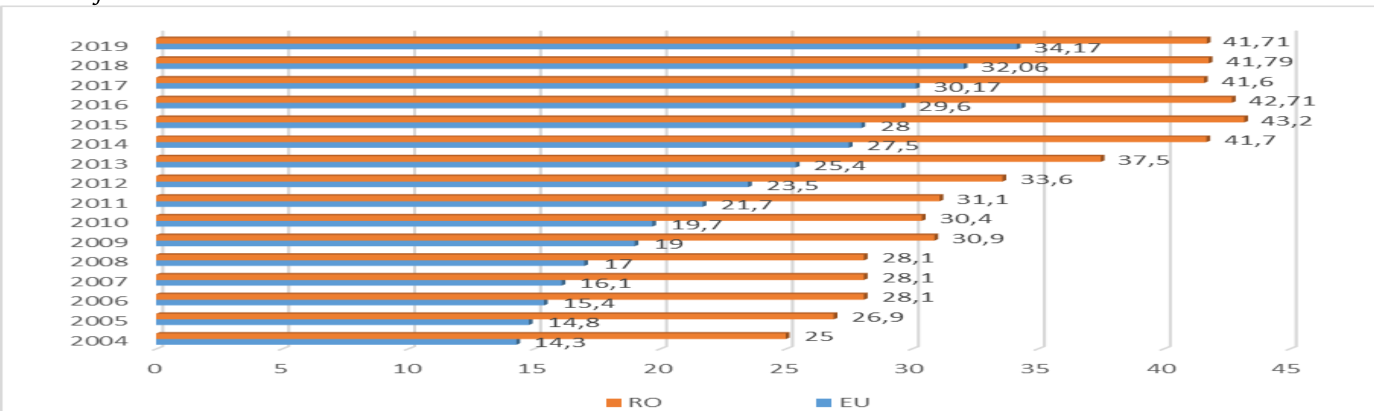
Table XI.30 – Electricity balance

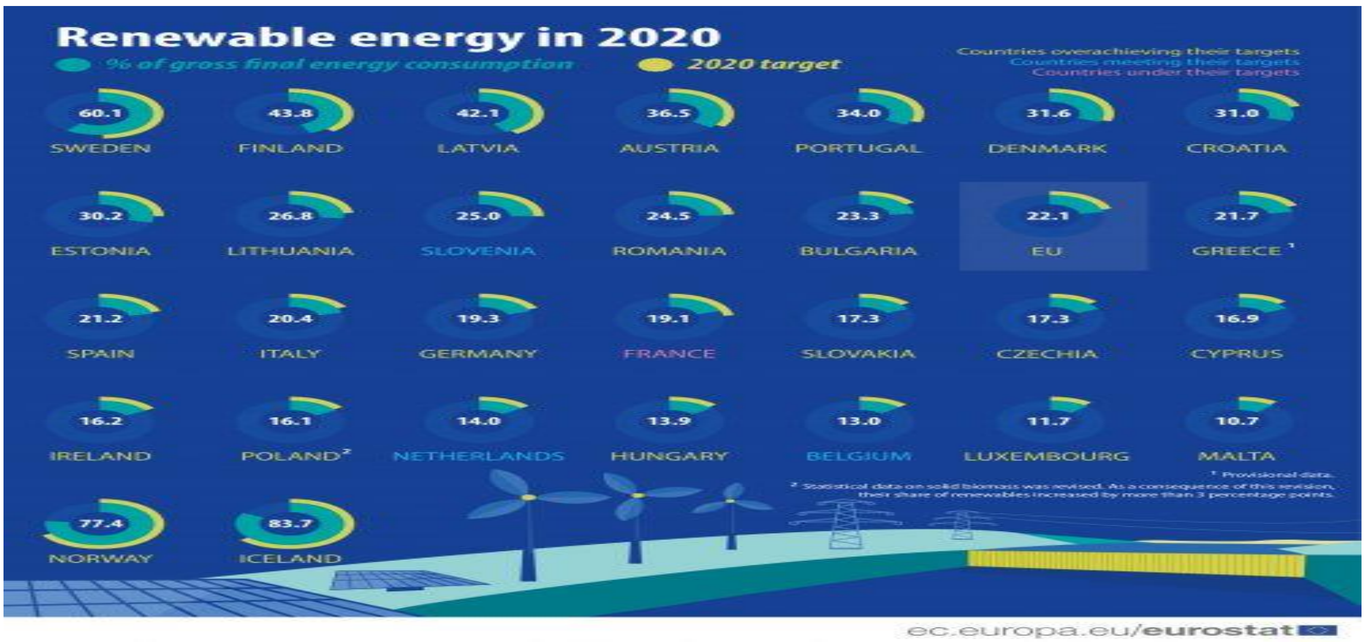
			billion kWh
	2019	**2020**	**2021[1)]**
Resources	**64.7**	**63.5**	67.1
Production	59.6	55.9	59.0
- produced in thermal power plants	23.8	20.0	22.2
- produced in hydropower plants	16.0	15.7	17.2
- nuclear-electric	11.3	11.5	11.3
- wind turbine[2)]	8.5	8.7	8.3
Import	5.1	7.6	8.1
Destinations - total	**64.7**	**63.5**	67.1
Consumption - total	54.6	52.5	55.7
- in the economy	41.0	38.4	41.4
- public lighting	0.6	0.5	0.5
- population	13.0	13.6	13.8
Export	3.6	4.8	5.5
Own technological consumption in networks and stations	6.5	6.2	5.9

[1)]Provisional data.				
[2)]Including solar photovoltaic energy.				

Source: https://insse.ro/cms/sites/default/files/field/publicatii/romania_in_cifre_2022.pdf

Figure XII.44 - Share of electricity from renewable energy sources in total electricity at the level of Romania and EU28 in the period 2004-2019 and 2020 (%)*Source: Eurostat https://ec.europa.eu/eurostat/web/energy/data/shares - no dates for 2021 have been identified*



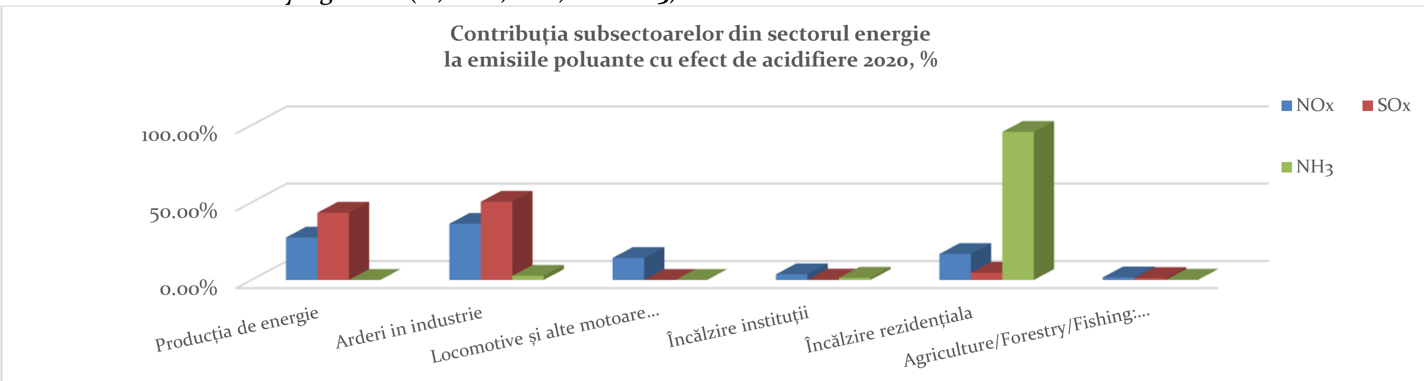


Renewable energy sources include wind energy, solar energy (thermal, photovoltaic, and concentrated), hydropower, tidal energy, geothermal energy, ambient heat captured by heat pumps, biofuels, and the renewable portion of waste. The use of renewable energy has many potential benefits, including reducing greenhouse gas emissions, diversifying energy supply, and reducing dependence on fossil fuel markets (particularly oil and gas). Increasing renewable energy sources can also stimulate job creation in the EU by generating employment opportunities in new 'green' technologies. The goal behind the European Green Deal (COM(2019) 640 final), a highly ambitious package of measures designed to enable European citizens and businesses to benefit from a sustainable ecological transition, is for Europe to become the world's first climate-neutral continent by 2050.

For trends see: https://energie.gov.ro/wp-content/uploads/2021/10/Anexa-HG-PNIESC.pdf

In Figure XI.45, the graph represents ***the contribution of subsectors within the energy sector to emissions of nitrogen oxides (NOX), ammonia (NH3), and sulfur oxides (SOX, SO2), relative to the total emissions from the energy sector***. Analyzing the data on the ***contribution of subsectors within the energy sector to pollutant emissions with an acidifying effect from this sector for the year 2020***, we observe a 95.70% share of ammonia resulting from residential heating activity, and high values of SO2 and NOx shares in energy production and burning in the industry. ***Relative to the national total, the share of emissions from the energy sector is 40.8% for NOx, 97.2% for SO2, and 5.9% for NH3.***

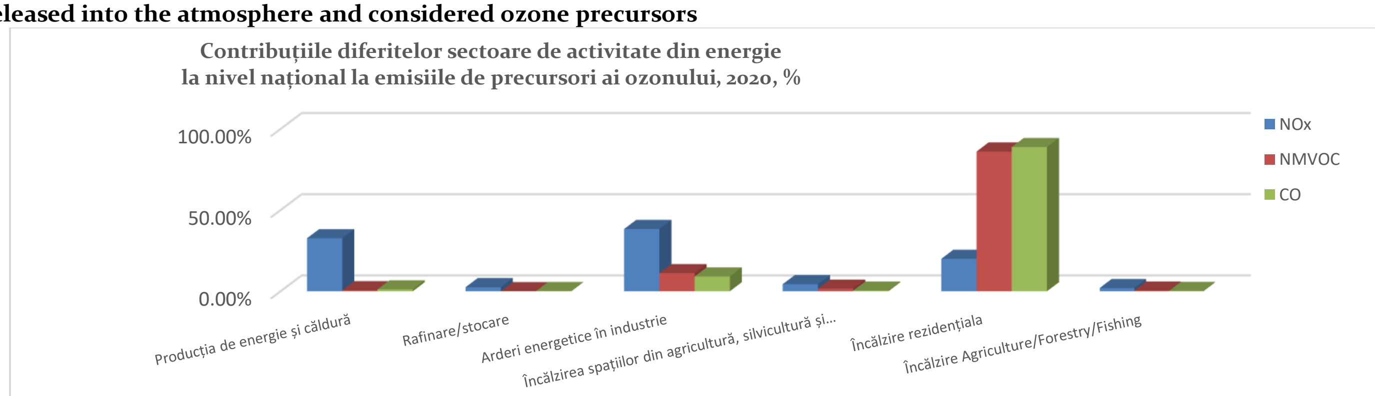
Figure XII.45 -The contributions of the activity subsectors in the energy sector, in 2020, to the emissions of polluting substances with an acidifying effect (%, NOx, SOx, and NH3)



Source: Romania's Informative Inventory Report 2022

In *Figure XI.46*, the graph illustrates the ***contribution of subsectors within the energy sector to anthropogenic emissions of ozone precursor pollutants: nitrogen oxides (NOx), carbon monoxide (CO), and non-methane volatile organic compounds (NMVOC), relative to the total emissions from the energy sector***. Analyzing the situation regarding the contribution of energy subsectors to emissions of ozone precursor pollutants from this sector for the year 2020, it is observed that the maximum share of NMVOC and CO pollutants (86.09%, 88.88%) is in residential heating activity, and NOx pollutant is in energy burning activities in industry and energy production. ***The share of NMVOC emissions from the energy sector is 36.1% of the national total NMVOC emissions, and for CO emissions, it is 63.4%.***

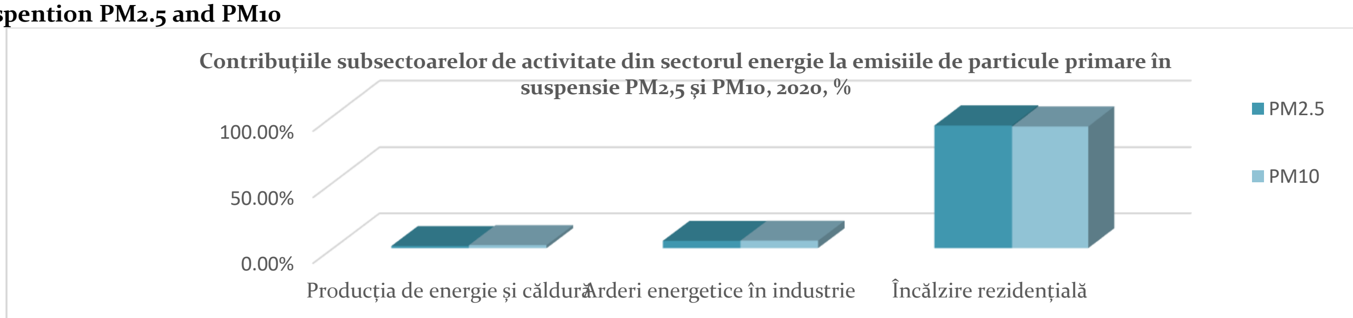
Figure XI.46 -The contributions of the activity subsectors in the energy sector, in 2020, to the emissions of polluting substances released into the atmosphere and considered ozone precursors



Source: Romania's Informative Inventory Report 2022

In *Figure XI.47*, the graph depicts the *contribution of subsectors within the energy sector to anthropogenic emissions of primary particles with a diameter less than 2.5µm (PM2.5) and 10µm (PM10), relative to the total emissions from the energy sector*. Analyzing the graph, it is evident that the maximum share of primary particle emissions in the energy sector, in both PM2.5 and PM10, is from residential heating, accounting for over 90% of the total. ***In terms of the national total of particle emissions, the share of PM10 emissions from the energy sector is 88.3%, and for PM2.5 emissions, it is 67.1%.***

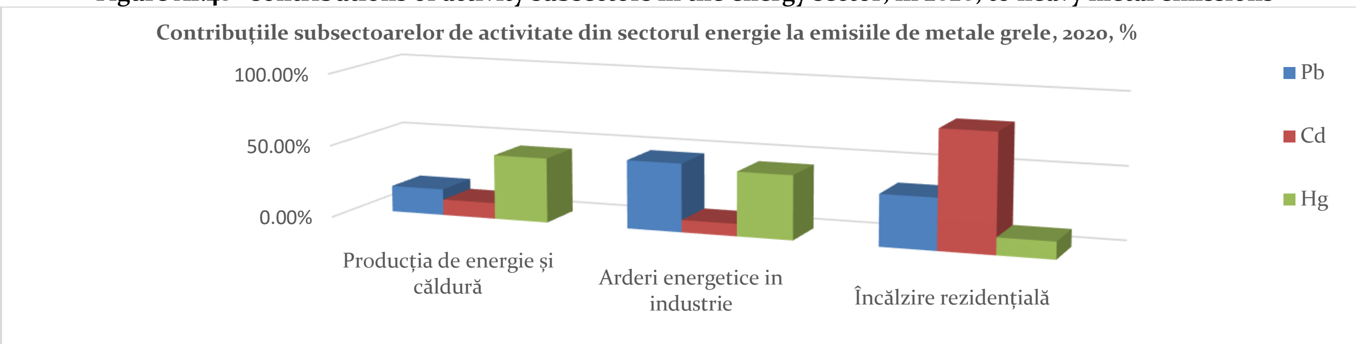
Figure XI.47 -The contributions of the activity subsectors in the energy sector, in 2020, to the emissions of primary particles in suspention PM2.5 and PM10



Source: Romania's Informative Inventory Report 2022

In *Figure XI.48*, the graph illustrates *the contribution of subsectors within the energy sector in the year 2020 to anthropogenic emissions of heavy metals (mercury, lead, cadmium, etc.), relative to the total emissions from the energy sector*. Analyzing the situation regarding the contribution of subsectors within the energy sector to heavy metal emissions in this sector for the year 2020, ***a significant share of Hg emissions is observed from the energy and heat production subsector, as well as energy combustion in industry (44.37%, 43.82%). The major share of cadmium emissions stems from the residential heating subsector (72.8%), while lead emissions have a significant share in all subsectors, averaging around 33%***.

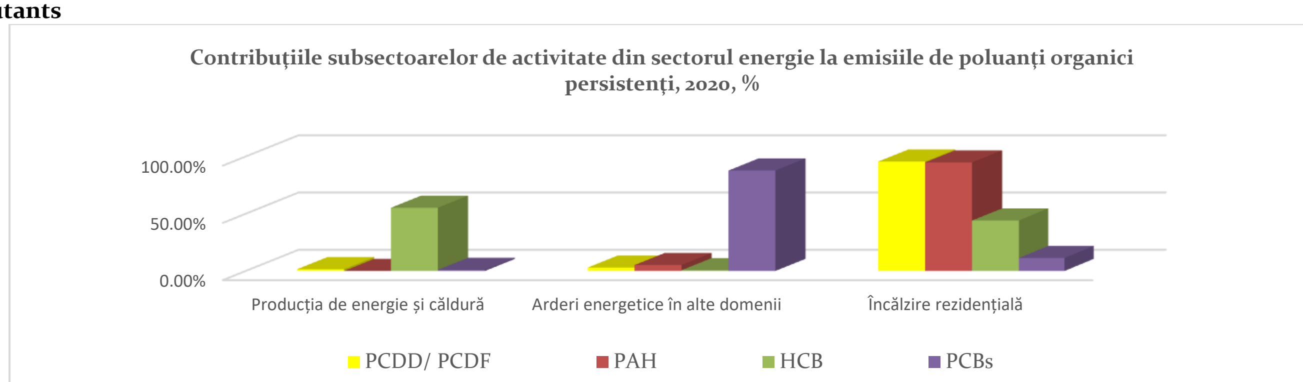
Figure XI.48 -Contributions of activity subsectors in the energy sector, in 2020, to heavy metal emissions



Source: Romania's Informative Inventory Report 2022

In *Figure XI.49*, the graph illustrates *the contribution of subsectors within the energy sector in the year 2020 to anthropogenic emissions of persistent organic pollutants and polycyclic aromatic hydrocarbons (PAHs), relative to the total emissions from the energy sector*. Analyzing the presented data regarding the contribution of subsectors to emissions of persistent organic pollutants from the energy sector in the year 2020, ***it is observed that residential heating has the major share, with values exceeding 90% for PCDD/PCDF dibenzofurans and PAH aromatic hydrocarbons***."

Figure XI.49 –The contributions of the activity subsectors in the energy sector, in 2020, to the emissions of persistent organic pollutants



Source: Romania's Informative Inventory Report 2022

RO 10
Indicator code Romania: RO 10
EEA indicator code: CSI 10
TITLE: **THE TREND OF GREENHOUSE GAS EMISSIONS**
DEFINITION: The indicator presents the trends (total and by sector) of greenhouse gas emissions in relation to the obligations of the member states to comply with the objectives of the Kyoto protocol. The emissions are presented according to their type and are analyzed according to their potential contribution to amplifying the phenomenon of global warming

The indicator analyzes the trends in total greenhouse gas (GHG) emissions in the EU starting from 1990 in connection with the objectives of both the EU and its Member States. *The European Union and its Member States, including Romania*, *have independently communicated a target of reducing greenhouse gas emissions associated with economic activities by 20% reduction by 2020 compared to 1990 levels*. Romania's emission reduction target for the years 2013-2020 is part of the common target of the European Union. The EU target is implemented within the framework of the EU Energy and Climate

Change Package.

At the national level, the limitation and reduction of greenhouse gas emissions are achieved through the application of the Greenhouse Gas Emission Trading Scheme (EU ETS) (the European target for Romania being -21% in 2020 compared to the hypothetical emissions levels from the EU ETS sector in 2005) and by implementing the provisions included in Decision No. 406/2009/EC. Considering the obligations to comply with the annual national targets for reducing GHG emissions in accordance with the provisions of Decision No. 406/2009/EC, it is necessary to develop strategies and action plans at the level of each economic sector to identify the measures and resources needed to ensure the national emission trajectory for the period 2013-2020.

Environmental policies related to climate change are a critically important step, and Romania must adhere to the European effort to achieve the ambitious goals set in the EU's climate change policy. The national policy for reducing GHG emissions follows the European approach, aiming on the one hand to ensure that some economic operators participate in the implementation of the greenhouse gas emission trading scheme, and on the other hand, to adopt sector-specific policies and measures in such a way that the GHG emissions associated with these sectors at the national level respect the linear emission trajectory set by the application of Decision No. 406/2009/EC. The Greenhouse Gas Emission Trading Scheme (EU ETS) regulates emissions from installations with significant production capacity and emissions from the Energy and Industrial Processes sectors.

To optimize the planning of GHG emission reductions from sources not covered by the EU ETS, a correlation of annual sectoral emission plans from sources regulated by the application of Decision No. 406/2009/EC (non-EU ETS) is necessary, taking into account the emissions and the reduction potential of each sector, as well as national economic development priorities. Analyzing the amount of CO_2 emissions at the European Union level, it has been found that the highest quantity is generated from the production of electricity and heat. For example, coal-based energy production in the EU states generated approximately 973 million tons of CO_2 emissions in 2005, representing 23% of the total CO_2 emissions in the EU. ***Regarding Romania, CO_2 emissions generated from various sectors also highlight the major contribution of the energy and transport sectors, meaning these are the areas where measures and actions to reduce CO_2 emissions are needed. According to Romania's National Greenhouse Gas Inventory 2022, in the year 2020, GHG emissions from the Energy sector represent approximately 94.54% of the total, including LULUCF, and 66.25% of the total, excluding LULUCF***. At the European Union level, the Transport sector remains the sector with the largest impact on greenhouse gas emissions in terms of associated level variation, showing an increasing trend. In 2020, emissions from the Transport Sector increased by 47.79% compared to emissions recorded in 1990, mainly due to the increased demand for passenger and goods transport as well as the preference for road transport over other less polluting means of transportation. Compared to 2019, emissions from the Transport Sector decreased by 2.83% (Table XI.31 and Figures XI.50). Note: Differences in the data between the report associated with the year 2021 and the report associated with the year 2020 are due to recalculations at the level of the National Inventory of Greenhouse Gas Emissions and the introduction of elements specific to the year 2020 *[Source: Climate Change Directorate within NEPA.]*.

Table XI.31 - The levels of total annual emissions of greenhouse gases in the period 2000 – 2020, (thousand tons of CO_2 equivalent)

Year	Total emissions (excluding LULUCF)	Total emissions (including LULUCF)
2000	138,979.50	107,585.90
2001	142,647.77	110,335.01
2002	144,186.01	113,910.07
2003	149,901.26	119,151.23
2004	148,139.99	117,626.80
2005	146,902.60	115,092.19
2006	148,403.92	116,994.40
2007	151,887.14	119,593.25
2008	147,982.51	115,107.11
2009	127,058.67	97,436.65
2010	122,862.63	94,626.85
2011	129,627.15	101,231.29
2012	127,537.24	96,676.89
2013	116,059.32	84,865.02
2014	115,292.89	81,226.92
2015	114,817.69	81,847.13

2016	113,456.38	78,546.08
2017	116,701.16	84,179.45
2018	117,597.48	87,881.40
2019	113,939.38	85,462.70
2020	109,934.33	77,040.37

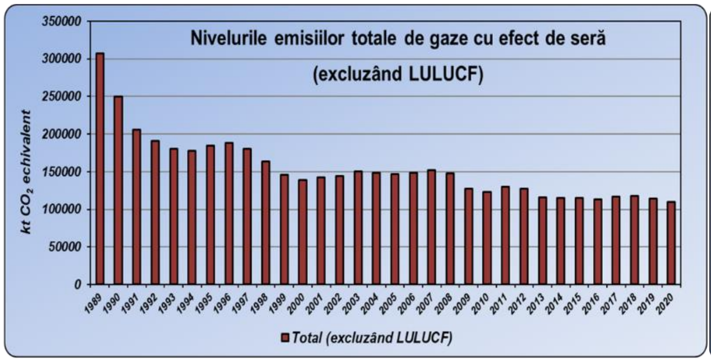
Source: NEPA

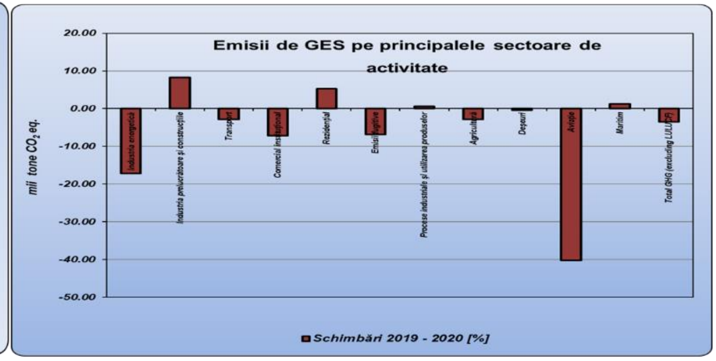
Figures XI.50 - Graphical representation of the levels of total annual emissions of greenhouse gases in the period 1989 – 2020 (thousand tons of CO2 equivalent) by activity sector and per inhabitant in Romania and compared for the EU 27

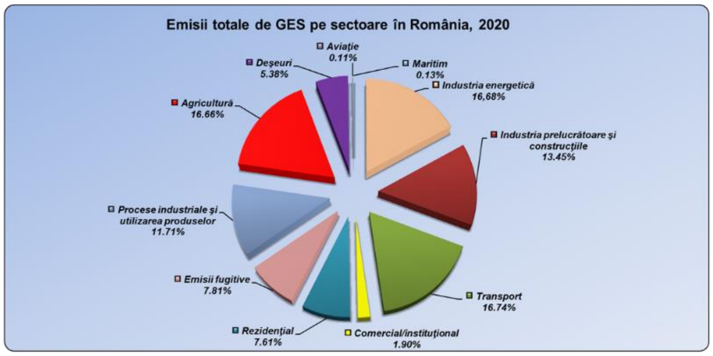
Source: NEPA -The National Inventory of Greenhouse Gas Emissions (INEGES), made according to the IPCC methodology, using the common reporting format for all countries (CRF)

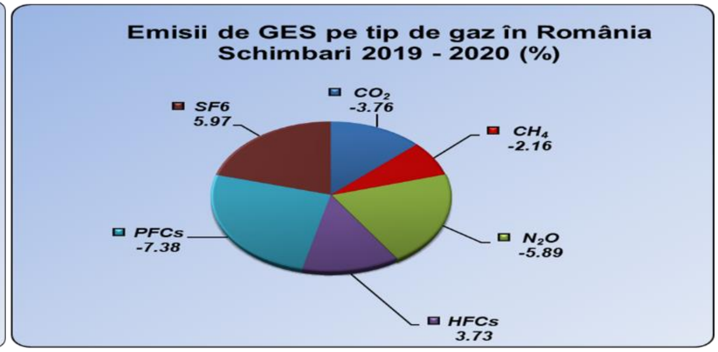
Sources of data and information:

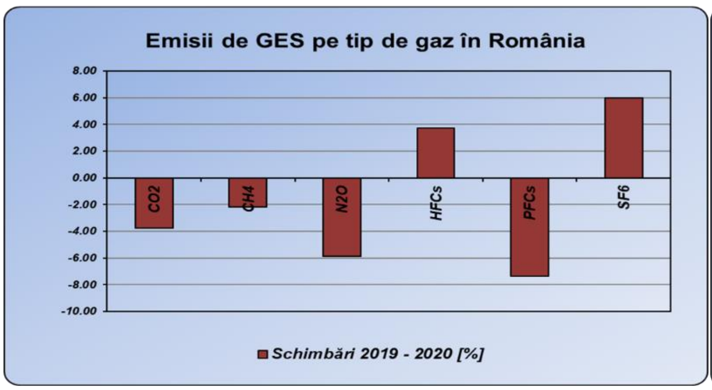
- ***National Environmental Protection Agency*****:** The National Inventory of Greenhouse Gas Emissions (INEGES), made according to the IPCC methodology, using the common reporting format for all countries (CRF):
  - INEGES transmitted as a Member State of the European Union: https://cdr.eionet.europa.eu/ro/eu/mmr/art07_inventory/
  - INEGES submitted as a Party to the United Nations Framework Convention on Climate Change and the Kyoto Protocol: https://unfccc.int/ghg-inventories-annex-i-parties/2022;https://cdr.eionet.europa.eu/ro/un/unfccc/
- ***European Environment Agency, The European Topic Center on Air and Climate Change***: Annual European Union greenhouse gas inventory and annual inventory report *http://acm.eionet.europa.eu/reports* ; National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism, *http://www.eea.europa.eu/data-and-maps/data/national-emissions-reported-to-the-unfccc-and-to-the-eu-greenhouse-gas-monitoring-mechanism-7*
- ***Eurostat***, statistical database
- ***National Institute of Statistics:*** the section containing data and information on the Gross Domestic Product (*http://www.insse.ro/cms/ro/content/produsul-intern-brut*)

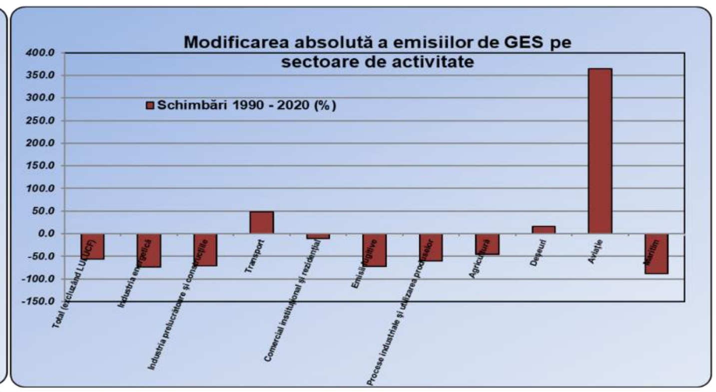

Nivelurile emisiilor totale de gaze cu efect de seră
(excluzând LULUCF)
kt CO2 echivalent
Total (excluzând LULUCF)

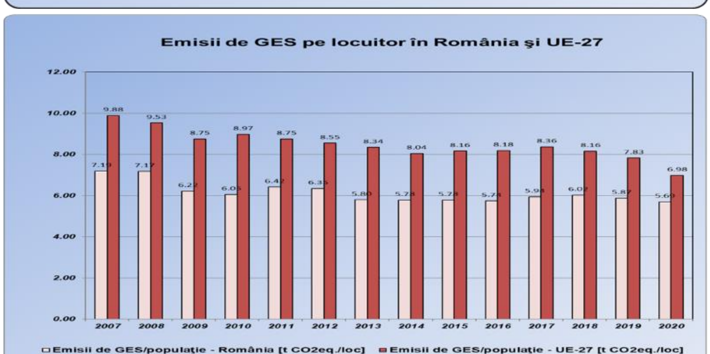

Emisii de GES pe principalele sectoare de activitate
mil tone CO2 eq.
Industria energetică
Industria prelucrătoare și construcțiile
Transport
Comercial/ instituțional
Rezidențial
Emisii fugitive
Procese industriale și utilizarea produselor
Agricultură
Deșeuri
Aviație
Maritim
Total GHG (excluding LULUCF)
Schimbări 2019 - 2020 [%]

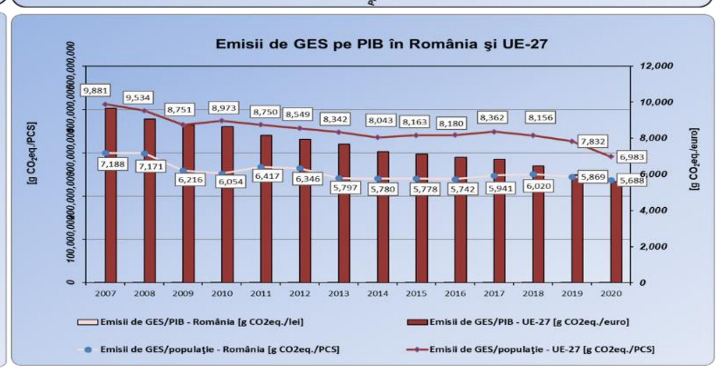

Emisii totale de GES pe sectoare în România, 2020
Aviație 0.11%
Maritim 0.13%
Deșeuri 5.38%
Industria energetică 16,68%
Agricultură 16.66%
Industria prelucrătoare și construcțiile 13.45%
Procese industriale și utilizarea produselor 11.71%
Emisii fugitive 7.81%
Transport 16.74%
Rezidențial 7.61%
Comercial/instituțional 1.90%

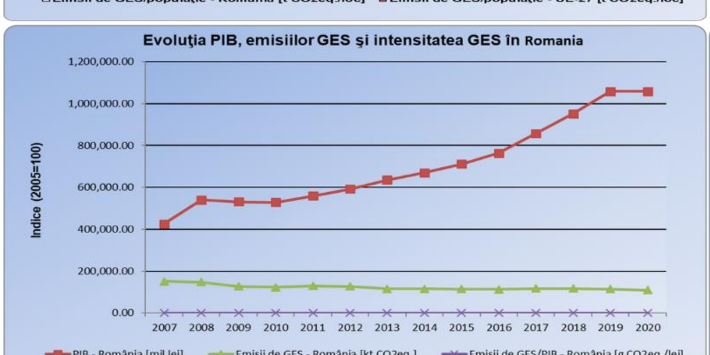

Emisii de GES pe tip de gaz în România
Schimbari 2019 - 2020 (%)
CO2 -3.76
CH4 -2.16
N2O -5.89
HFCs 3.73
PFCs -7.38
SF6 5.97

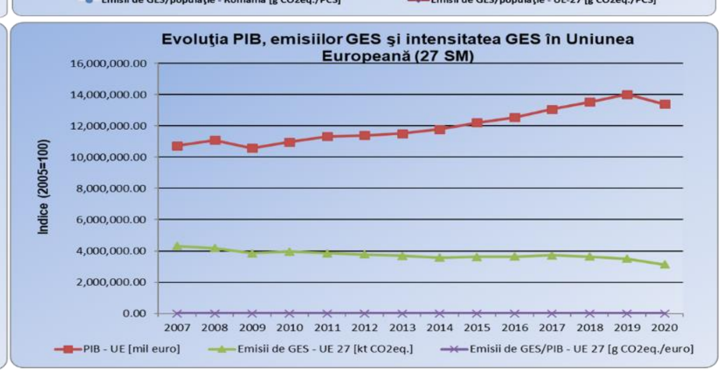

Emisii de GES pe tip de gaz în România
CO2
CH4
N2O
HFCs
PFCs
SF6
Schimbări 2019 - 2020 [%]


Modificarea absolută a emisiilor de GES pe sectoare de activitate
Schimbări 1990 - 2020 (%)
Transport
Deșeuri
Aviație
Maritim


Emisii de GES pe locuitor în România și UE-27
Emisii de GES/populație - România [t CO2eq./loc]
Emisii de GES/populație - UE-27 [t CO2eq./loc]


Emisii de GES pe PIB în România și UE-27
[g CO2eq/PCS]
[g CO2eq./euro]
Emisii de GES/PIB - România [g CO2eq./lei]
Emisii de GES/PIB - UE-27 [g CO2eq./euro]
Emisii de GES/populație - România [g CO2eq./PCS]
Emisii de GES/populație - UE-27 [g CO2eq./PCS]


Evoluția PIB, emisiilor GES și intensitatea GES în Romania
Indice (2005=100)
PIB - România [mil lei]
Emisii de GES - România [kt CO2eq.]
Emisii de GES/PIB - România [g CO2eq./lei]


Evoluția PIB, emisiilor GES și intensitatea GES în Uniunea Europeană (27 SM)
Indice (2005=100)
PIB - UE [mil euro]
Emisii de GES - UE 27 [kt CO2eq.]
Emisii de GES/PIB - UE 27 [g CO2eq./euro]

Industry

From the graph in figure XI.51 regarding the Evolution of final energy consumption by types of activity sectors, 2016-2020 (thousands of toe) it is observed that the energy consumption in the residential sector has the largest share, followed by industrial activities and transport activities.

RO 27

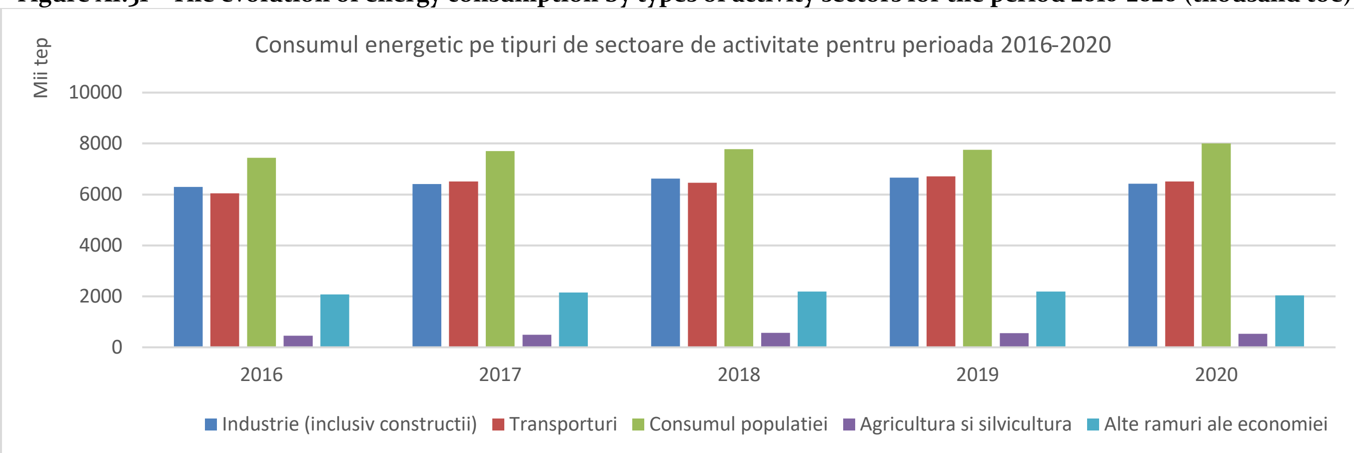
Indicator code Romania: RO 27

EEA indicator code: CSI 27

TITLE: **FINAL ENERGY CONSUMPTION BY TYPE OF ACTIVITY SECTOR**

DEFINITION: Final energy consumption covers the energy supplied to the final consumer for the most diverse energy purposes. It is calculated as the sum of the final energy consumption from all sectors of activity. They are structured to include industry, transport, households, services and agriculture

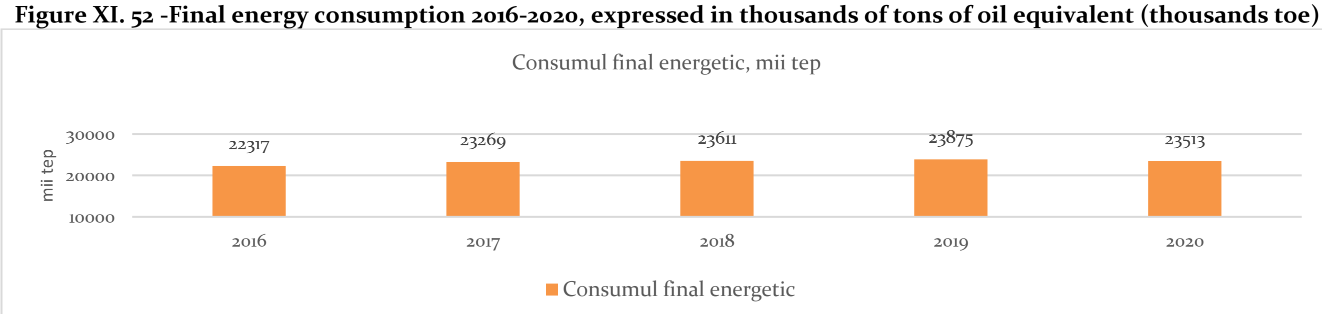
Figure XI.51 – The evolution of energy consumption by types of activity sectors for the period 2016-2020 (thousand toe)



Source: http://www.insse.ro

In 2020, **final energy consumption** decreased by 362 thousand toe (-1.5%) compared to 2019 (*figure XI.52*). **Final energy consumption** showed declines in almost all types of economic activities, except for construction (+10.1%). Final energy consumption by the population increased compared to the previous year, both in quantity (+254 thousand toe, representing 3.3%) and as a share of the total final energy consumption (34.0%, compared to 32.5% in 2019). (Source**:** *[http://www.insse.ro)](http://www.insse.ro)*

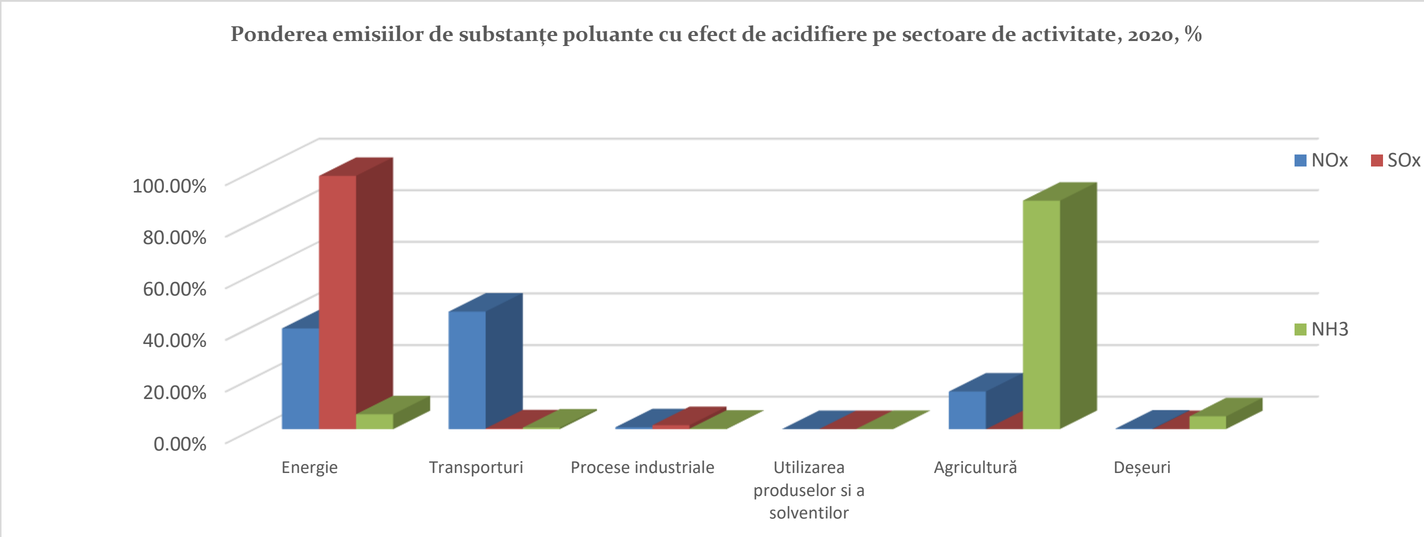
Figure XI. 52 -Final energy consumption 2016-2020, expressed in thousands of tons of oil equivalent (thousands toe)



Source: National Institute of Statistics -http://www.insse.ro

Based on the acidification potential, the chart depicts the share of anthropogenic emissions of nitrogen oxides (NOx), ammonia (NH_3), and sulfur oxides (SOx, SO_2) by economic sectors at the national level: energy, transportation, industrial processes, product use, agriculture, and waste in the year 2020 (Figure XI.53). It is observed that at the national level, the acidification effect predominantly originates from the energy sector for sulfur oxides (98.13%), from transportation and energy for nitrogen oxides (45.50% and 38.97%, respectively), and from agriculture for ammonia (88.51%).

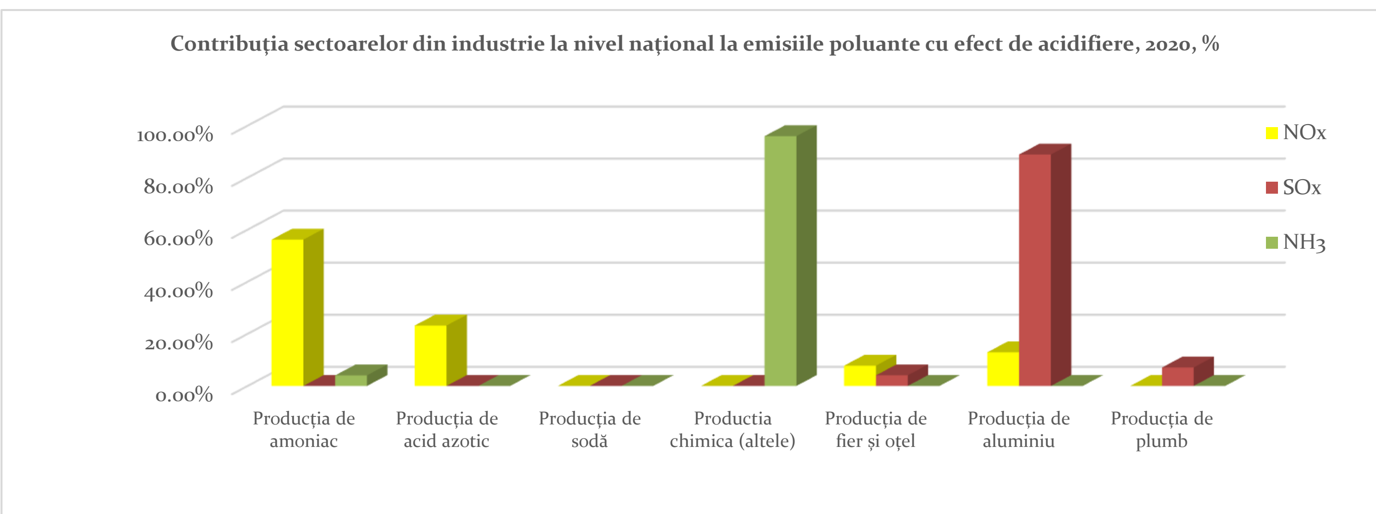
Figure XI. 53 - The share of emissions of acidifying pollutant substances by activity sectors at national level in the year 2020.



Source: Romania's Informative Inventory Report 2022

In the industrial sector, notable activities include aluminum production with SOx emissions (88.87% of total industry emissions), chemical production with NH3 emissions (95.95% of industry), and ammonia production with NOx emissions (56.15% of industry). Additionally, NOx emissions are notable in the production of nitric acid (23.17%), aluminum production (12.90%), and iron and steel production (7.79%). The contributions from subsectors within the industrial activity to acidifying pollutant emissions (NOx, NH3, SOx) in the year 2020 are presented graphically in *Figure XI.54*.

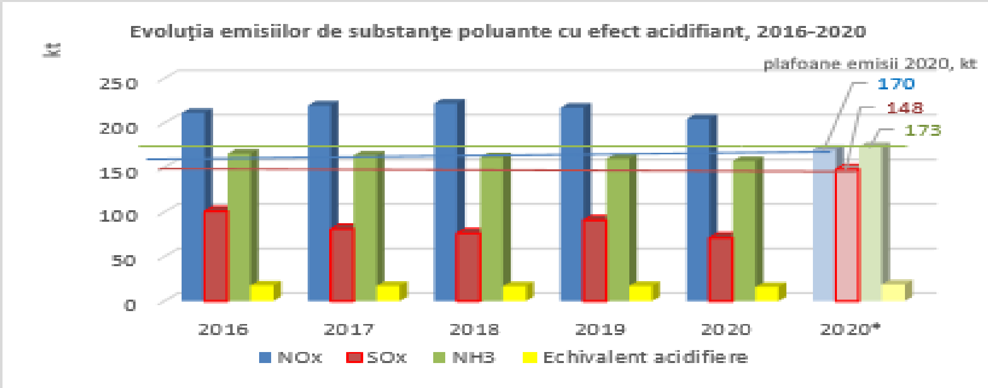
Figure XI. 54 -The contribution of the sub-sectors of activity in the industry sector, in 2020, to pollutant emissions with an acidifying effect (NOx, SOx, and NH3)



Source: Romania's Informative Inventory Report 2022

From the analysis of the data regarding acidifying substance emissions in Figure XI.55, the predominant sector for the SOx pollutant is the energy sector, for NOx pollutants, the transport and energy sectors are predominant, and for NH3 pollutant, the agricultural sector has the highest share. Acid equivalent is a parameter used to evaluate the total sum of acidifying substances emitted into the atmosphere. These substances contribute to soil, air, and aquatic acidification. The acid equivalent is based on the potential to fix H+ ions. The calculation takes into account the following pollutants: NOx, SOx, and NH3, and the acid equivalent can be calculated using the following weighting coefficients: *0.0217 for NOx, 0.0313 for SOx, and 0.0588 for NH3*.

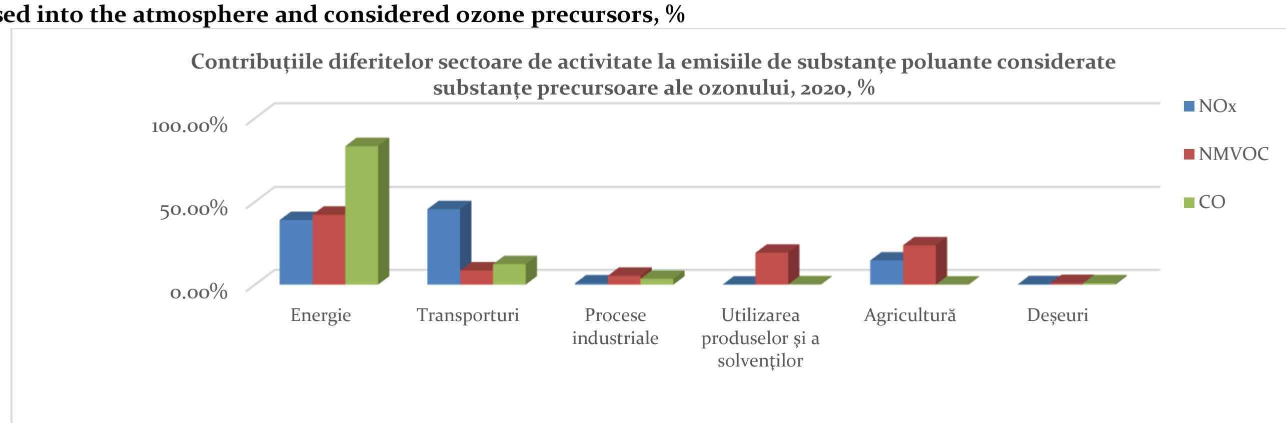
Figure XI. 55 - Emissions of polluting substances with an acidifying effect evolution at national level in the period 2016-2020 and *the target for the year 2021*



*Note: * Target emission ceilings for the year 2020, according to the revised Gothenburg Protocol 2010*

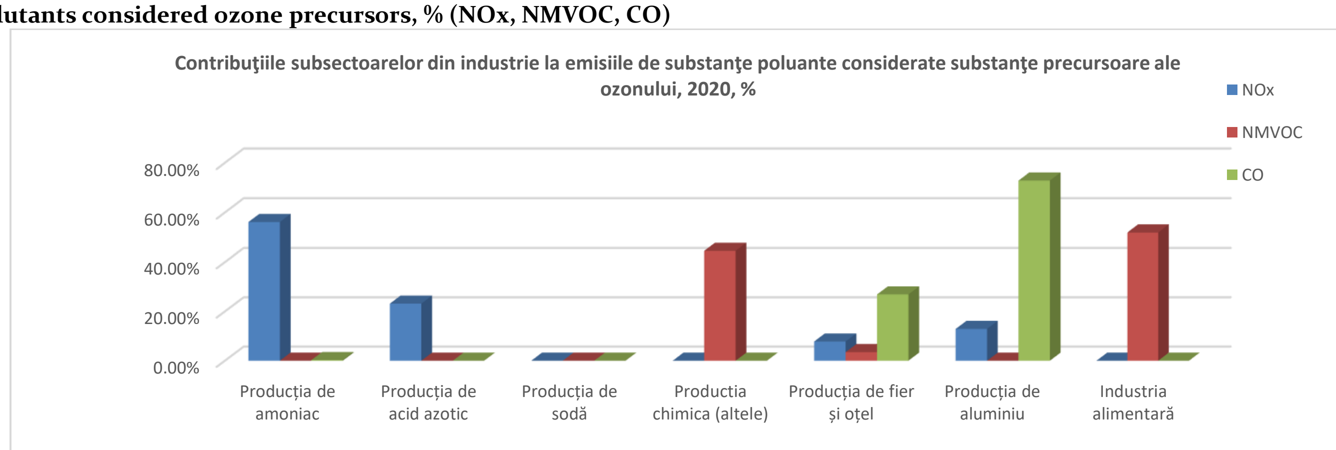
"The share of pollutant emissions released into the atmosphere and considered precursor substances to ozone (NMVOC, NOX, and CO) at the national level by economic sectors in the year 2020 is presented graphically in Figure XI.56. The graphically presented data highlight that the energy sector significantly contributes to ozone precursor pollutant emissions at the national level, followed by the transportation sector. The agriculture and product use and solvent sectors significantly contribute to NMVOC emissions.

Figure XI. 56 -The contributions of the activity sectors at national level, in 2020 to the emissions of polluting substances released into the atmosphere and considered ozone precursors, %



Source: Romania's Informative Inventory Report 2022

Figure XI. 57 -The contribution of the activity subsectors in the industry sector, in 2020, to the emissions of atmospheric pollutants considered ozone precursors, % (NOx, NMVOC, CO)

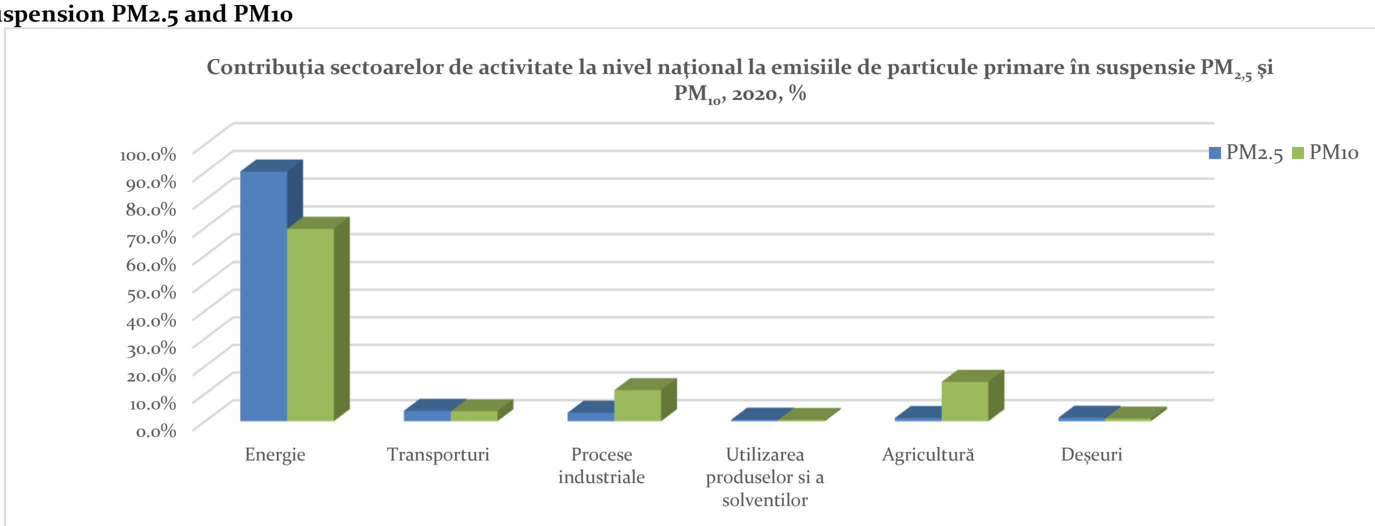


Source: Romania's Informative Inventory Report 2022

From the analysis of the presented data regarding the contribution of various sectors to ozone precursor pollutant emissions in the industrial sector, a significant share of subsectors can be observed, such as aluminum production with high values of CO emissions, ammonia and nitric acid production with significant values of NOx emissions, followed by the chemical and food industries, which show the highest values of NMVOC emissions.

In *Figure XI.58*, the graphical representation illustrates the shares of economic sectors in primary suspended particle emissions PM2.5 and PM10 at the national level in the year 2020. By comparing the values for different economic sectors at the national level, it is noted that the energy sector has the highest share in primary suspended particle emissions (90.2% PM2.5, and 69% PM10), predominantly due to dust emissions from residential heating activities in this sector. Sectors like agriculture and industrial processes show significantly smaller shares for PM10 emissions (14.2% and 11.2%, respectively).

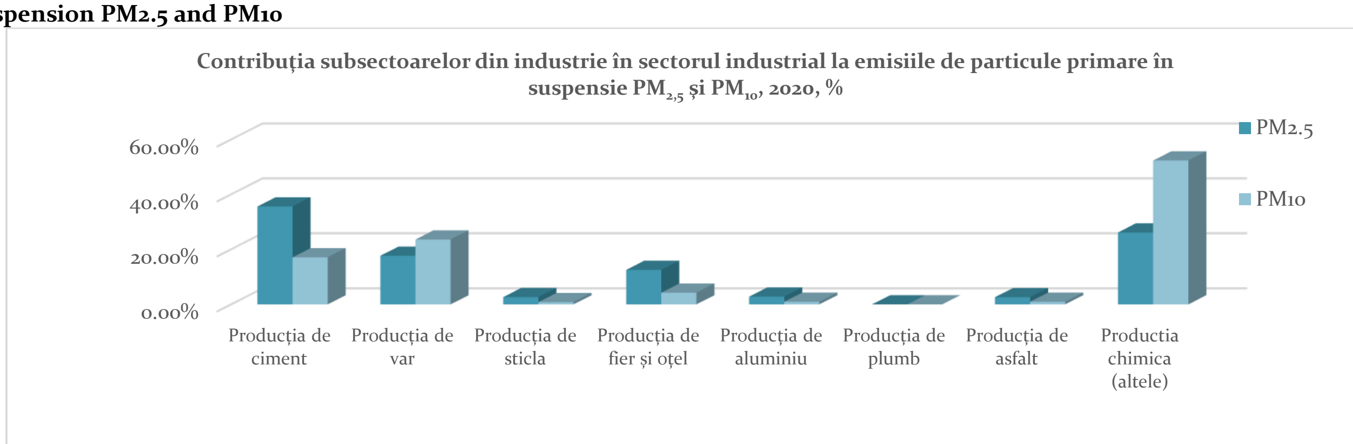
Figure XI. 58 -The contribution of the activity subsectors at national level in 2020, to the emissions of primary particles in suspension PM2.5 and PM10



Source: Romania's Informative Inventory Report 2022

From the analysis of the data presented in Figure XI.59 regarding the contribution of subsectors within the industrial activity to primary suspended particle emissions PM2.5 and PM10 in the industrial sector, it is observed that cement production, lime production, and asphalt production have the highest shares compared to other activities.

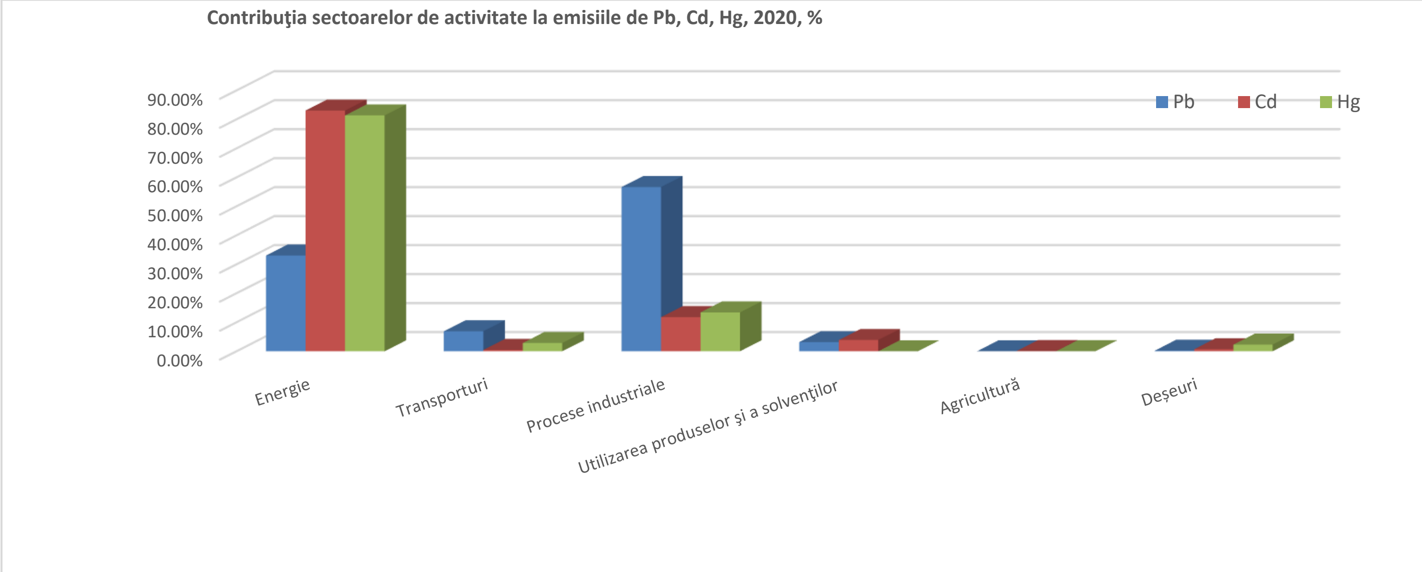
Figure XI. 59 -The contribution of the activity subsectors of the industry sector, in 2020, to the emissions of primary particles in suspension PM2.5 and PM10



Source: Romania's Informative Inventory Report 2022

The contributions of economic sectors to heavy metal emissions (Cd, Hg, Pb) at the national level in the year 2020 are presented in Figure 60. From the analysis of the data, it is evident that the energy and industrial processes sectors have the highest shares nationally compared to other activities in heavy metal emissions of Pb, Cd, and Hg..

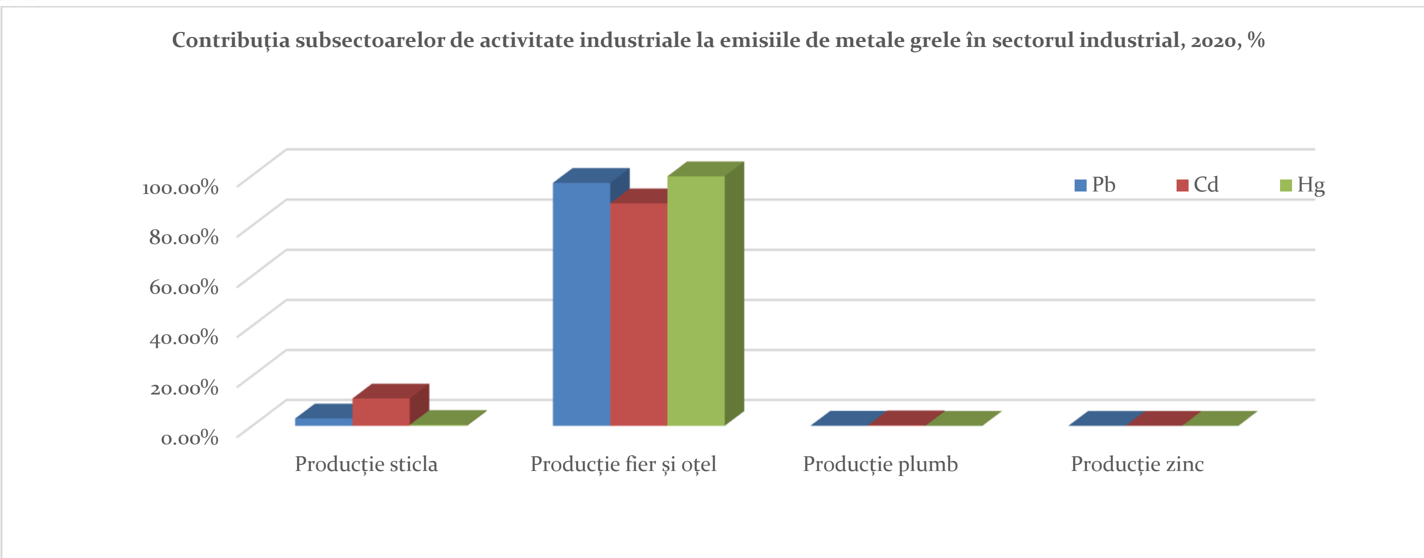
Figure XI. 60 -Contribution of activity sectors at national level to emissions of heavy metals Pb, Cd, Hg, 2020



Source: Romania's Informative Inventory Report 2022

From the analysis of the data presented graphically in Figure XI.61 regarding the contribution of subsectors within the industrial activity to heavy metal emissions in the industrial sector, it can be observed that the share of iron and steel production activities in heavy metal emissions of Pb, Cd, and Hg is predominant in the year 2020, representing a significant source of pollution at the national level.

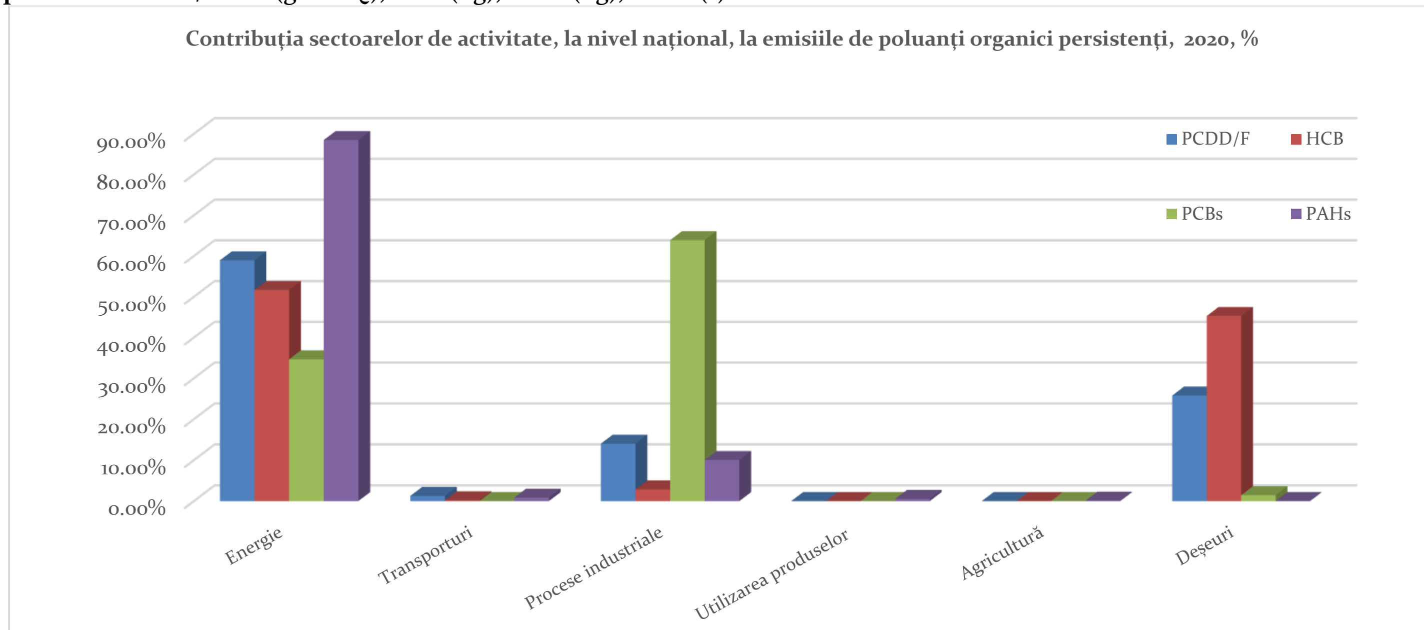
Figure XI. 61 –The contribution of sub-sectors of activity in the industry sector to the emissions of heavy metals, Pb, Cd, Hg, 2020



Source: Romania's Informative Inventory Report 2022

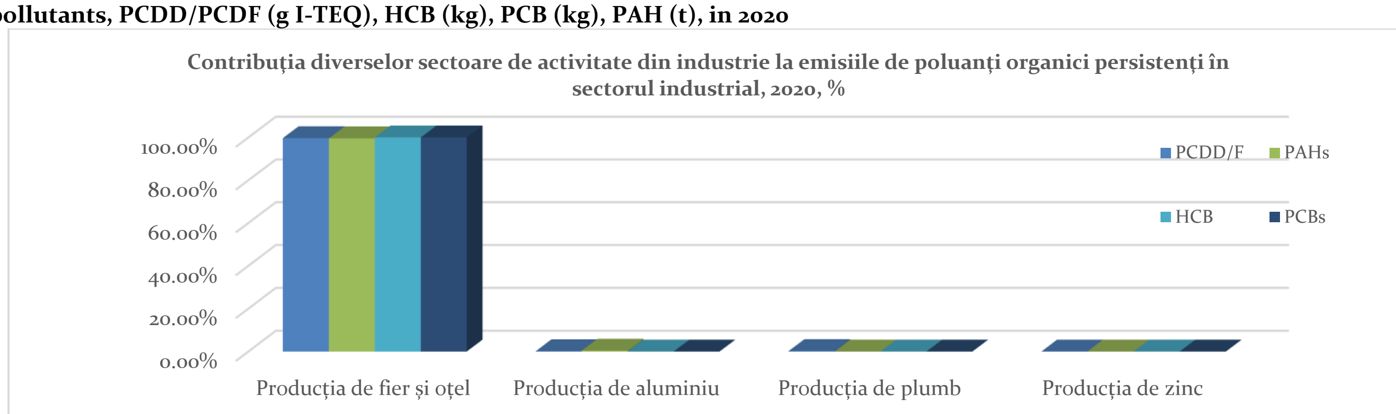
The contributions of emissions of Persistent Organic Pollutants (POPs) - hexachlorobenzene (HCB), polychlorinated biphenyls (PCBs), dioxin (PCDD), furans (PCDF), and polycyclic aromatic hydrocarbons (PAHs) - by economic sectors at the national level for the year 2020 are presented graphically in Figure XI.62. At the national level, two sectors significantly contribute to emissions of persistent organic pollutants. These are the energy sector with emissions of polycyclic aromatic hydrocarbons, hexachlorobenzene, dioxins, and furans, and the industrial sector, particularly with emissions of polychlorinated biphenyls. The waste sector also has a significant contribution to emissions of persistent organic pollutants, particularly dioxins, furans, and hexachlorobenzene. From Figure XI.63, it is observed that the activity with the maximum share for all persistent organic pollutants for subsectors within the industrial sector in the year 2020 is iron and steel production.

Figure XI. 62 –The contribution of the activity sectors at national level in 2020, to the emissions of persistent organic pollutants PCDD/PCDF (g I-TEQ), HCB (kg), PCBs (kg), PAHs (t)



Source: Romania's Informative Inventory Report 2022

Figure XI. 63 –The contribution of the activity subsectors in the industry sector to the emissions of persistent organic pollutants, PCDD/PCDF (g I-TEQ), HCB (kg), PCB (kg), PAH (t), in 2020



Source: Romania's Informative Inventory Report 2022

Agriculture

RO 25
Indicator code Romania: RO 25
EEA indicator code: CSI 25
TITLE: **GROSS NUTRIENT BALANCE**
DEFINITION: The indicator estimates the nitrogen surplus on agricultural land. This is done by calculating the balance between the total amount of nitrogen entering the agricultural system and the total amount of nitrogen leaving the system, per hectare of agricultural land.

In *Table XI.32*, **the situation of chemical fertilizer application on agricultural soils during the period 1999-2021** is presented, highlighting the continuation of the trend of chemical fertilizer application, with a peak in 2021 when 92.5% of the country's arable land was fertilized. The fertilized area in 2021 increased by 1,171,158 hectares compared to 2020. Compared to previous years, the following observations can be made: the quantities of applied chemical fertilizers (N, P_2O_5, K_2O) are on an upward trend, reaching a peak in 2021; the quantities of applied N increased by about 15%, while those of P_2O_5 and K_2O increased by about 42% and 44%, respectively, compared to 2020; compared to 1999, the quantities of N and

P2O5 applied in 2021 increased by 139% and 186%, respectively, while those of K2O increased by 809%; on arable land, the total NPK quantities increased from 35.4 kg in 1999 to 98.21 kg in 2021; of the total fertilizers used in 2021, those based on N represent 58%, those with phosphorus 29%, and those based on potassium 13%; in 2021, maximum values were reached for phosphorus and potassium-based fertilizers; compared to 1999, the fertilized area with NPK increased 2.4 times. (*Source: MARD. – I.C.P.A based on NIS data*).

Table XI.32 -The use of chemical fertilizers in Romanian agriculture in the period 1999-2021

Year	Chemical fertilizers used (tons of active substance)				N+P2O5+K2O (kg/ha)		Fertilized surface, ha
	N	P2O5	K2O	Total	Arable	Agricultural	
1999	225000	93000	13000	331000	35.4	22.5	3640900
2000	239300	88300	14600	342200	36.5	23.0	3724578
2001	268000	87000	14000	369000	39.3	24.8	-
2002	239000	73000	14000	326000	34.7	22.0	-
2003	252000	95000	15000	362000	38.5	25.6	-
2004	270000	94000	16000	380000	40.3	25.8	-
2005	299135	138137	24060	461392	49.0	31.3	5737529
2006	252201	93946	16837	363000	38.5	24.7	5388348
2007	265487	103324	18405	387000	41.1	26.3	6422910
2008	279886	102430	15661	397977	42.3	27.1	6762707
2009	296055	100546	29606	426207	45.3	29	5889264
2010	305756	123330	51500	480586	51.0	32.7	7092256
2011	313333	126249	47362	486944	51.8	33.3	6893863
2012	289983	113045	34974	438002	46.8	30.0	6340780
2013	328088	107543	33324	468955	49.9	32.1	5965817
2014	303562	118574	30103	452239	48.2	30.9	6676089
2015	357352	132657	42693	532702	56.7	36.41	6574741
2016	344000	126000	44000	514000	54.7	35.13	6491498
2017	381342	144869	44259	581470	61.89	39.74	7272565
2018	547694	227605	66894	842193	89.8	57.7	6740184
2019	455964	201329	92258	749551	79.78	51.23	7373689
2020	468891	187577	81985	738453	78.60	50.48	7522224
2021	538610	265678	118199	922487	98.21	63.05	8693382

Source: National Institute of Statistics-http://www.insse.ro,data provided by MARD

The quantity of organic fertilizers (*Table XI.33*) applied **in 2021** increased by 42,928 tons **compared to the amount used in 1999,** and the area where organic fertilizers were applied saw a 31% increase compared to 1999. Compared to 2020, both the total quantity of organic fertilizers applied and the area of application decreased by 10% and 7%, respectively. The average quantity of organic fertilizers applied in 2021 was 18.8 tons per hectare. In 2021, only 9.5% of the cultivated area was fertilized with organic fertilizers. (*Source: MARD. – I.C.P.A based on NIS data*).

Table XI.33 -The amount of natural fertilizers applied in the period 1999-2021

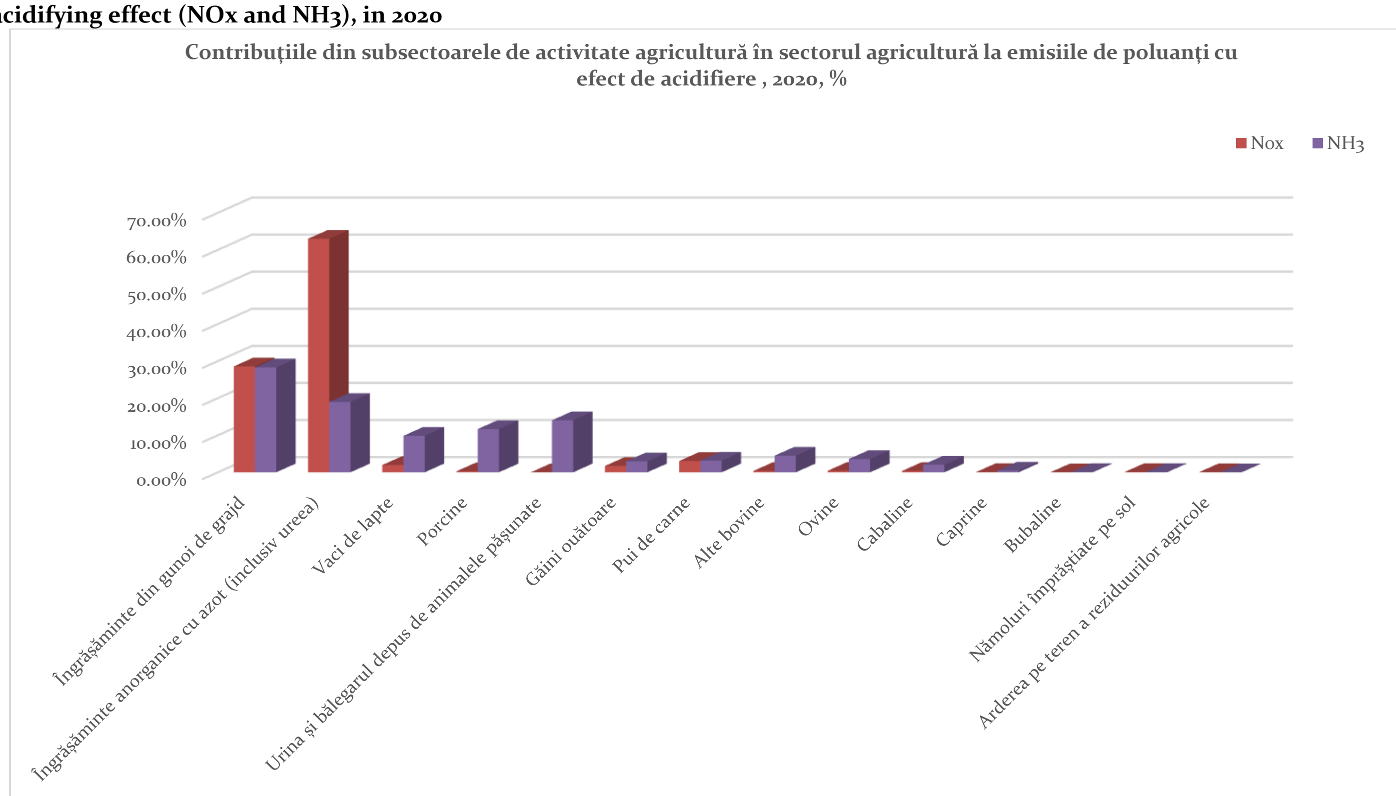
Year	Total fertilizers		Area on which was applied		The proportion of the applied area to the cultivable area	Average quantity per ha			
						on the applied area		on the agricultural area	
	t	%	Ha	%	%	t/ha	%	t/ha	%
1999	16,685,312	100	680,016	100	6.90	24,537	100	1,129	100
2000	15,812,625	95	674,200	99	6.80	23,454	96	1,068	95
2001	15,327,000	92	-	-	-	-	-	1,032	91
2002	15,746,000	94	-	-	-	-	-	1,061	94
2003	17,262,000	103	-	-	-	-	-	1,173	104
2004	17,749,000	106	-	-	-	-	-	1,200	106
2005	16,570,000	99	632,947	93	6.78	26,179	107	1,124	100
2006	14,900,000	89	575,790	85	6.10	25,877	105	1,011	90
2007	13,498,000	81	536,929	79	5.69	25,139	102	0.916	81
2008	11,725,220	70	494..412	73	5.25	23,715	97	0.797	71
2009	13,748,307	82	569,531	83.8	6.05	24,140	98	0.935	83
2010	15,231,715	91	600,052	88.2	6.37	25,38	103	1.04	92

2011	14,510,194	87	630,293	92.7	6.70	23.02	94	0.99	88
2012	13.292.61713.2	80	605,694	89	6.48	21.95	89.5	0.91	81
2013	82,877	80	613,563	90	6.53	21.65	88.2	0.91	81
2014	16,261,702	98	795,031	117	8.47	20.45	83.3	1.11	98
2015	15,212,325	91	864,218	127	9.20	17.60	71.7	1.04	92
2016	14,927,000	90	862,330	127	9.18	17.31	70.5	1.02	90
2017	12,625,073	76	708,364	104	7.54	17.8	72.5	0.86	76
2018	14,617,549	88	771,814	113	8.52	18.9	77.02	1.05	88
2019	15,323,344	92	816,713	120	8.69	18.8	76.6	1.05	93
2020	18,680,226	112	952,337	140	10,14	19.6	79.88	1.28	113
2021	16,728,240	100	887,952	131	9.45	18.8	76.62	1.14	101

Source: National Institute of Statistics-http://www.insse.ro, data provided by MARD

The contributions from agricultural subsectors to acidifying pollutant emissions (NOx, NH3) in the year 2020 are presented in *Figure XI.64*. From the analysis of the data regarding *the contribution of agricultural subsector activities to acidifying pollutant emissions* in the year 2020, it is observed that the impactful activities are the application of synthetic and natural fertilizers in agricultural crops, followed by livestock breeding (dairy cows, pigs, laying hens). ***The subsector related to the application of organic and inorganic nitrogen-based fertilizers (including urea) on the soil is the primary contributor to NOx emissions in agriculture***.

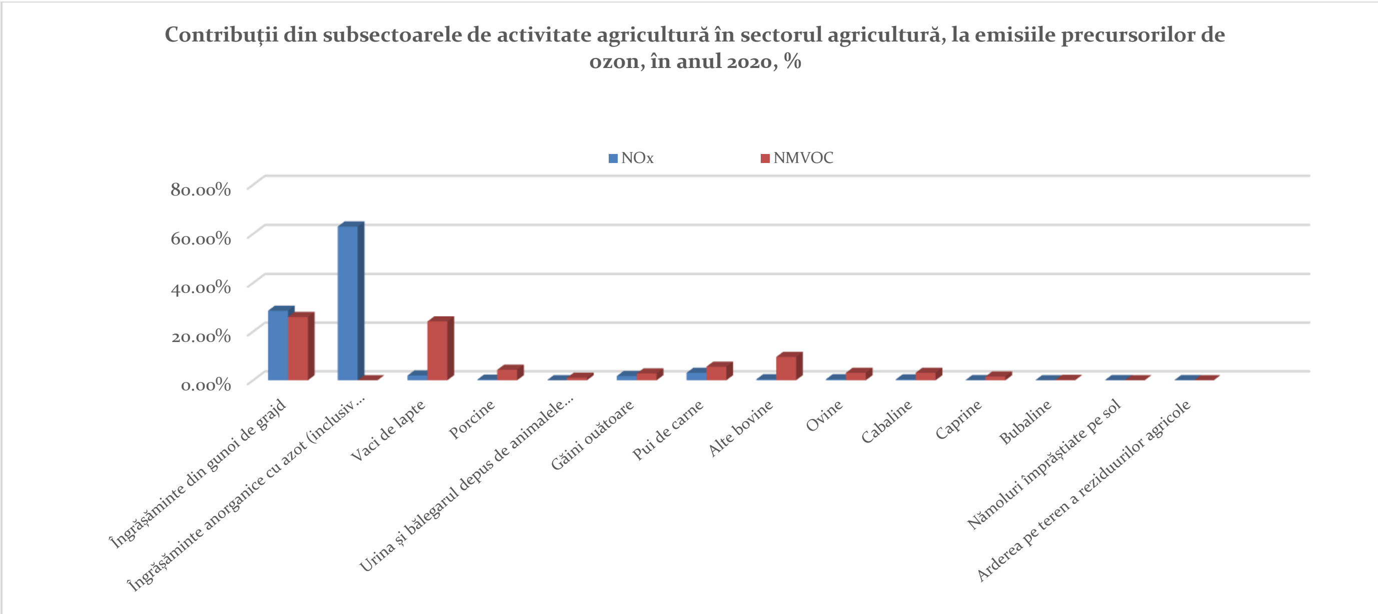
Figure XI.64 -The contributions of the sub-sectors of activity in the agricultural sector to the emissions of pollutants with an acidifying effect (NOx and NH3), in 2020



Source: Romania's Informative Inventory Report 2022

The data regarding the trend of *anthropogenic emissions of ozone precursor pollutants from ground level* (troposphere): nitrogen oxides (NOx), carbon monoxide (CO), methane (CH_4), and non-methane volatile organic compounds (NMVOCs) *originating from subsectors of the agricultural sector* are presented graphically in *Figure XI.65*. From the analysis of the data regarding the contribution of agricultural sector activities to ozone precursor emissions at the national level, it is observed that activities related to livestock breeding (dairy cows, meat chickens, other cattle) along with those related to the application of fertilizers from manure have the highest share for NMVOC pollutant. As for NOx emissions, the main emitter is the subsector related to the application of inorganic nitrogen-based fertilizers (including urea) and the subsector related to the application of fertilizers from manure.

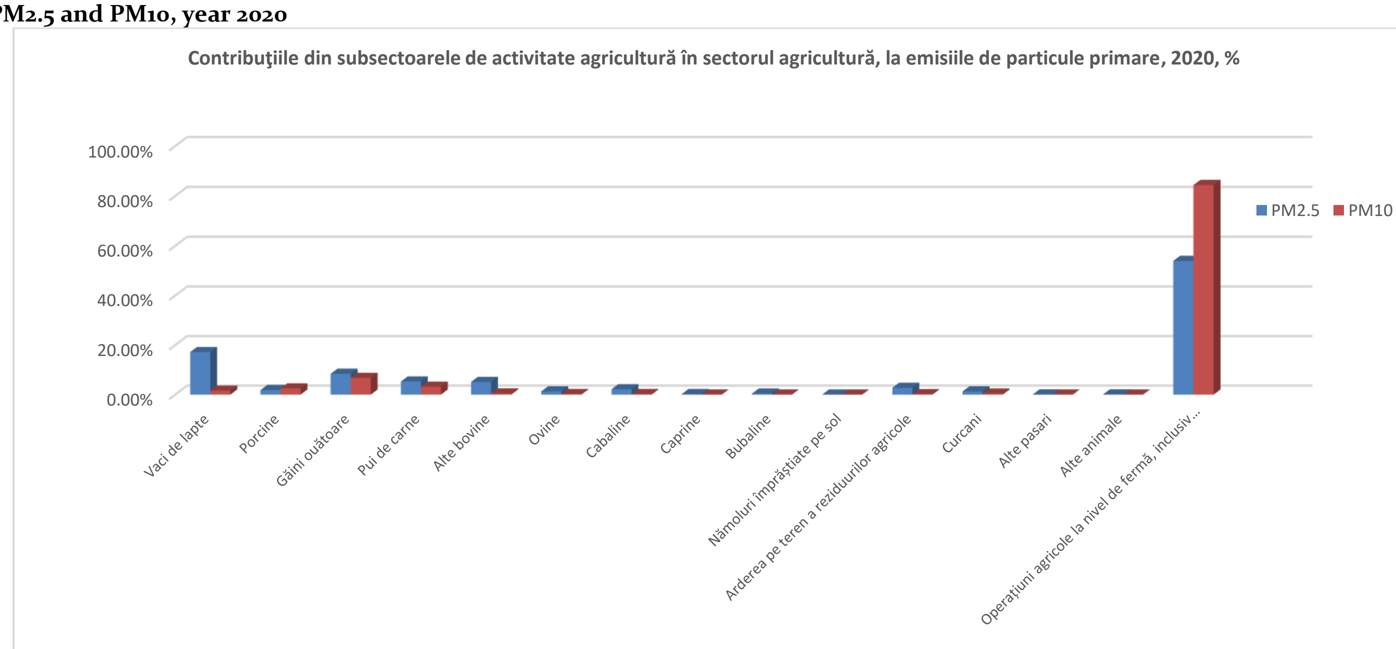
Figure XI.65 -The contributions of the subsectors of activity in the agricultural sector to the emissions of ozone precursors (NMVOC and NOx), in 2020



Source: Romania's Informative Inventory Report 2022

The contributions of subsectors within the agricultural sector to primary particle emissions PM2.5 and PM10 in the year 2020 are presented graphically in *Figure XI.66*. From the analysis of the data regarding the contribution of agricultural sector activities to primary particle emissions PM2.5 and PM10 in the agricultural sector, it is observed that a significant share is held by activities related to agricultural operations on farms, transportation, and storage of agricultural products, followed by dairy cow farming.

Figure XI.66 -The contributions of the subsectors of activity in the agricultural sector to the emissions of primary particles PM2.5 and PM10, year 2020



Source: Romania's Informative Inventory Report 2022

The agricultural sector had a national contribution of 0.0661 tons in the year 2020, representing 0.1% of the national total for polycyclic aromatic hydrocarbon emissions resulting from on-field burning of agricultural residues.

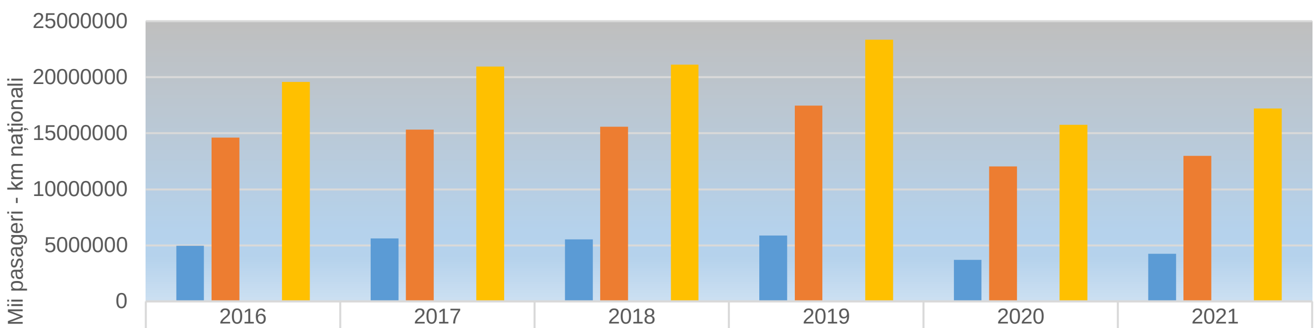
Transport

RO 35
Indicator code Romania: RO 35
EEA indicator code: CSI 35
TITLE: **PASSENGER TRANSPORT DEMAND**
DEFINITION: Passenger transport demand is defined as the sum of domestic passenger-kilometers traveled each year. Domestic passenger transport includes transport by cars, buses and coaches and trains

The indicator presents data related only to domestic transport, regardless of the nationality of the transport vehicle, for passenger transport by cars, buses, and coaches, as well as trains (excluding metro and trams) over a period of at least 5 years. The variable is calculated from the indicator "passenger-kilometer" (pkm), defined as the transportation of one passenger over a distance of one kilometer. *Figure XI.67* presents the share of passenger transport modes [thousands of passengers - national km] at the national level for the period 2016 – 2021. *Table XI.34* presents the share of each mode of transport in the total passenger-kilometers [% pkm] at the national level for the period 2016 – 2021. Notice the relatively different variations for the three modes of transport: rail, road, and water, between 2016 and 2021. In the year 2021, 341,811 thousand passengers were transported in interurban and international transport, and 1,374,994 thousand passengers in local public transport. The majority of passengers were recorded in local public transport by buses and minibuses, totaling 781,934 thousand passengers.

[***Source:***
https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf]

Figure XI.67 -Share of passenger transport modes [thousand passengers – national km] at national level, 2016 – 2021



	2016	2017	2018	2019	2020	2021
Feroviar	4952622	5629215	5542677	5866008	3700445	4239195
Rutier	14609472	15319994	15573425	17478123	12039970	12972769
Căi navigabile	7,650	7,650	6,000	5,572	6,699	7,352
Total	19569744	20956859	21122102	23349703	15747114	17219316

Feroviar Rutier Căi navigabile Total

Source: Ministry of Transport and Infrastructure,www.mt.ro

Share of each mode of transport in passenger transport

Table XI.34 - Share of each mode of transport in total passenger transport (% pkm), 2016 – 2021

%	2016	2017	2018	2019	2020	2021
Railway	17.50	17.41	15.49	16,28	23.49	24.61
Road	81.97	81.86	83,82	83.07	76.45	75.33
Waterways	0.04	0.04	0.03	0.03	0.04	0.04
TOTAL	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source: Ministry of Transport and Infrastructure,www.mt.ro

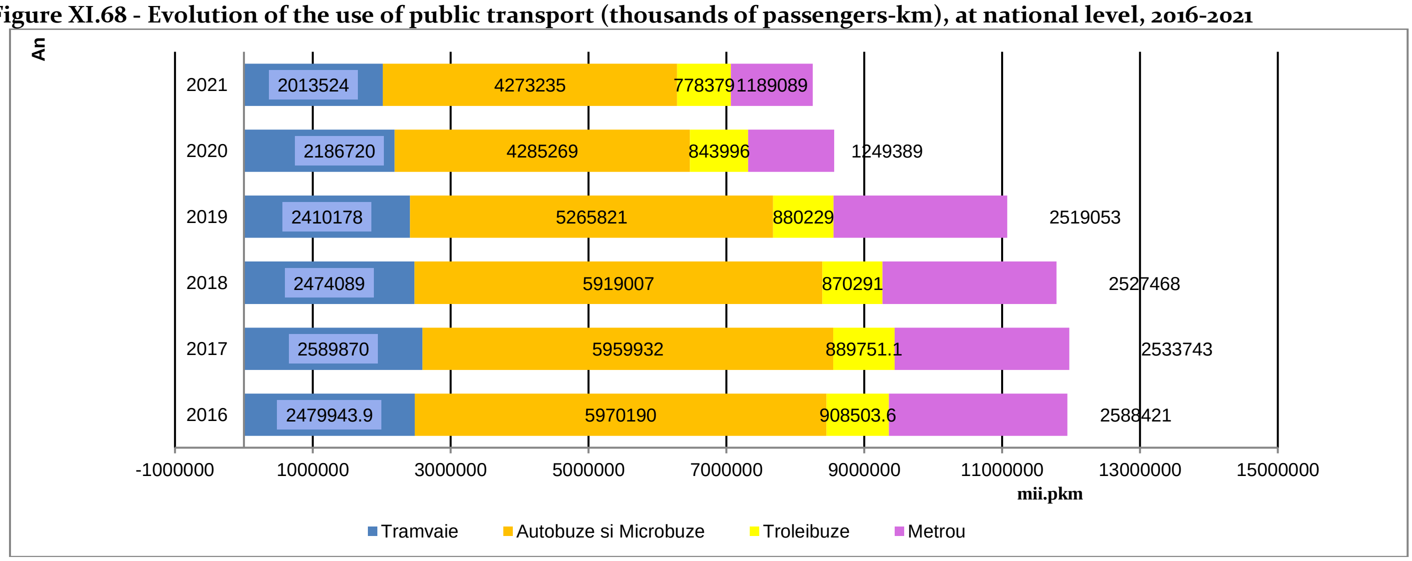
Use of Public Transport. The volume of **local public passenger transport** refers to transportation by bus, minibus, metro, trams, and trolleybuses. Local public passenger transport includes transportation within the administrative-territorial area of a locality without exceeding its limits. The calculated variable is *passenger-kilometer (pkm)*, defined as the transportation of one passenger over a distance of one kilometer. Analyzing the trend in the use of public transport (*Table XI.35 and Figure XI.68*), a fluctuating trend is observed in the period 2016-2021.

Table XI.35 - Evolution of the use of public transport (thousands of passengers-km), at national level, 2016 – 2021, thousand passenger-km

Use of public transport	2016	2017	2018	2019	2020	2021
TRAMS	2479943.9	2589870.0	2474089	2410178	2186720	2013524
Buses, minibuses	5979190.0	5959932.0	5919007	5265821	4285269	4273235
Trolleys	908503.6	889751.1	870291	880229	843996	778379
Subway	2588421.0	2533743.0	2527468	2519053	1249389	1189089
TOTAL	11956059.2	11973296.0	11790855	11075281	8565374	8254227

Source: Ministry of Transport and Infrastructure,www.mt.ro
https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

Figure XI.68 - Evolution of the use of public transport (thousands of passengers-km), at national level, 2016-2021



Source:: National Institute of Statistics
https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

RO 36
Indicator code Romania: RO 36
EEA indicator code: CSI 36
TITLE: **FREIGHT TRANSPORT DEAMAND**
DEFINITION: The demand for freight transport is defined as the sum of internal tonne-kilometers traveled each year. According to the most recent metadata, internal maritime transport includes road, rail, and inland waterway transport: inland waterways and rail transport are based on movements within the national territory ('territorial principle'), regardless of the nationality of the vehicle or vessel. Road transport is based on all vehicle movements recorded within the reporting country.

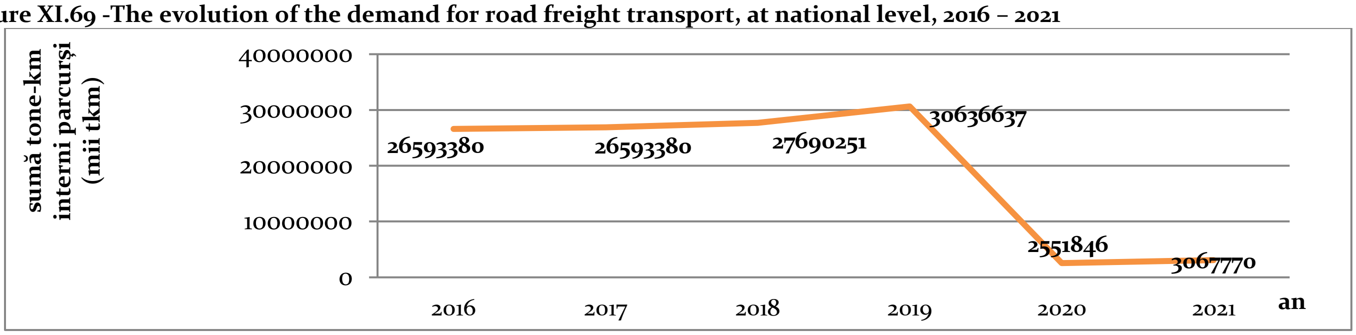
The road transport of goods includes the transport on vehicles registered in the reporting country, and the railway transport and the transport on inland waterways include the transport on the national territory, regardless of the nationality of the transport vehicle, registered for a period of at least 5 years. The variable is calculated from the ton-km (tkm) indicator, defined as the transport of one ton of goods over a distance of one kilometer.

Upward trend in the volume of transported goods and their distance in both rail and road transport

Source: https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

From the analysis of the evolution of road freight transport demand *(Figure XI.69)*, it can be observed that **in 2021, road freight transport** recorded a 15.1% increase in terms of transported goods volume compared to 2020. Out of a total of 306,777 thousand tons of goods transported, 82.2% were recorded in national transport, marking a 16.1% increase from the previous year. The distance traveled by the goods increased by 12.4% compared to 2020, with national transport showing an 18.4% increase. In **rail transport**, the volume of goods increased by 15.6% compared to the previous year, attributed to positive trends in all components. A total of 57,424 thousand tons of goods were transported, with 81.8% in national transport. The tariff distance of the goods increased by 10.9%, with international transport showing the most significant increase among components, at 14.5%. **Maritime transport** saw 53,121 thousand tons in international transport, a 12.5% increase compared to 2020. **Goods transported on inland waterways** totaled 32,120 thousand tons, with 50.2% in national transport. The volume of transported goods increased by 5.2% compared to the previous year, while the distance traveled by the goods decreased by 0.9%. **Transport through main oil pipelines** recorded 6,385 thousand tons of goods transported, a 0.4% decrease from 2020, while the distance traveled by the goods totaled 1,087 million tonne-kilometers, a 1.6% increase from the previous year. In **air transport**, the volume of transported goods totaled 41 thousand tons, a 1.9% increase from 2020. The values for the year 2021 compared to 2020 for the volume of transported goods are presented in Figure XI.17 and for the distance traveled by the goods (for the transport modes for which, according to legislation, this indicator is calculated) in Figure XI.18.

Figure XI.69 -The evolution of the demand for road freight transport, at national level, 2016 – 2021



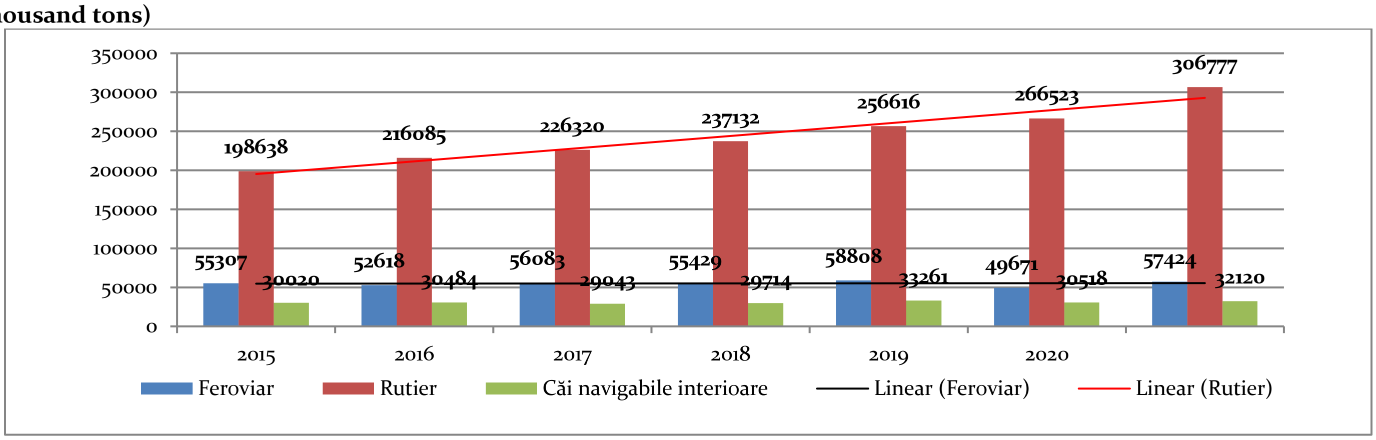
Source: National Institute of Statistics

Source: https://insse.ro/cms/sites/default/files/field/publicatii/transportul_de_pasageri_si_marfuri_pe_moduri_de_transport_in_anul_2021.pdf

The share of each mode of transport in the freight transport

The considered modes of transportation are: a) road, b) rail, and c) inland waterways. Road freight transport encompasses transportation on vehicles registered in the reporting country, while rail and inland waterway transport include transportation within the national territory, regardless of the nationality of the transport vehicle. The share is calculated from *the indicator tonne-kilometer (tkm)*, defined as the transportation of one ton of goods over a distance of one kilometer. It is observed that both in the case of passenger and freight transport, road transport holds a significant share compared to other modes of transportation. Additionally, *sustainable mobility objectives* require shifting an increasingly larger volume of passenger and freight transport from road to rail. *Figure XI.70 presents the volume of transported goods in Romania, by rail, road, and inland waterways, for the period 2015 – 2021, in thousand tons. Figures XI.20 – XI.23 show the types of transport by divisions of transported goods in the year 2021. Tables XI.11 and XI.12* present the evolution for the year 2021 compared to 2020 for transported goods and their distance by modes of transport; and Figure XI.24 illustrates the share of each mode of transport in freight transport (tkm), at the national level, for the period 2015 – 2019.

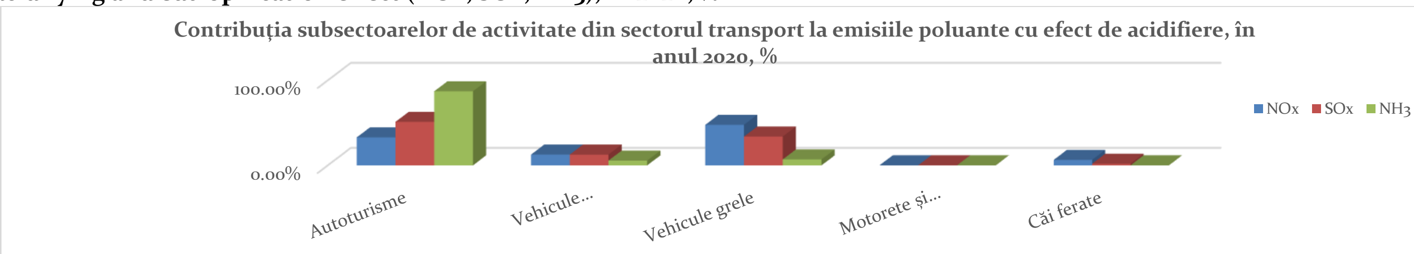
Figure XI.70 - The volume of goods transported in Romania, by rail, road and inland waterways, in the period 2015 – 2021 (thousand tons)



Source:National Institute of Statistics ,Ministry of Transport and Infrastructure

Based on the acidifying potential of anthropogenic emissions of nitrogen oxides (NOx), ammonia (NH_3), and sulfur oxides (SOx, SO_2), *Figure XI.71* presents the proportions of activity sub-sectors within the transport sector (excluding aviation) in the year 2020. From the analysis of the presented data regarding the acidifying potential of anthropogenic emissions of nitrogen oxides (NOx), sulfur oxides (SOx, SO_2), and ammonia (NH_3), it can be observed that within the total transport emissions, the largest contribution comes from road transport, specifically the category of passenger cars, followed by heavy-duty vehicles, light-duty vehicles, and rail transport.

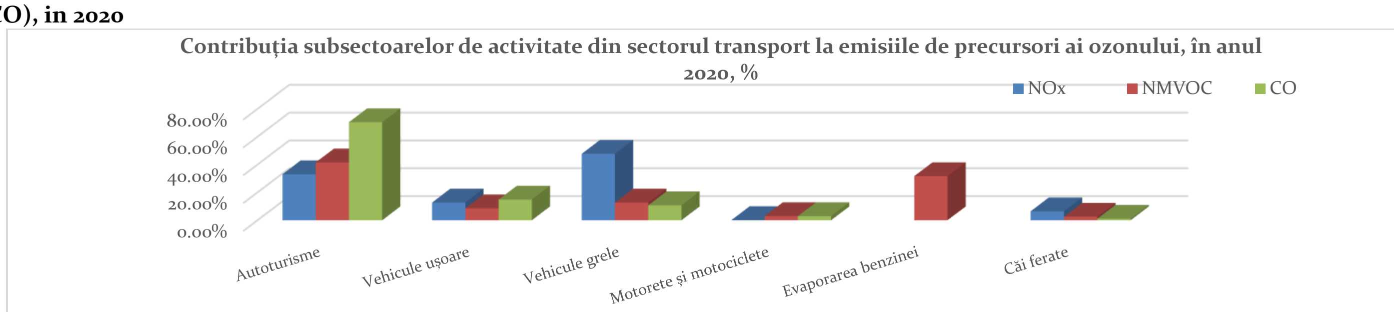
Figure XI.71 - The contribution of the activity subsectors in the transport sector to the emissions of pollutants with an acidifying and eutrophication effect (NOx, SOx, NH3), in 2020, %



Source: Romania's Informative Inventory Report 2022

In Figure XI.72, the graph illustrates the contribution of activity sub-sectors within the transport sector to ozone precursor emissions (NOx, NMVOC, CO) in the year 2020. It is observed that in the transport sector, road transport, specifically the category of passenger cars, has the highest share for carbon monoxide (CO) and non-methane volatile organic compounds (NMVOC). Additionally, for nitrogen oxides (NOx), heavy-duty road transport holds the highest contribution. Evaporation processes in vehicles equipped with gasoline engines significantly contribute to emissions of non-methane volatile organic compounds (NMVOC).

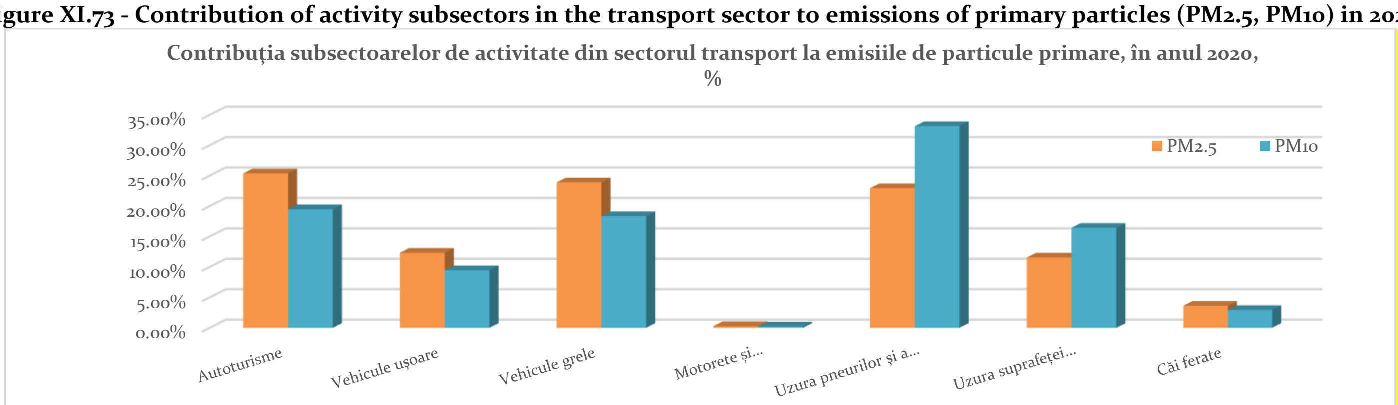
Figure XI.72 - The contribution of activity subsectors in the transport sector to emissions of ozone precursors (NOx, NMVOC, CO), in 2020



Source: Romania's Informative Inventory Report 2022

In Figure XI.73, the graph illustrates the contribution of activity sub-sectors within the transport sector to emissions of primary particles with a diameter smaller than 2.5μm (PM2.5) and 10μm (PM10), relative to the total emissions from this sector. From the analysis of the data within the transport sector, it is observed that primary particle emissions and precursor emissions for secondary particles primarily originate from road transport.

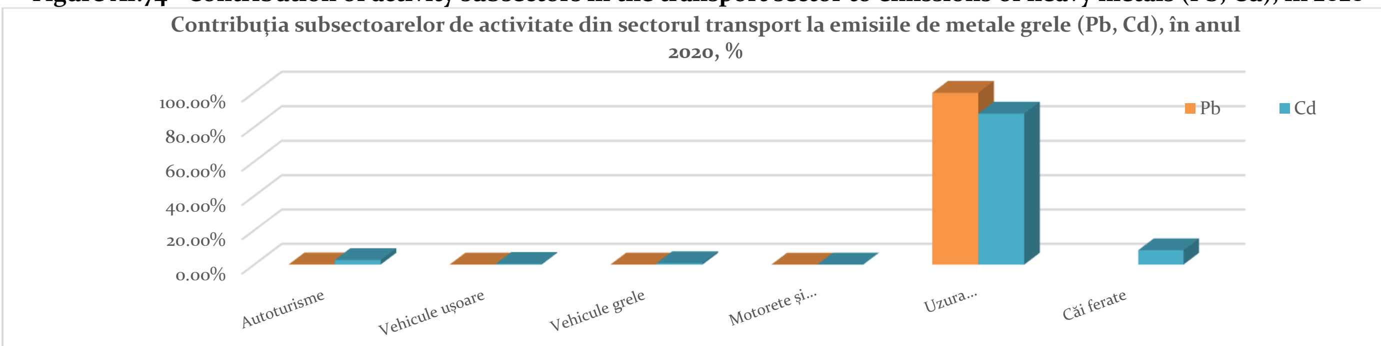
Figure XI.73 - Contribution of activity subsectors in the transport sector to emissions of primary particles (PM2.5, PM10) in 2020



Source: Romania's Informative Inventory Report 2022

In Figure XI.74, the graph presents the proportion of anthropogenic emissions of heavy metals (Pb, Cd) from sub-sectors within the transport sector in the year 2020. It is observed that within the transport sector, the largest contribution to heavy metal emissions comes from tire and brake wear from road vehicles.

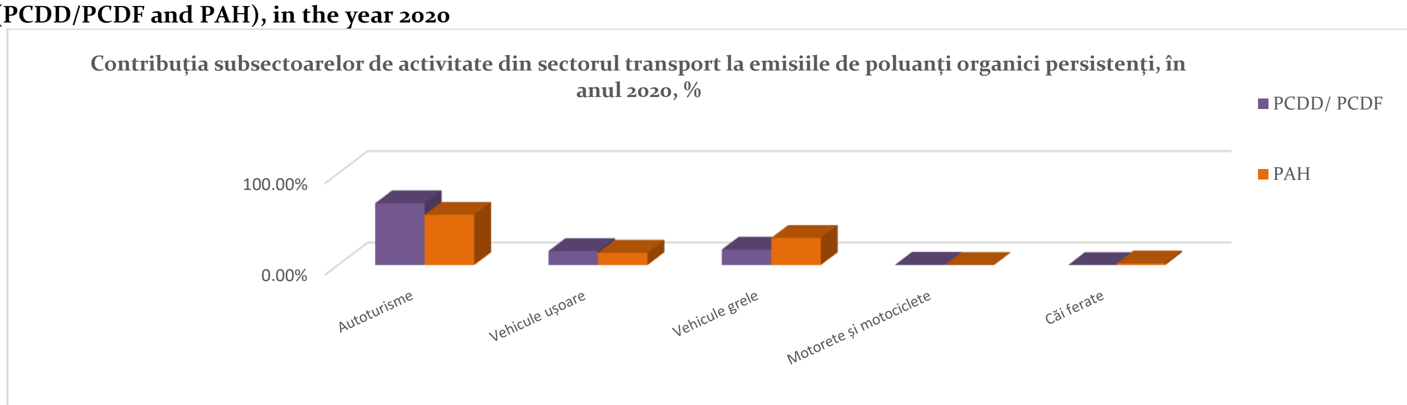
Figure XI.74 - Contribution of activity subsectors in the transport sector to emissions of heavy metals (Pb, Cd), in 2020



Source: Romania's Informative Inventory Report 2022

In Figure XI.75, the graph presents the proportion of anthropogenic emissions of persistent organic pollutants (dioxins - PCDD, furans - PCDF, and polycyclic aromatic hydrocarbons - PAH) from sub-sectors within the transport sector in the year 2020. It is observed that within the transport sector, the highest share of emissions of persistent organic pollutants comes from road transport, specifically the passenger cars category, followed by the heavy-duty vehicles and light-duty vehicles categories.

Figure XI.75 - Contribution of activity subsectors in the transport sector to emissions of persistent organic pollutants (PCDD/PCDF and PAH), in the year 2020



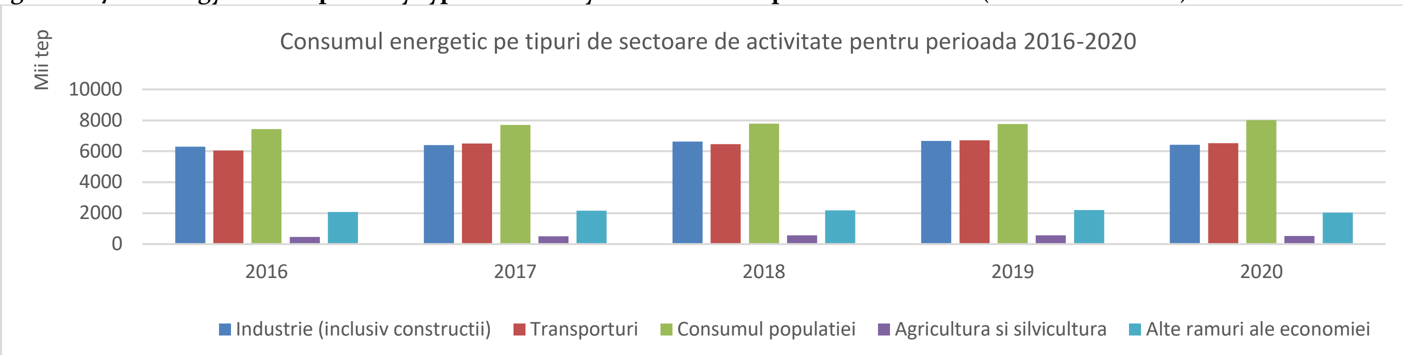
Source: Romania's Informative Inventory Report 2022

Housing

RO 27
Indicator code Romania: RO 27
EEA indicator code: CSI 27
TITLE: **FINAL ENERGY CONSUMPTION BY ACTIVITY SECTOR TYPE**
DEFINITION: Final energy consumption covers the energy supplied to the final consumer for the most diverse energy purposes

In figure XI.76 regarding energy consumption by types of activity sectors in the period 2016-2020, it can be observed that the largest share is held by energy consumption in the residential sector, followed by industry activities and transport activities.

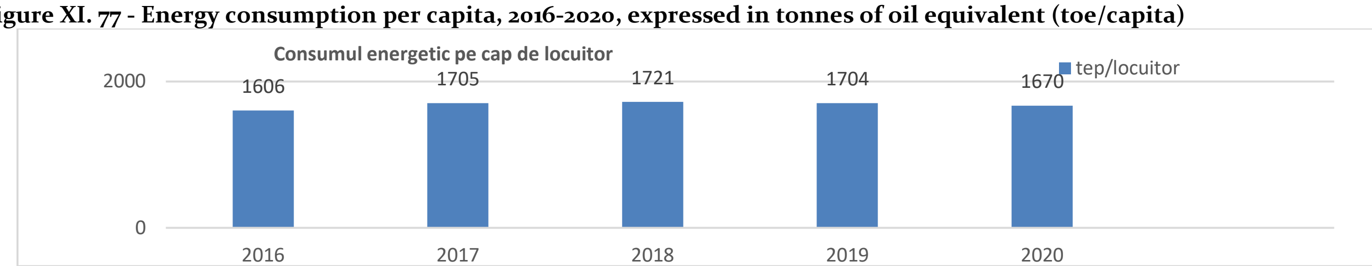
Figure XI.76 - Energy consumption by types of activity sectors for the period 2016 – 2020 (thousands of toe)



Source:http://www.insse.ro

Gross domestic energy consumption per inhabitant in 2020 it was 1670 kg oil equivalent, down 2.0% compared to 2019 - *figure XI.77*.

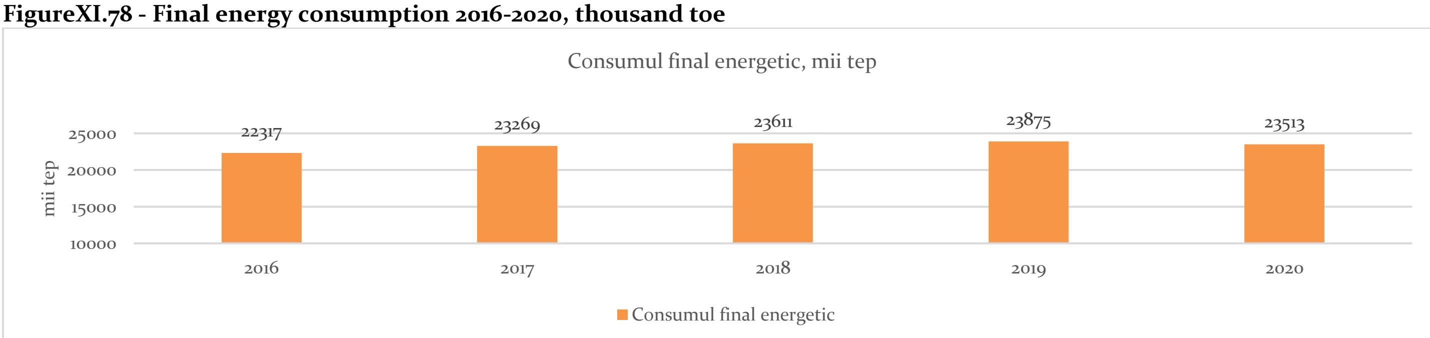
Figure XI. 77 - Energy consumption per capita, 2016-2020, expressed in tonnes of oil equivalent (toe/capita)



Source:http://www.insse.ro

Final energy consumption in 2020 decreased by 362 thousand toe (-1.5%) compared to 2019.(*figure XI.78*). Final energy consumption recorded decreases in almost all types of economic activities, except construction (+10.1%). The final energy consumption of the population increased compared to the previous year, both quantitatively (+254 thousand toe, representing 3.3%), and as a share in the total final energy consumption (34.0%, compared to 32.5% in the year 2019). *Source:http://www.insse.ro*

FigureXI.78 - Final energy consumption 2016-2020, thousand toe



Source:http://www.insse.ro

Trends: Romania's energy consumption between 2030 and 2050

The analysis of energy consumption by resource types and demand segments does not show major changes in energy consumption by demand segments and sectors of activity. However, significant transformations will occur in the energy mix, particularly noticeable in the demand for various types of energy at the sectoral level and in terms of technologies used (*Source: Energy Strategy of Romania 2019 – 2030, with the perspective of 2050,http://energie.gov.ro*).

RO 10
Indicator code Romania: RO 10
EEA indicator code: CSI 10
TITLE: **THE TREND OF GREENHOUSE GAS EMISSIONS**
DEFINITION: The indicator represents the trends (total and by sector) of greenhouse gas emissions in relation to the obligations of the member states to comply with the objectives of the Kyoto protocol

Starting from the year 2002, Romania annually submits to the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) as a Party to the UNFCCC/Kyoto Protocol (KP), the National Inventory of Greenhouse Gas Emissions (NIGGE). Additionally, as a Member State of the European Union since 2007, Romania also submits the inventory to the European Commission and the European Environment Agency. The NIGGE is managed in accordance with associated legal provisions at international, European Union, and national levels. The administration of the inventory is supported through the implementation of the National Inventory Arrangements (NIA) and arrangements associated with the National System for estimating anthropogenic emissions from sources or removals through sequestration of all greenhouse gases (NSNEAGG). Methodologically, the NIGGE is developed using IPCC applicable methodologies: the IPCC Guidelines for National Greenhouse Gas Inventories, a document prepared by IPCC in 2006 (IPCC 2006), the Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol, a document prepared by IPCC in 2013 (KP Supplement), and the Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, a document prepared by IPCC in 2013: Wetlands (Wetlands Supplement). *The NIGGE serves as a reporting tool for anthropogenic greenhouse gas emissions and removals. It includes elements in the Common Reporting Format (CRF) (CRF tables and the xml-type database) and the NIR Report. The NIR Report provides detailed information on how the inventory was developed and contains general data and information, sector-specific data and information from the NIGGE, as well as other additional data and information required by the Kyoto Protocol*.

The total greenhouse gas emissions (excluding the contribution of the Land Use, Land Use Change and Forestry sector - LULUCF) decreased by approximately 3.52% in 2020 compared to the emissions level recorded in 2019 (*Table XI.36*). The share of greenhouse gas emissions from the Energy sector in the total greenhouse gas emissions (excluding the contribution of the LULUCF sector) for the year 2020 was approximately 66.25%. The contributions of sub-sectors attributed to the Energy sector are as follows: Energy Industry 25.18%; Manufacturing and Construction Industry 20.30%; Transport 25.26%; Fugitive Emissions 11.58%; Other sub-sectors 17.47%. The contribution of other sectors in the NIGGE for the year 2020 is represented as follows: Industrial Processes and Product Use (IPPU) is approximately 11.71%; Agriculture represents 16.66%; Waste is 5.38%.

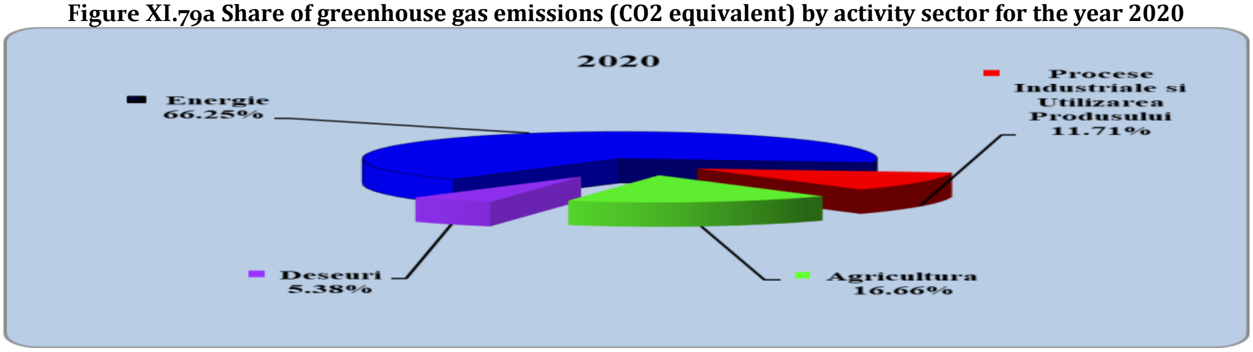
Table XI.36 Greenhouse gas emissions by activity sector

No. crt.	Sector/Sub-sector - NIGGE	Emissions (kt CO2 equiv.)		Trend (%)	
		2019	2020		
1	**Energy**	76,350.44	72,834.34	-4.61	↘
	- Energy industry	22,130.93	18,339.29	-17.13	↘
	-Manufacturing industry and constructions	13,656.83	14,781.93	8.24	↗
	- Transport	18,936.57	18,401.03	-2.83	↘
	- Institutional commercial	2,250.68	2,090.24	-7.13	↘
	-Residential	7,946.08	8,366.10	5.29	↗
	- Fugitive emissions	9,212.56	8,584.68	-6.82	↘
2	**Industrial processes and product use**	12,786.25	12,867.96	0.64	↗
3	**Agriculture**	18,861.24	18,315.85	-2.89	↘
4	**Waste**	5,941.45	5,916.18	-0.43	↘
5	**Total GHG (excluding LULUCF)**	113,939.38	109,934.33	-3.52	↘

Source: NEPA

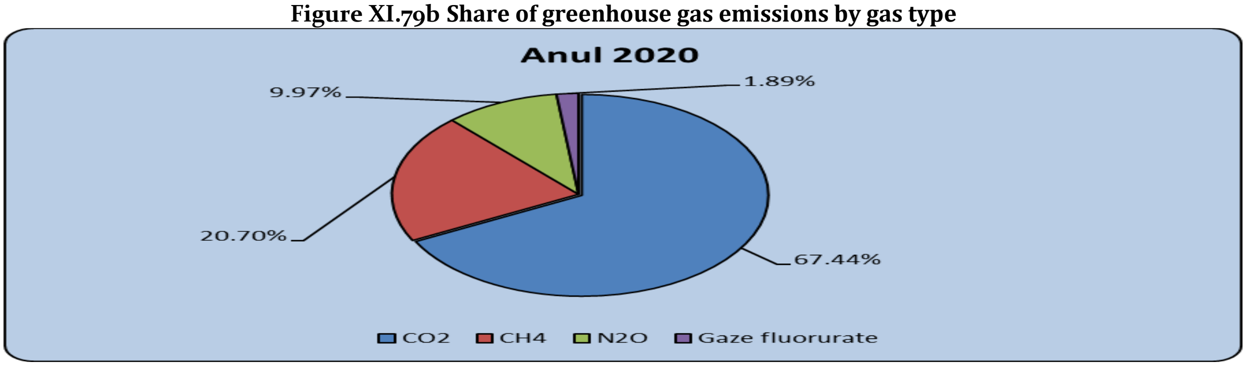
In *Figure XI.79a*, the share of emissions for the year 2020 by sectors of activity is presented. In *Figure XI.79b*, the share of greenhouse gas emissions by gas type for the year 2020 is presented, as well as the changes in greenhouse gas emissions for the year 2020 compared to 2019, expressed in percentages.

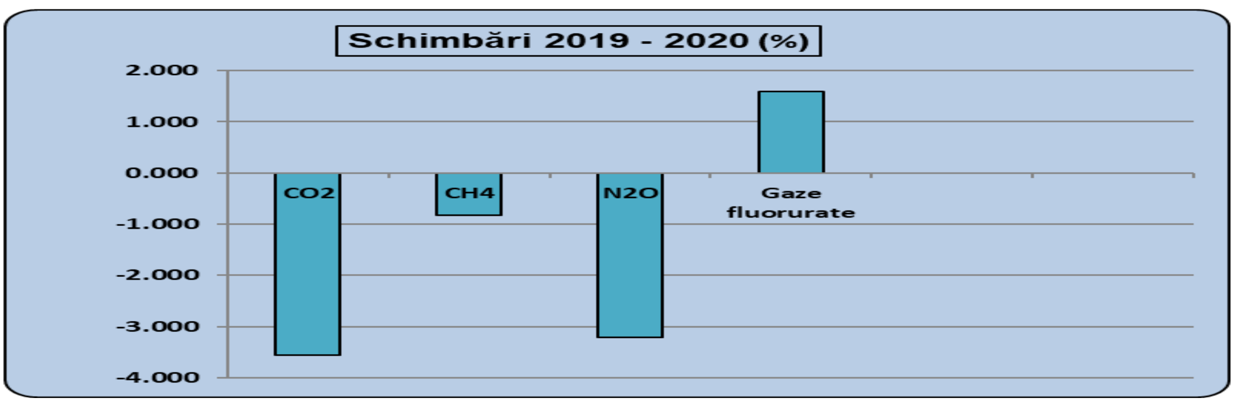
Figure XI.79a Share of greenhouse gas emissions (CO2 equivalent) by activity sector for the year 2020



Source:National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

Figure XI.79b Share of greenhouse gas emissions by gas type

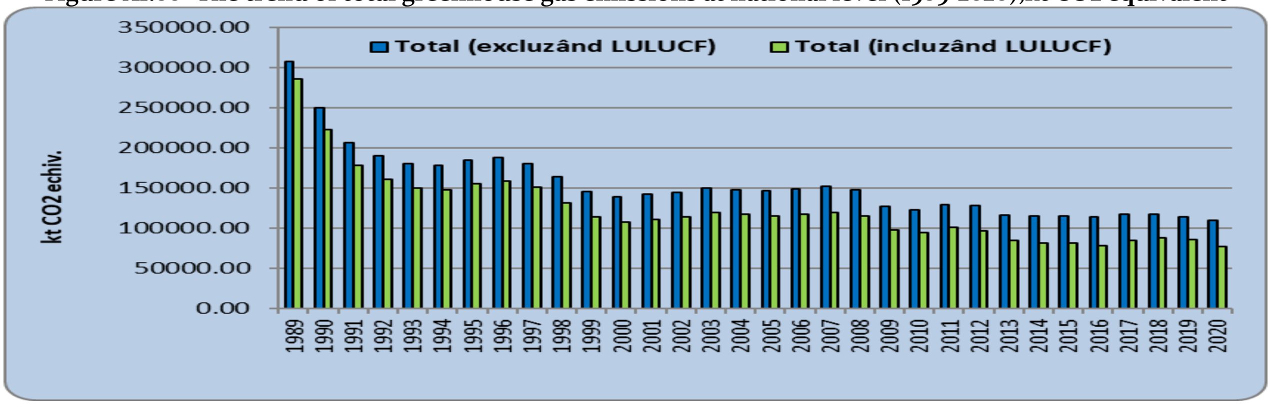




Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

In 2020, total greenhouse gas (GHG) emissions (excluding the 'Land use, land use change and forestry - LULUCF' sector) decreased by 64.20% compared to the emissions level in 1989. Meanwhile, net GHG emissions/retentions (taking CO_2 retentions into account) decreased by 73.02% (*Figure XI.80*). The total GHG emissions in 2020, excluding sequestration by absorbers, amounted to 109,934.33 kt CO_2 equivalent. The emission trend reflects changes during this period characterized by the transition to a market economy. This period can be divided into three sub-periods: 1989-1999, 2000-2008, and 2009-2020. The decline in economic activities and energy consumption between 1989 and 1992 directly led to the reduction in total emissions during this period. With the entire economy in transition, some major energy-consuming industries reduced their activities, resulting in a reduction of GHG emissions. Emissions started to increase until 1996, following the revitalization of the economy. Considering the start of operation of the first reactor at the Cernavodă nuclear power plant (1996), emissions decreased again in 1997 and continued to decline until 1999. The level of emissions increased after 2000, reflecting economic development during the period 2000-2008. The limited decrease in GHG emissions in 2005, compared to the levels in 2004 and 2006, was caused by the hydrological year positively influencing energy production in hydroelectric plants. Due to the global financial and economic crisis, GHG emissions decreased again in the period 2009-2012 and stabilized in the period 2013-2016. In 2017-2018, GHG emissions increased slowly in relation to the rise in the level of economic activities (*Figure XI.80*).

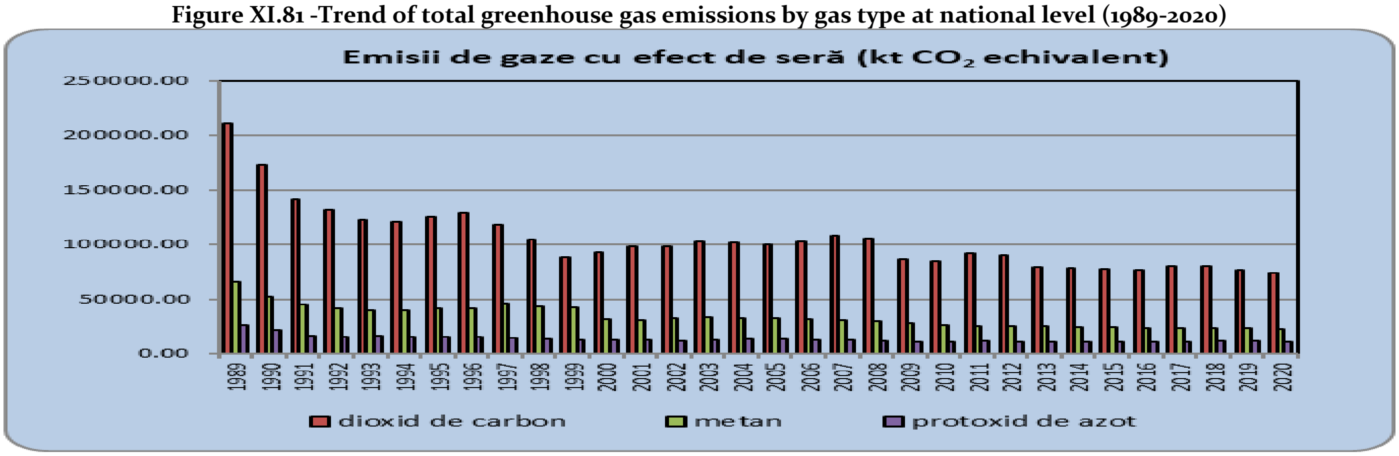
Figure XI.80 -The trend of total greenhouse gas emissions at national level (1989-2020),kt CO_2 equivalent



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

Among the greenhouse gases monitored at the national level, carbon dioxide (CO_2) represents the pollutant with the most significant share, followed by methane (CH_4) and nitrous oxide (N_2O) (Figure XI.81). ***Carbon dioxide*** (CO_2) is the most important anthropogenic greenhouse gas. The decrease in CO_2 emissions by 64.86% in 2020 compared to 1989 (from 210,970.96 kt in 1989 - 68.71% to 74,138.01 kt in 2020 - 67.44%) is attributed to the reduction in the amount of fossil fuels burned in the energy sector (especially in electricity and heat production, as well as manufacturing and construction industries) due to decreased activity**.** ***Methane (CH_4) emissions***, mainly related to fugitive emissions from fossil fuel extraction and distribution and livestock, decreased by 65.25% in 2020 compared to 1989 (from 65,484.39 kt CO_2 equivalent in 1989 to 22,757.37 kt CO_2 equivalent in 2020). The reduction in CH_4 emissions in agriculture is due to reduced animal growth rates. ***Nitrous oxide (N_2O) emissions*** are primarily generated within activities in agricultural soils in the agricultural sector and activities in the chemical industry within the Industrial Processes sector. The decline in these activities (reduction in animal growth rates, reduced application of synthetic fertilizers with applied N on soil quantities, decreased crop production levels) is reflected in the trend of N_2O emissions, which decreased by 58.06% in 2020 (from 26,143.74 kt CO_2 equivalent in 1989 to 10,965.12 kt CO_2 equivalent in 2020).

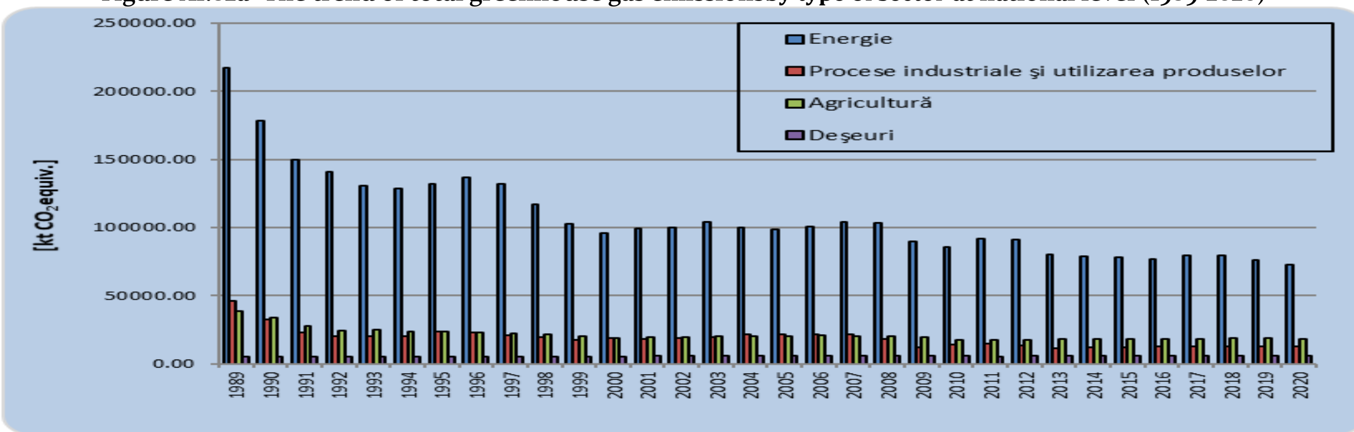
Figure XI.81 -Trend of total greenhouse gas emissions by gas type at national level (1989-2020)



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

Figure XI.82a presents the trends in greenhouse gas (GHG) emissions for each sector within INEGES, excluding the LULUCF sector. GHG emissions from the energy sector decreased by 66.50% compared to the 1989 baseline. A significant decline of 72.06% in GHG emissions was recorded in the Industrial Processes and Product Use sector in 2020, compared to the 1989 level, due to the decline or cessation of certain production activities. GHG emissions from the Agriculture sector also decreased in 2020 by 52.25% compared to the 1989 emissions. This was attributed to the decline in the livestock sector, reduced crop production, and decreased application of synthetic fertilizers based on N on the soil. In the Waste sector, emissions increased by 13.82% in 2020 compared to the 1989 level.

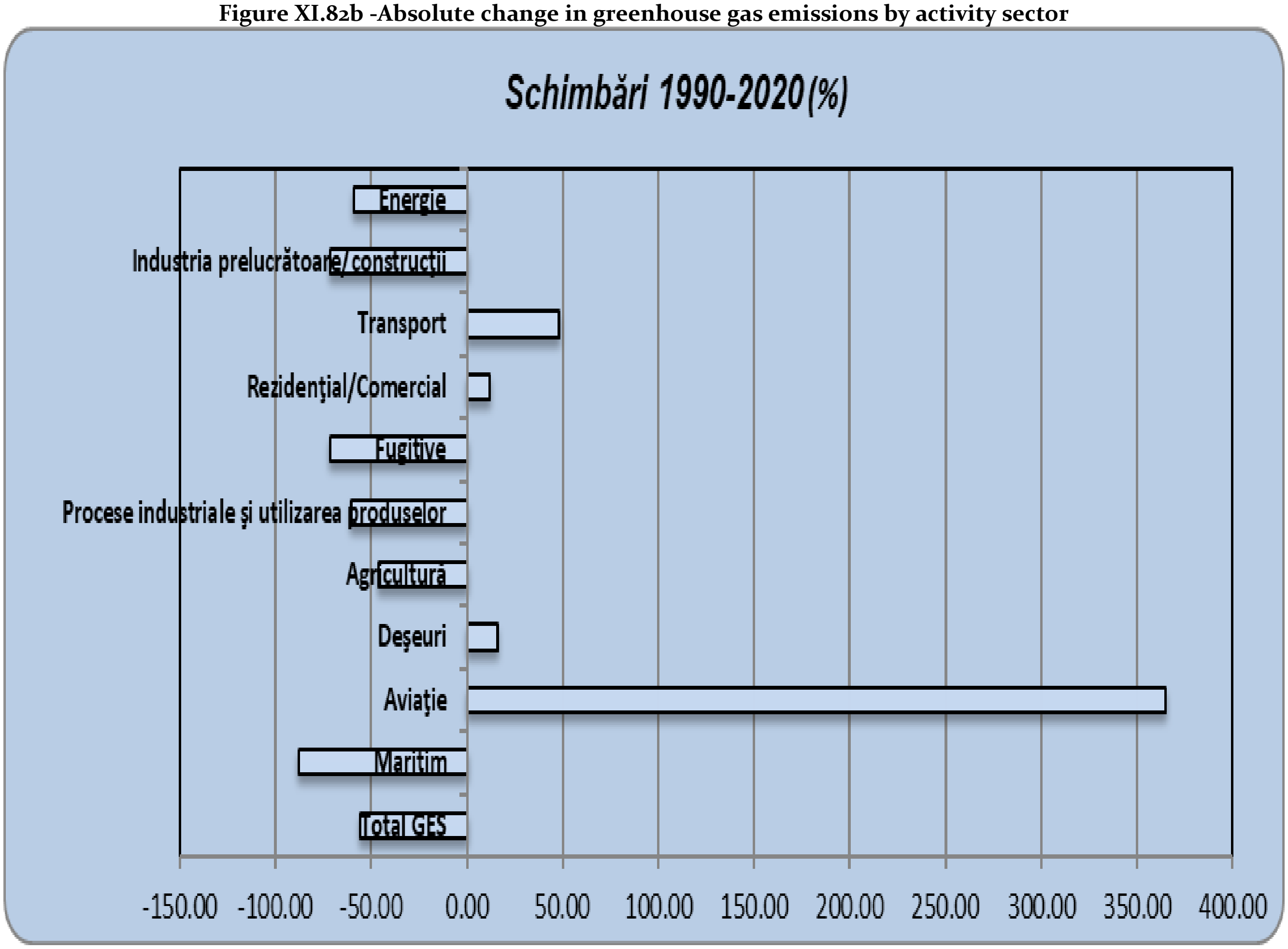
Figure XI.82a -The trend of total greenhouse gas emissionsby type of sector at national level (1989-2020)



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

Figure XI.82b shows the changes in GHG emissions, for each sector of INEGES, at the level of 2020 compared to 1990.

Figure XI.82b -Absolute change in greenhouse gas emissions by activity sector



Source: National emissions reported under the European Union Greenhouse Gas Emissions Monitoring and Reporting Mechanism

RO 16
Indicator code Romania: RO 16
EEA indicator code: CSI 16
TITLE: **MUNICIPAL WASTE GENERATION**
DEFINITION: The indicator expresses the total amount of municipal waste generated per capita (kg per capita and year)

According to the provisions of the National Waste Management Plan, approved by Government Decision no. 942/2017, *'municipal waste' refers to household waste and other waste which, by nature or composition, is similar to household waste*. *According to Emergency Ordinance no. 92/2021 on waste management, municipal waste means: a) mixed waste and separately collected waste from households*, including paper and cardboard, glass, metals, plastics, biodegradable waste, wood, textiles, packaging, waste electrical and electronic equipment, batteries and accumulators, and bulky waste, including mattresses and furniture; b) *mixed waste and separately collected waste from other sources*, where such waste is similar in nature and composition to household waste. *Municipal waste does not include* waste from production, agriculture, forestry, fishing, septic tanks and sewerage systems, including sewage sludge, end-of-life vehicles, or waste from construction and demolition activities. This definition also applies when waste management responsibilities are shared between public and private actors. *The collection of municipal waste* is the responsibility of municipalities, which can carry out these tasks either directly (through specialized services within Local Councils) or indirectly (by delegating this responsibility based on a contract to specialized and authorized sanitation companies).

Generated municipal waste

The value was calculated by summing the quantities generated for the following types of waste:

- household and assimilated waste and from municipal services collected by sanitation operators, excluding inert waste;
- household waste generated and not collected by sanitation operators;
- recyclable waste from the population, collected through authorized economic operators, other than sanitation operators (paper and cardboard, metals, plastic, glass, wood, textiles, WEEE, waste batteries and accumulators).

It includes bulky waste, waste from parks, gardens and street cleaning, including the contents of street waste bins, as well as electrical and electronic equipment waste from households.

Excluded are: Sludges from urban wastewater treatment; Construction and demolition waste.

According to the method of collection, municipal waste is:

- Collected by or on behalf of municipalities;
- Collected directly by private economic operators - valid for WEEE and other types of recyclable waste;
- Generated and not collected by a sanitation operator, but managed directly by the generator.

The amounts of waste generated by the population not served by sanitation services are calculated using *the generation indices provided for in the National Waste Management Plan*. For the year 2020, the generation indices taken into account are: 0.61 kg/capita/day for the urban environment and 0.29 kg/capita/day for the rural environment. *Table XI.37* shows the amounts of municipal waste generated by waste category in the period 2016-2020.

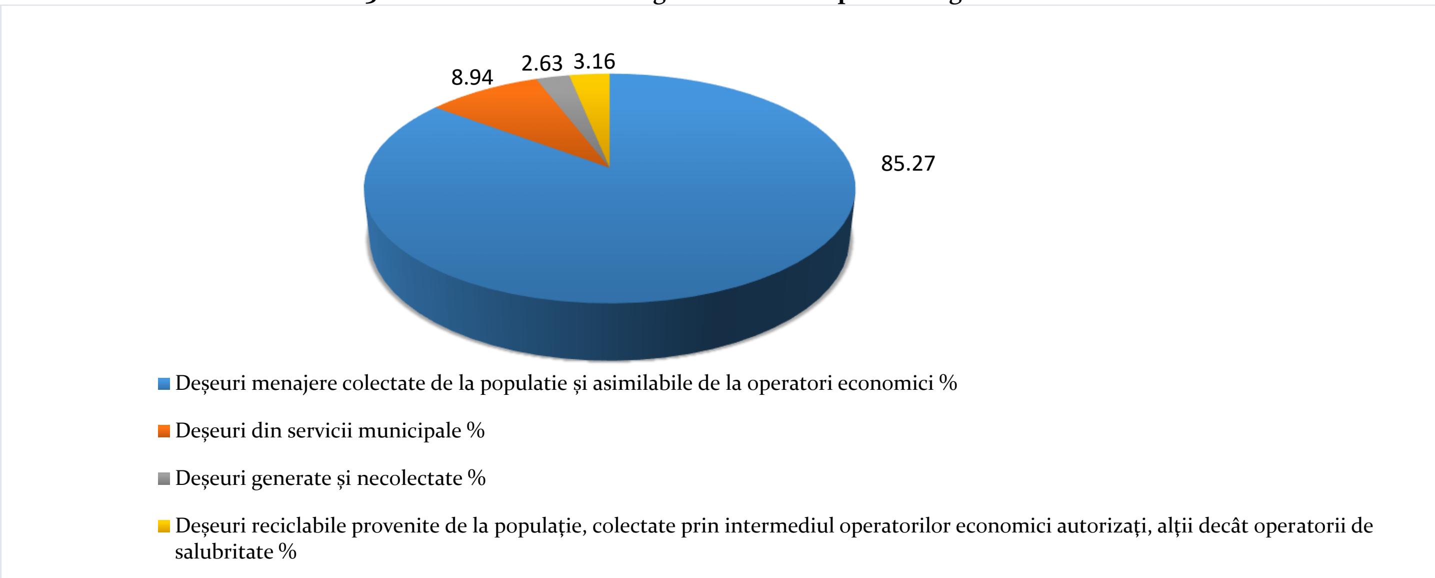
Table XI.37 – Quantities of municipal waste generated during 2016-2020

Indicator name	2016	2017	2018	2019	2020
Amount of generated municipal waste (tons)	5142542	5333171	5296239	5430341	5587893
From which:					
- Household waste collected from the population and assimilated from economic operators (tons)	3894853	4162921	4249988	4632802	4764923
- Waste from municipal services (tons)	454170	400228	430097	419429	499450
- Generated and uncollected waste (tons)	523670	419444	314022	178470	146873
- Recyclable waste from the population, collected through authorized economic operators, other than sanitation operators (tons)	269849	350578	302132	199640	176647
-Municipal waste generation indicator (kg/capita/year)	261	272	272	280	289

Source: National Environmental Protection Agency

Figu

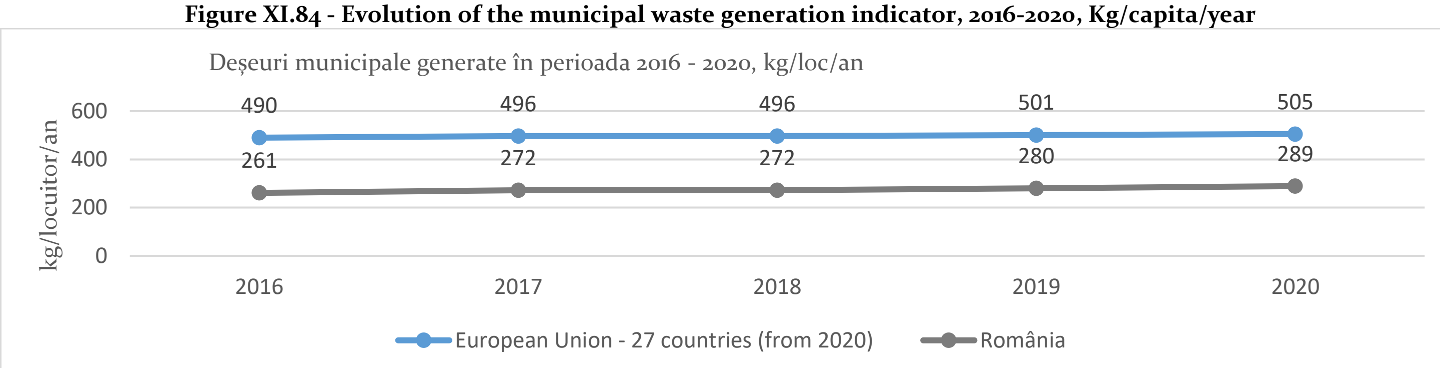
re XI.83 – Share of the main categories of municipal waste generated in 2020



Source: National Environmental Protection Agency

Figure XI.84 shows the evolution of the municipal waste generation indicator in Romania compared to the average recorded in the European Union.

Figure XI.84 - Evolution of the municipal waste generation indicator, 2016-2020, Kg/capita/year



Source: EUROSTAT and the National Environmental Protection Agency - 2022

Sustainable development indicators regarding municipal waste

Sustainable development indicators regarding municipal waste refer to:

- Municipal waste generated;
- Municipal waste treated by: recycling (exclusive of composting and anaerobic digestion), composting, energy recovery and storage.

Considering the above, based on the data reported by waste management operators, authorized waste collection operators other than sanitation operators, authorized waste treatment operators, the following ***sustainable development indicators regarding municipal waste were calculated at the national level***:

- The degree of connection to the sanitation service
- The amount of municipal waste collected separately
- Amount of municipal waste recycled (including composting)
- The degree of recycling achieved for municipal waste.
- The amount of municipal waste used for energy
- The amount of biodegradable waste stored

Specific sustainable development indicators regarding municipal wast eare presented in *table XI.38.*

Table XI.38 – Specific information on municipal waste in the period 2016-2020

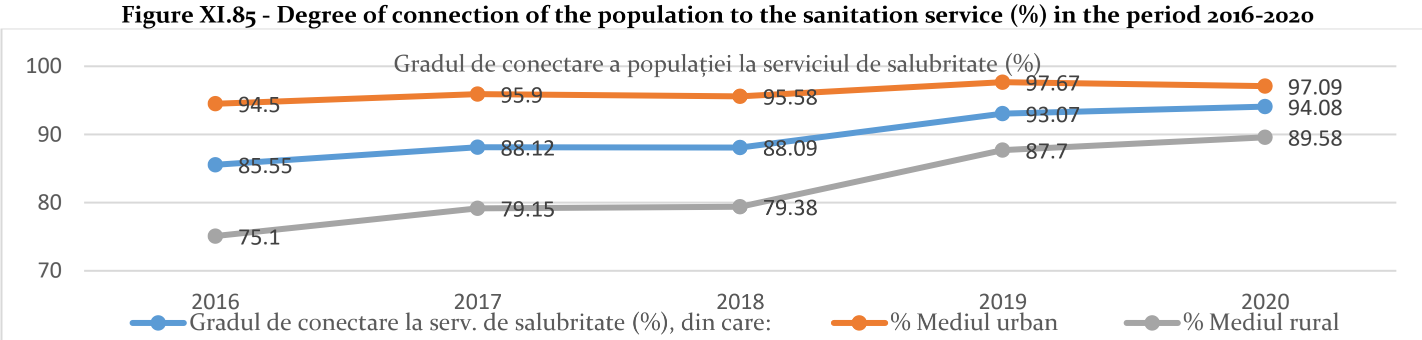
Indicator name	2016	2017	2018	2019	2020
The degree of connection to the sanitation service (%)	85.55	88.12	88.09	93.07	94.08
- Urban area	94.5	95.9	95.58	97.67	97.09
- Rural area	75.1	79.15	79.38	87.7	89.58
Amount of municipal waste collected separately (tons)	580602	696742	634536	576816	685092
Amount of municipal waste recycled * (tons)	689443	745427	586406	623214	662979
The degree of recycling achieved for municipal waste (%)	13.41	13.98	11.07	11.48	11.86
The amount of municipal waste used for energy (tons)	219608	227280	241445	251277	298421
Amount of biodegradable waste from municipal waste deposited (tons)	1913329	2159103	2068288	2120022	2077089
Number of compliant municipal warehouses in operation	37	42	43	44	46
Number of transfer stations in operation	51	52	53	84	95
Number of sorting stations in operation	101	103	105	103	107

**recycled waste comes from both separate collection and waste collected in a mixture, entered into treatment processes*

Source: National Environmental Protection Agency

According to what is presented in figure XI.85, at national level, ***in 2020 the degree of connection of the population to the sanitation service increased to 94%. In the urban environment this is approximately 97% and in the rural environment approximately 90%***.

Figure XI.85 - Degree of connection of the population to the sanitation service (%) in the period 2016-2020

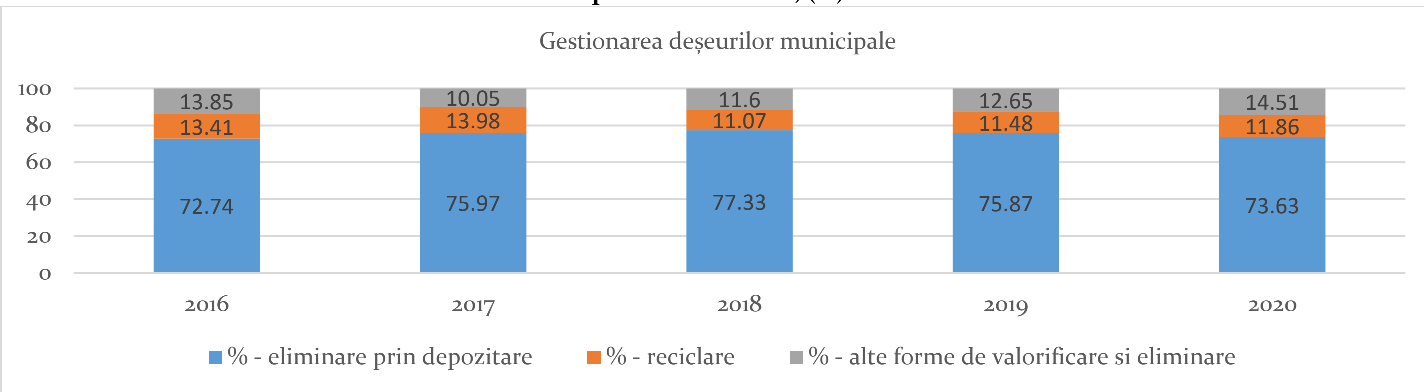


Source: National Environmental Protection Agency

Municipal waste management involves the collection, transportation, recovery, and disposal of waste, including the supervision of these operations and subsequent maintenance of disposal sites. The responsibility for municipal waste management lies with local public administrations, which, either through their own means or by concessioning the sanitation service to an authorized operator, must ensure the collection (including separate collection), transportation, and treatment of these wastes. For certain waste streams categorized as municipal waste, collection is allowed from both the public and authorized business operators. Some of the collected municipal waste is sent directly for final recovery (material or energy), or disposal, while another portion is sent to intermediate treatment facilities (sorting stations, composting) - see *Figure XI.86. The disposal of municipal waste is exclusively through landfilling*. ***As of now, Romania has not put into operation waste incineration facilities for municipal waste. At the end of 2020, 46 compliant landfills for municipal waste were authorized and operational***.

From figure XI.86 it can be seen that in 2020 there was a slight reduction in the quantities of municipal waste stored. However, the amount of stored waste still remains high, which is inconsistent with the principles and objectives adopted by the EU through the circular economy legislative package.

Figure XI.86 - Share of the main municipal waste management activities, in relation to the amount of waste generated, in the period 2016 – 2020, (%)



Source: National Environmental Protection Agency

Note: The decrease in the share of recycled waste starting from 2018 is determined by the change in the calculation methodology - starting this year, the amount of individually composted biodegradable waste was no longer considered recycled, taking into account the provisions of PNGD and European legislation

Reducing the amount of stored biodegradable waste

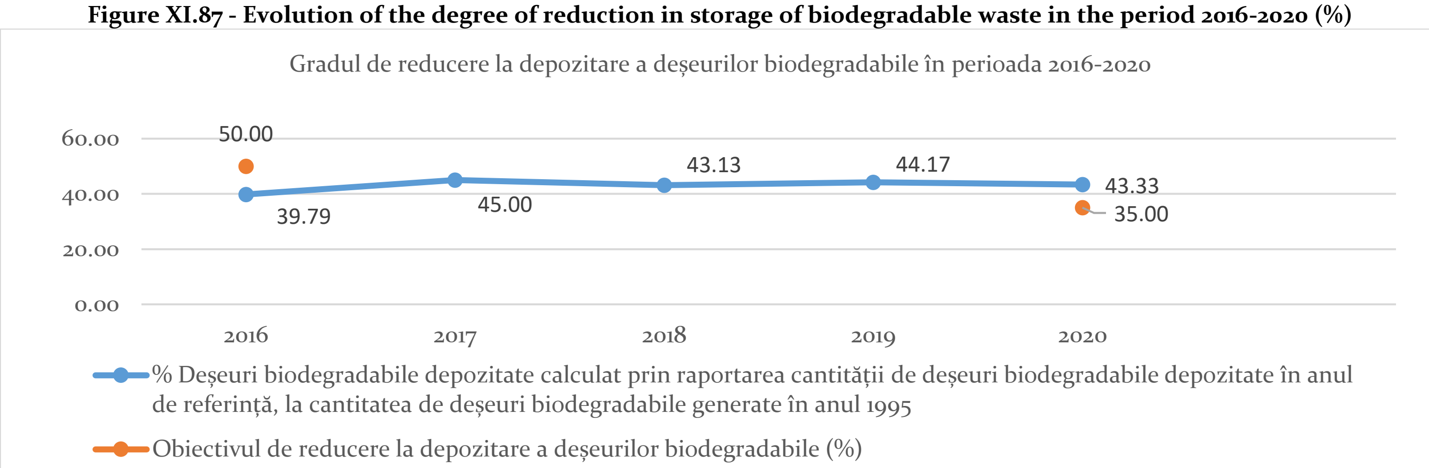
Biodegradable waste, according to waste storage legislative provisions, refers to any waste that can undergo aerobic or anaerobic decomposition, such as food products, garden waste, paper, or cardboard. *According to Government Ordinance no. 2/2021* regarding waste storage, the quantity of biodegradable waste deposited for the year 2020 must be a maximum of 35% of the total quantity, expressed gravimetrically, produced in 1995. Table XI.39 presents the quantities of biodegradable waste generated and deposited during the period 2016-2020.

Table XI.39 – Quantities of biodegradable waste generated and stored in the period 2016-2020

Indicator name	1995	2016	2017	2018	2019	2020
Amount of biodegradable waste generated (million tons)	**4.80**	**2.64**	**2.89**	**2.81**	**2.99**	**3.00**
Amount of stored biodegradable waste (million tons)		1.91	2.16	2.07	2.12	2.08
Biodegradable waste deposited compared to 1995 (%)		39.79	45.00	43.13	44.17	43.33

Source: National Environmental Protection Agency

Figure XI.87 - Evolution of the degree of reduction in storage of biodegradable waste in the period 2016-2020 (%)



Source: National Environmental Protection Agency

As can be seen from the above graph, the objective of reducing the landfilling of biodegradable waste was not achieved.

Energy efficiency of buildings

(*Source: Energy Strategy of Romania 2019 – 2030,with the perspective of 2050,http://energie.gov.ro/- sections VI.6.2.* and VII)

The energy consumption for heating and cooling homes is estimated based on the following: the heated area approximated by the total surface area of the households (m2); the energy requirement for heating per unit area (kWh/m2), which depends on the thermal insulation quality of the dwelling and the number of degree-days (external temperature); the fact that many households in Romania are only partially heated (indoor temperature).

The surface area of approximately 7.47 million permanently occupied households in Romania in 2015 is estimated at 350 million m2 (average useful area of 47 m2), of which almost half are partially heated. The aging population trend will lead to a slight decrease in the number of households, down to 7.14 million permanently occupied households in 2030. However, the useful surface area of households is expected to increase by nearly 40% to 490 million m2; the average useful area will reach 68 m2/household in 2030, an increase of almost 50% from 2015.

Efficiency in energy conversion improves by adopting efficient heating solutions, such as modern heating systems, replacing clay stoves with natural gas or widely adopted heat pump-based heating systems, etc. Some of these investments are recovered quickly, constituting the scope of activity for Energy Service Companies (ESCOs).

The building stock in Romania has relatively low energy efficiency, and the specific energy consumption for heating and cooling is relatively high, with a national average of 157 kWh/m2/year, considering that about half of the households are only partially heated. National programs to improve energy efficiency, alongside rising energy costs, will encourage investments in thermal insulation of households over the next 15 years in all development scenarios.

After 2030, additional improvements in energy efficiency for heating will be more costly, involving more extensive and complex rehabilitation works. Thus, a decrease in specific energy consumption for heating and cooling can be foreseen between 2030 and 2050, from 108 to 81 kWh/m2/year, through average annual investments of 2.6 billion Euros.

The total energy consumption of households will largely follow the heating and cooling needs. The energy demand of households for cooking, heating, lighting, electronics, and appliances is expected to increase very little due to the gradual adoption of new eco-design technologies with increasingly lower specific consumption.

Efficiency of thermal power plants and technological self-consumption

(*Source: Energy Strategy of Romania 2019 – 2030,with the perspective of 2050,http://energie.gov.ro/– sections: VI.6.3, VI.6.8. and VII*)

Thermal power plants in Romania, built mainly during the 1960-1990 period, have a relatively low average efficiency in converting primary energy into electricity, up to 35%. It should be noted that the design efficiency of these groups was 36-37%, comparable to similar groups built in the same period in other European and global countries. Thus, in 2017, for a gross electricity production of 29 TWh in thermal power plants, coal, natural gas, and oil shale (in insignificant quantities) with an energy content of 86 TWh were used. Cogeneration plants additionally utilized 18 TWh in the form of thermal energy for heating and/or industrial steam, resulting in transformation losses of only 39 TWh. The frequent use of thermal power plants in the balancing market, rather than in the originally planned base load regime, involves operating at partial loads, power increases and decreases, and frequent start-ups/shutdowns, significantly reducing their efficiency.

In recent years, smaller unit capacities with superior efficiencies using these technologies have become accessible to Romania. SC Electrocentrale Bucharest commissioned the first 200 MW combined heat and power (CHP) plant in 2008, OMV Petrom operates an 840 MW combined cycle plant, and ROMGAZ is investing in another combined cycle plant. The Oltenia Energy Complex is also attempting to form a partnership with a foreign investor for a lignite-fired power plant of approximately 600 MW with supercritical parameters. This is a strategic project for Romania, and finding alternative funding solutions (with state support) is necessary if the public-private partnership does not materialize.

It is crucial for the natural gas-based power generation capacity, which can also balance intermittent production from renewable sources, to have high efficiencies even during frequent and rapid power variations, achieved by utilizing state-of-the-art cost-effective technologies.

Efficiency improvements in the thermal power plant fleet will lead to a reduced primary energy demand required to meet the final electricity consumption and a significant reduction in greenhouse gas emissions.

Older and inefficient thermal power plants initially had high technological self-consumption (above 11%). After 1989, through the modernization works carried out on the majority of the operational power plants, the technological self-consumption of thermal power plants was reduced to below 10%. In 2015, the total technological self-consumption of condensing and cogeneration thermal power plants was approximately 5250 GWh. Technological self-consumption will decrease through the replacement of old and inefficient power plants, as they reach the end of their technical or economic lifespan. Modeling results for the year 2030 estimate technological self-consumption at 4650 GWh, representing an 11% reduction from the 2015 level, due to the decrease in gross electricity production in thermal power plants and their increased use in the balancing market.

District Heating Systems (DHS) consist of two main components: thermal power plants or CHP plants and thermal distribution networks. More than half of the 60 localities with operational DHS in Romania require substantial investments in modernizing the thermal distribution network by replacing old pipes with new ones.

Investment in thermal distribution networks is estimated between €1.3 and €2.6 billion, according to the most recent study on the potential of highly efficient district heating and cogeneration in Romania (ME 2015), submitted to the European Commission at the end of 2015. The required annual investments are estimated between €87 million and €175 million, with the higher level assumed in the Optimistic Scenario, to ensure the long-term development of the sector.

In parallel, replacing the old cogeneration thermal power plants, nearing the end of their lifespan, is necessary, with investment needs estimated between €1 and €1.5 billion. Additionally, investments will be made in replacing a portion of the hot water boilers that have reached the end of their use, with estimated expenditures ranging between €45 million and €60 million/year. Investments in new cogeneration capacities are expected to be €90 million/year until 2030, and a minimum of €45 million/year for hot water boilers. Units that produce thermal and electric energy through cogeneration are preferred..

FORECASTS, POLICIES, AND MEASURES REGARDING CONSUMPTION AND THE ENVIRONMENT

The National Strategy for Sustainable Development of Romania establishes concrete objectives for the transition, within a reasonable and realistic time frame, to the development model generating high added value, propelled by the interest in knowledge and innovation, oriented towards the continuous improvement of the quality of people's lives and of the relationships between them in harmony with the natural environment.

According to the National Sustainable Development Strategy of Romania, the short, medium and long term strategic objectives are:

- Horizon 2013: The organic incorporation of the principles and practices of sustainable development into the overall programs and public policies of Romania as an EU member state.
- Horizon 2020: Reaching the current average level of the European Union countries in the main indicators of sustainable development.
- Horizon 2030: Romania's significant approach to that year's average level of EU member countries from the point of view of sustainable development indicators.

Meeting these strategic objectives will ensure, in the medium and long term, a high economic growth and, consequently, a significant reduction of the socio-economic disparities between Romania and other European Union member states. In terms of the synthetic indicator measuring the process of real convergence, namely Gross Domestic Product (GDP) per capita at purchasing power standard (PPS), the implementation of the Strategy has created conditions for GDP per capita expressed in PPS to exceed, in 2013, half of the European Union's average at that time, to approach 80% of the European Union's average in 2020, and to slightly exceed the European average level in 2030.

The Strategy proposes a vision for the sustainable development of Romania in the perspective of the next two decades, with objectives that transcend electoral cycles and conjunctural political preferences.

Projection of the main macroeconomic indicators 2022-2025

[Source: National Strategy and Forecast Commission]

In making the forecast for the period 2022 - 2025, the following factors that could influence future economic developments were taken into account:

- the uncertainty regarding the duration and aggressiveness of the Russia-Ukraine conflict;
- the effects of the energy crisis and disruptions in supply chains;
- the uncertainties regarding the evolution of the health crisis, the probability of the appearance of new waves in the future or of some mutations of the virus;
- attracting European funds through the National Recovery and Resilience Plan as well as from the Multiannual Financial Framework.

The estimates for economic growth for the year 2022, according to the spring forecast, project a real increase in Gross Domestic Product (GDP) of 2.9% compared to the previous year, with a nominal value of 1,327.9 billion lei

On the **supply side**, in 2022, economic growth will be supported by construction and services. The most significant increase is estimated for the gross value added in construction, namely 5.7%, well above the growth rate of gross domestic product. For services, the growth in gross value added is projected at 3.4%, with the 'information and communication' sector expected to play a crucial role. As for the industry, the estimate is modest, with a growth of only 1.5%, as the sector is most affected by rising energy product prices and deepening blockages in the global supply system.

On **elements of use**, the underpinning of economic growth for 2022 was based on a favorable contribution from domestic demand, both through investment and consumption components. As 2022 is the first year in which funds from the National Recovery and Resilience Plan (PNRR) are allocated, the impact on the economy is expected to be relatively restrained, with gross fixed capital formation increasing by 4.8%. The amplification of inflationary pressures will lead to a erosion of the population's purchasing power, thus a subdued dynamic of private consumption (3.1%) is projected. Conversely, external demand will have a negative contribution of 0.6 percentage points to the growth of gross domestic product. The need to meet domestic demand will result in a real increase in the import of goods and services by 5.1%, a growth rate higher than that of exports of goods and services (4.4%)

Table XI.40 –The evolution of the gross domestic product

- percentage changes compared to the previous year, %

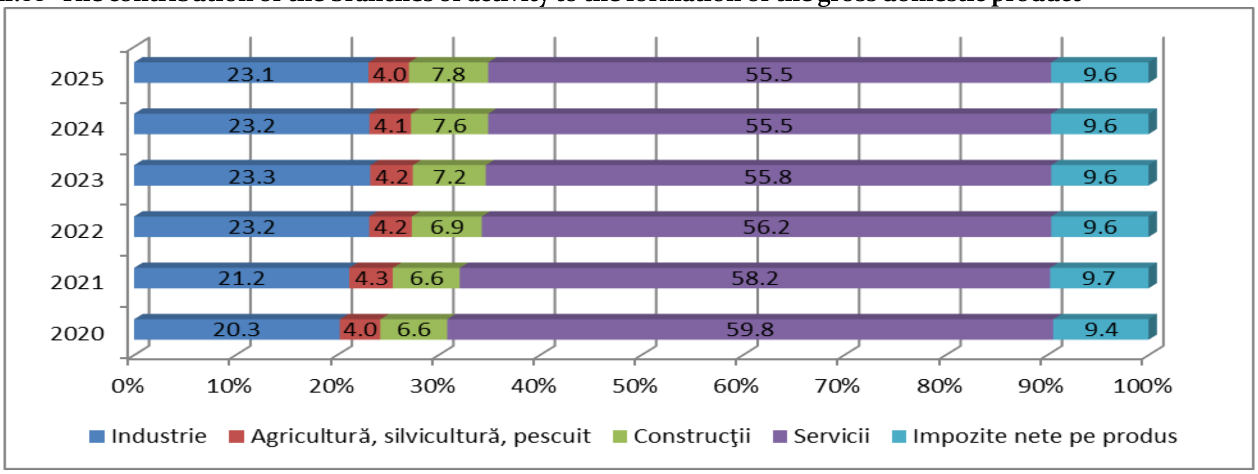
	2021	2022	2023	2024	2025
Gross domestic product	5.9	2.9	4.4	4.8	**4.5**
GDP - expenditure method					
Private consumption expenditure	7.9	3.1	4.5	4.7	**4.5**
Government consumption expenditure	0.4	1.3	1.7	2.8	**2.4**
Gross fixed capital formation	2,3	4.8	8.6	9.1	**7.1**
Exports of goods and services	12.5	4.4	5.3	5.5	**4.9**
Imports of goods and services	14.6	5.1	6.5	6.5	**5.5**
GDP – production method					
Industry	5.0	1.5	4.5	4.8	**4.0**
Agriculture, forestry and fish farming	13.5	-0.4	5.1	2.7	**2.0**
Construction	-1.7	5.7	8.4	9.2	**7.5**
Services	**6.1**	**3,4**	**3.9**	**4.5**	**4.5**

Source: National Institute of Statistics and National Strategy and Forecasting Commission

For the period 2023 – 2025, the average annual growth rate is projected to be 4.6%. An essential role in supporting economic growth during this period will be played by the use of European funds, resulting in an extensive investment process. Consequently, for the construction sector, an annual average growth rate higher than the Gross Domestic Product (GDP) is estimated, specifically 8.3%. For the industry and services, the average annual developments are slightly lower, namely 4.4% and 4.3%, respectively, with a focus on modern activities with an increased contribution of gross value added.

The structure of the Gross Domestic Product (GDP) exhibits certain characteristics for the period 2022 – 2025, with an increase in the shares of industry and construction in the first 2 years, primarily due to significant price increases in energy products and construction materials. Services will continue to be the main contributor to the Gross Domestic Product (GDP) during the forecast period. Although their contribution shows a slight downward trend, at the forecast horizon, they will remain at over 55% of the GDP. Industry ranks second in terms of its contribution to GDP formation, generating 23.1% of it by 2025. The share of construction is on an upward trend, with year-on-year increases, and will contribute 7.8% to the GDP in 2025 (see Figure XI.88).

Figure XI.88 -The contribution of the branches of activity to the formation of the gross domestic product



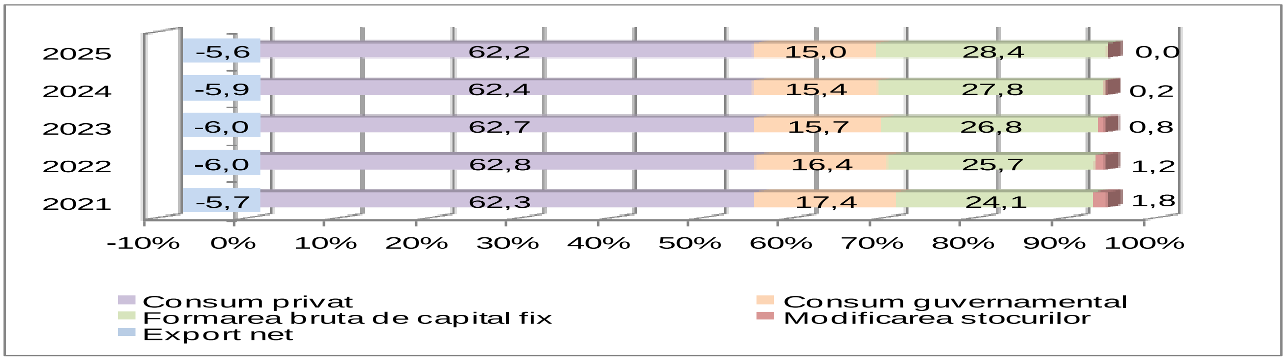
NOTE: The structure was calculated based on nominal values. Any inconsistencies in summation are due to rounding.

Source: National Institute of Statistics and National Strategy and Forecasting Commission

In terms of expenditure components, domestic demand, with an average annual growth rate of 5% over the 2023-2025 horizon, will continue to be the engine of economic growth. Given that both public and private investments will be financed from the funds allocated through the PNRR, gross fixed capital formation will represent the driving force of the economy, substantially contributing to Romania's economic and social recovery (8.3%). For private consumption, moderate growth has been estimated, with an average annual rate similar to Gross Domestic Product (GDP) (4.6%), while government consumption is expected to increase on average by 2.3%. Net exports will gradually diminish, exerting a negative contribution to GDP growth, reaching -0.6 percentage points at the end of the forecast period.

In the **medium-term forecast** for 2022-2025, the **National Commission for Strategy and Forecasting** estimated a slight decrease in the share of final consumption in GDP, from approximately 79% in 2022 to about 77% in 2025. This is while private consumption will maintain its share (around 62%), and government consumption is expected to show a decreasing trend, representing 15% of GDP in 2025. To have a sustainable and competitive economy, Romania needs investments to close the economic gaps compared to the rest of the European Union and to reduce regional disparities. *Therefore, major investments will be made in priority areas from the funds allocated through the PNRR and the Multiannual Financial Framework 2021-2027, including transport infrastructure, environment, energy efficiency, education, and healthcare. This will drive an increase in the investment rate (Gross Fixed Capital Formation as a percentage of GDP), reaching 28.4% in 2025, up from 25.7% in 2022, the first year in which investments from the PNRR allocations will be realized. Net exports will remain in negative territory throughout the forecast period, dampening economic growth.*

Figure XI.89 -GDP structure by elements of use

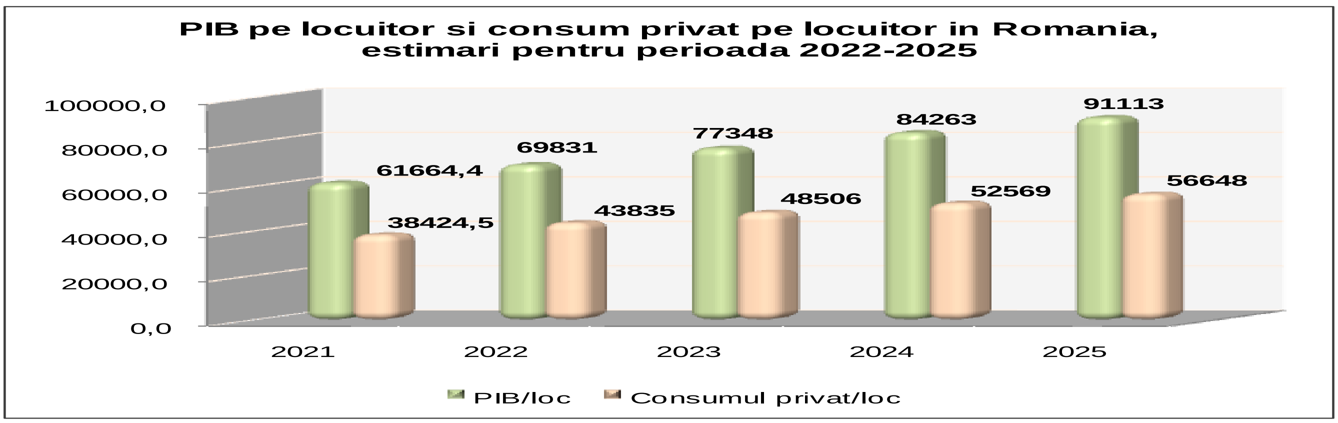


NOTE: The structure was calculated based on nominal values. Any inconsistencies in summation are due to rounding.

Source: National Institute of Statistics and National Strategy and Forecasting Commission

The estimates regarding the Gross Domestic Product (GDP) and population dynamics in Romania lead to GDP per capita values, an economic indicator that reflects the level of prosperity of a country at a given time, of approximately 69,800 lei in 2022, reaching around 91,100 lei in the year 2025. Private consumption per capita will reach approximately 56,600 lei in 2025, up from about 43,800 lei in 2022.

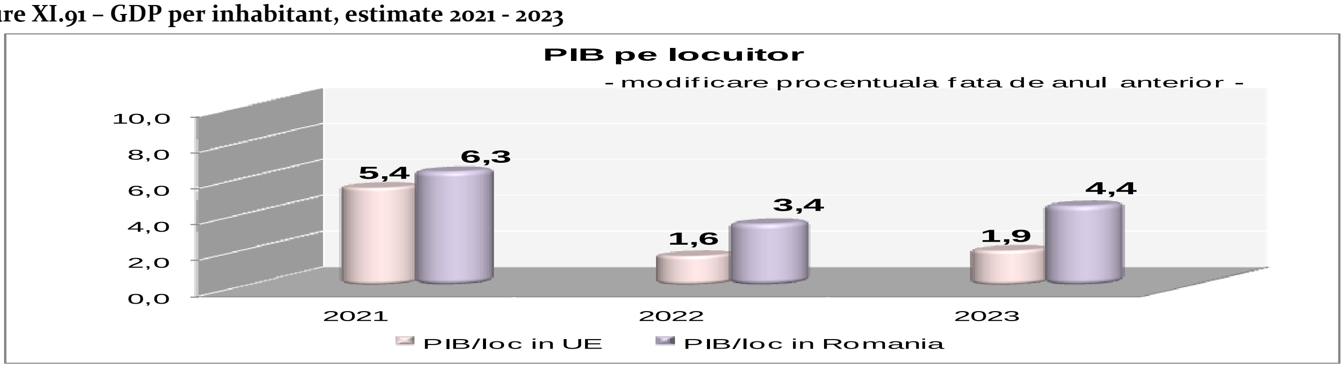
Figure XI.90 - GDP per inhabitant and private consumption per inhabitant in Romania, estimates for the period 2022 - 2025



Source: National Institute of Statistics and National Strategy and Forecasting Commission

The European Commission's spring forecast anticipates a 2.7% growth for the EU economy in 2022 and a 2.3% growth in 2023, while projecting a rise in Romania's Gross Domestic Product (GDP) by 2.6% in 2022 and 3.6% in 2023. According to these estimates, GDP per capita in Romania will increase by 3.4% in 2022 and by 4.4% in 2023, surpassing the EU average (1.6% in 2022 and 1.9% in 2023).

Figure XI.91 – GDP per inhabitant, estimate 2021 - 2023



Source: European Commission Spring 2022 Forecast (European Economic Forecast – Spring 2022)

Energy balance forecast 2022-2025

[Source: National Strategy and Forecast Commission]

The trajectory of the Romanian economy throughout 2021 was strongly affected by a convergence of supply-side pressures stemming from the ongoing pandemic and the onset of the energy crisis. The limited supply of energy goods (fuel, natural gas, electricity) amidst ongoing economic recoveries led to substantial price hikes, adversely impacting demand, a trend expected to continue into the current year.

The 5.9% economic growth recorded in 2021 was achieved with an increased need for energy resources by 3.4%, primarily driven by import dynamics (+13.3%), while national production of energy resources increased by only 1.9%. The evolution of resources and primary energy consumption are directly impacted by electricity consumption and the formation of resources to balance the energy account.

The energy intensity of the economy, calculated as the ratio between domestic energy consumption and GDP at constant prices, is estimated to decrease by 3.4% compared to the previous year, a value surpassing the average of the 2015-2020 period (-2.8%).

The forecast for the energy balance for 2022-2025 was formulated in a challenging macroeconomic context, disrupted by a high degree of uncertainty stemming from the simultaneous occurrence and overlap of multiple crises, significantly impacting the energy sector. These crises include the ongoing energy crisis, primarily driven by a reduced supply of energy products globally, resulting in significant price increases since the previous year.

In addition to this shock in the energy market, in February, the conflict between Russia and Ukraine erupted, with unfavorable global repercussions. As expected, the escalation of this conflict leads to deeper disruptions in supply chains and a further increase in global prices for oil, natural gas, and agricultural products. In the context of these tensions, the energy balance estimates considered a deterioration in trade relations with these two states, implying a reduction in energy resources from import (especially natural gas). This assumption is supported by recent statements from decision-makers indicating Romania's efforts to increase energy independence in the medium term.

On the other hand, the intensification of energy price increases fuels existing inflationary pressures, increasing uncertainty regarding the extent of the global economic recovery. The impact of these price increases will be felt in energy-intensive sectors, such as the chemical and metallurgical industries or transportation, due to rising fuel prices. It's worth mentioning a potential contraction in household energy consumption due to high prices, an assumption not factored in due to measures of capping and compensation adopted by the government.

In this new geopolitical context, ensuring the domestic natural gas requirement through imports from the Russian Federation becomes uncertain. Under these circumstances, until alternative solutions for substituting Russian gas imports are identified and implemented, and *in line with new European approaches, the trend of reducing the use of coal for energy purposes, previously adopted to meet energy and climate objectives, has been revised. For the beginning of the forecast period, an increase in the use of coal for electricity and heat production has been estimated to counterbalance the decrease in the domestic natural gas need*s.

Regarding **domestic natural gas production**, the current scenario foresees an average annual growth of 2.3%, following the opening of new reserves and improved recovery rates for existing ones. A slight improvement in the efficiency of natural gas transformation into electricity has been assumed, resulting from the commissioning of new combined cycle turbine power plants.

Regarding **primary electricity production**, it is assumed that electricity from renewable sources will increase by about 4% annually during the 2022-2025 period, primarily due to increased installed capacities in wind and photovoltaic power plants, investments provided for in the National Recovery and Resilience Plan (PNRR). For oil production, the continued downward trend has been considered, with an estimated annual decrease of 2.3%.

Another assumption used in the forecast was improving the energy consumption efficiency in economic sectors compared to the values of recent years. At the same time, nuclear energy production has been kept constant throughout the forecast period, with increases in production capacities expected after 2025.

The current version of the energy balance forecast considers an increase in primary energy resources as an average annual rate of 1.5%, supported by both import growth and domestic production.

At the level of domestic primary energy production, the estimated dynamics are positive, gradually attenuating to a growth of 1.2% in 2025. The increase is supported by the increased utilization of coal in the first part of the forecast period, with favorable developments anticipated for electricity production from renewable sources. These resources are designed to ensure domestic consumption and exports. The latter, after an estimated reduction for the current year of over 10%, will resume its upward trend with annual dynamics of over 4.5%.

The growth rate of domestic consumption is supported by the final consumption, the evolution of which is determined by the economic indicators included in the macroeconomic forecast elaborated within the National Commission for Strategy and Forecast. The highest weights in final consumption are found at the level of industrial branches and transportation, as well as household consumption.

Initiatives at European level

[Source: National Strategy and Forecast Commission]

At the European level, environmental challenges and climate change continued to be **priorities for the European Commission.**

On November 11, 2019, the "**Green Deal - European Green Deal**" was launched, through which Europe aims to become the first climate-neutral continent by transitioning to a modern economy that utilizes resources more efficiently. Thus, it presents "*a new growth strategy aimed at transforming the EU into a fair and prosperous society, with a modern, competitive, and resource-efficient economy, with no net greenhouse gas emissions by 2050, and where economic growth is decoupled from resource use*." ***The European Green Deal is an integral part of the European Commission's strategy*** **for implementing the United Nations 2030 Agenda and the Sustainable Development Goals.**

Although the ***year 2020*** was marked by the outbreak of the Covid-19 pandemic, throughout the year, ***several European initiatives and proposals were launched, such as the Just Transition Mechanism, the EU Action Plan for the Circular Economy, the EU Strategy for Promoting Sustainability in the Chemicals Sector, the Methane Strategy, and more***.

Additionally, to contribute to the EU's goal of climate neutrality ***by 2050***, the European Commission presented ***the EU Strategy on Offshore Renewable Energy***. The strategy proposes **increasing Europe's offshore wind capacity from the current 12 GW to at least 60 GW by 2030 and 300 GW by 2050**. The European Commission aims to complement this capacity with **40 GW from ocean energy** and other emerging technologies like wind turbines and floating solar panels by 2050.

As a component of the European Green Deal, on ***December 9, 2020***, the **European Climate Pact** was launched, a EU-level initiative inviting citizens, communities, and organizations to participate in climate actions and build a greener Europe. It provides a space for everyone to exchange information on the climate crisis, discuss the topic, take action, and be part of a growing European climate movement. The European Climate Pact **offers citizens a platform to connect**, jointly develop and implement climate solutions, whether small or large. The Pact **is an open, inclusive, and evolving initiative to combat climate change**.

In 2021, several strategies were initiated or adopted, such as the one on adapting to climate change (which outlines the path to cope with the inevitable consequences of climate change), ***the EU Action Plan "Towards Zero Pollution for Air, Water, and Soil***" (which interconnects all relevant EU policies on combating and preventing pollution, placing a special emphasis on using digital solutions to combat pollution), and the approach for a ***Sustainable Blue Economy*** in the EU (where all sectors of the blue economy, including fishing, aquaculture, coastal tourism, maritime transport, port activities, and shipbuilding, will need to reduce their impact on the environment and climate).

In ***July 2021***, the **European Climate Law** was published, a central point of the European Green Deal, *aiming for the EU to* *achieve climate neutrality by 2050, with an intermediate target of reducing greenhouse gas emissions by at least 55% by 2030*.

The second half of 2021 brought **new challenges in the energy sector**. In the context of rising gas prices, which reached historic highs, **coal-based energy generation regained attention in the EU**, although in this case, price increases and emissions certificates doubled compared to the beginning of the year. Thus, the share of coal in the energy mix gained ground in many European producer states. Furthermore, the outbreak of the Ukraine-Russia conflict at the beginning of this year and the goal of eliminating dependence on Russian gas temporarily reinforced the importance of this resource, so that the EU's energy security is not threatened by the transition to green energy. *In Germany, the largest coal producer in Europe, excluding Russia, in 2021, the share of coal in the portfolio of electricity producers increased significantly to 30.2%, from 24.8% in 2020. Thus, last year, coal represented the most important source of energy for the German economy. In Poland, the third largest coal producer in Europe, lignite production increased by over 13%, and superior coal production by 1.2%. In Romania (7th place in Europe), net coal production totaled 3.2 million tons of oil equivalent (toe) in 2021, a 16.5% increase compared to 2020.*

At the beginning of 2022, the European Commission presented **the REPowerEU initiative**, its response to the urgencies generated by the need to end the EU's dependency on Russian fossil fuels and counteract the climate crisis. **The measures in the REPowerEU plan** aim to stimulate energy savings, diversify our energy sources, and accelerate the introduction of energy from renewable sources to replace fossil fuels in households, industry, and energy production. This plan presents a series of **measures designed to address the rising energy prices** in Europe **and replenish gas stocks for the following winter**. The plan is based on two pillars:

- Diversification of gas supply through increased imports of liquefied natural gas (LNG) and pipelines from suppliers outside Russia and through increased production and imports of biomethane and hydrogen
- Faster reduction of fossil fuel use in EU households, buildings, industry, and energy system by improving energy efficiency, relying more on renewable energy sources and electrification, and removing infrastructure bottlenecks.

Following the launch ***at the end of May 2022*** of the **Spring Package within the European Semester**, all member states received energy recommendations in line with the objectives of the EC's REPowerEU proposal.

The Recovery and Resilience Fund (RRF) ***is an important tool for achieving REPowerEU goals***. The RRF provides a monitoring and reporting framework in which member states can report progress in achieving REPowerEU objectives, in full synergy with the implementation of existing and updated national energy and climate plans and the European Semester. Member states are encouraged to propose additional investments and reforms and strengthen existing measures to boost EU energy security and reduce dependence on Russian fossil fuels. In this regard, **member states are invited to propose a dedicated REPowerEU chapter in their National Recovery and Resilience Plans (PNRR), in line with the respective guidelines. In this context, the new Country-Specific Recommendations (CSRs) issued in 2022 in the energy sector will become particularly relevant for the reforms and investments included in the REPowerEU chapters**.

One of the specific country recommendations for Romania is to adopt measures to reduce overall dependence on fossil fuels in the period 2022-2023. This includes facilitating the further expansion of sustainable energy production by accelerating the development of renewable sources, modernizing energy transport networks, and increasing interconnection with neighboring member states. It also involves speeding up the pace and scale of renovations to enhance the energy efficiency of the building stock.

Accelerating the decarbonization process will reduce dependence on fossil fuels and support the achievement of climate objectives by 2030 as outlined in the European Climate Law.

XII. TRENDS AND CHANGES IN ROMANIA

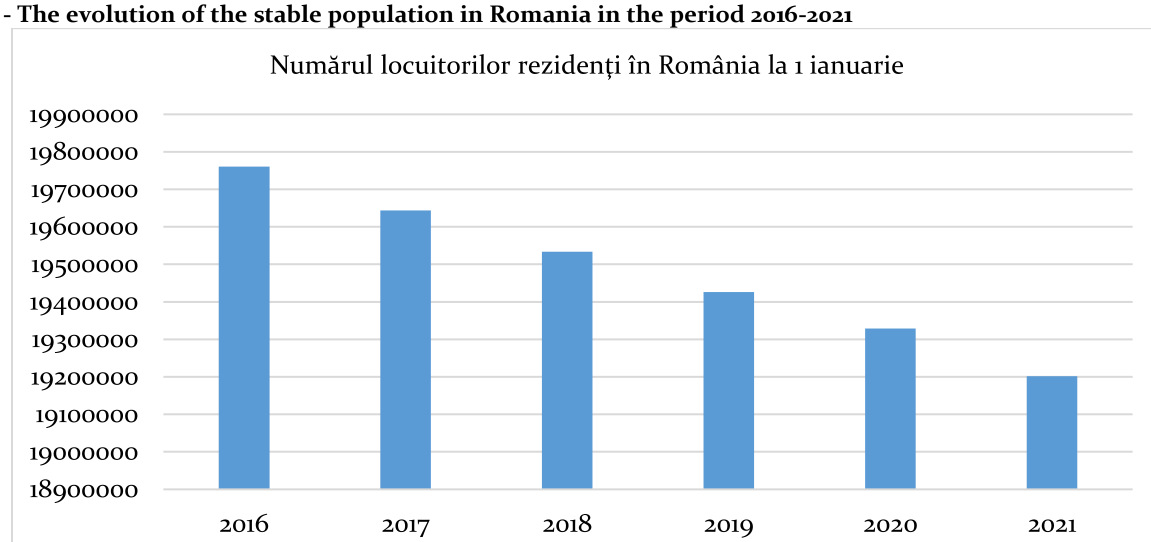
Adopting the principle of sustainable development requires that all policies be formulated and implemented with consideration for their economic, social, and environmental impact. Therefore, from the perspective of this integrated approach, it is desirable for sustainability to become a catalyst for both domestic and foreign policy decisions, economic actions, and public opinion to promote not only new structural and institutional reforms but also changes in production and consumption behaviors.

To achieve this objective, first and foremost, coherence should be ensured among the three dimensions - *economic growth, social cohesion, and environmental protection* - traditionally seen as contradictory options. Pursuing social cohesion requires an income redistribution policy that may limit the sources of economic growth. Environmental protection entails adopting restrictive measures regarding the use of natural resources and technologies, which may introduce distortions in the allocation of factors based on economic efficiency criteria. Reconciling the three dimensions of sustainable development would mean: *economic growth that provides the prerequisites for social progress and environmental protection; a social policy that stimulates economic growth; an environmental policy focused on market economy-specific tools that are simultaneously effective and economically efficient*.

SOCIAL

According to the data from the National Institute of Statistics (NIS), as of January 1, 2021, Romania's population was 19,201,662 people. Negative values of natural growth (low birth rates combined with high mortality) coupled with external migration have led to a decrease in the country's population between 2016 and 2021, with a decrease of 558,923 people (*see Figure XII.1*). According to Eurostat and NIS data, Romania recorded the second-largest decrease in total population in the European Union (EU-27) in terms of absolute population decline between January 1, 2016, and January 1, 2021, after Italy, and ranks 5th (after Latvia, Croatia, Bulgaria, and Lithuania) in terms of the percentage rate of decline (-2.83% in Romania). Across the EU-27, there was an overall population increase of approximately 0.54% during the period from January 1, 2016, to January 1, 2021.

Figure XII.1 - The evolution of the stable population in Romania in the period 2016-2021

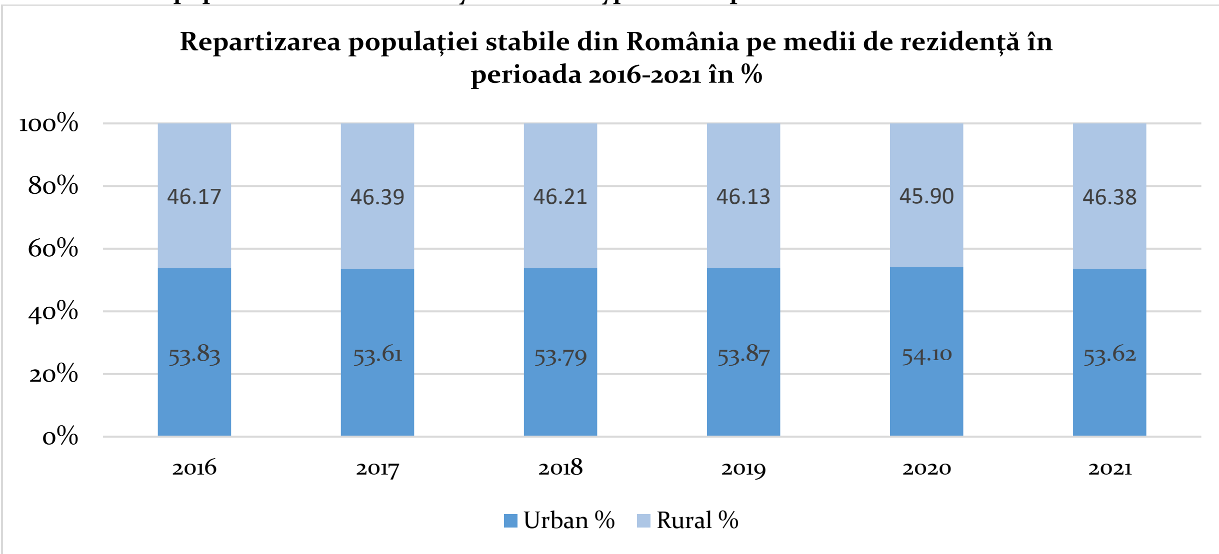


Sources: INS, online Tempo database
https://europa.eu/european-union/about-eu/countries_ro

DISTRIBUTION OF THE POPULATION BY RESIDENCE TYPE

Urbanization is currently one of the general global trends. Currently, the degree of urbanization in Romania is 53.62%. Thus, on January 1, 2021, 10,296,393 people lived in urban areas, representing more than half of the country's population, and 8,905,269 people lived in rural areas, representing 46.38% of the country's population (*see figure XII.2*) . The effects of the current demographic trends in Romania are manifested more strongly in the rural environment through: the aging of the population; emigration that affects especially the rural environment; internal rural-urban migration that contributes to the depopulation of villages.

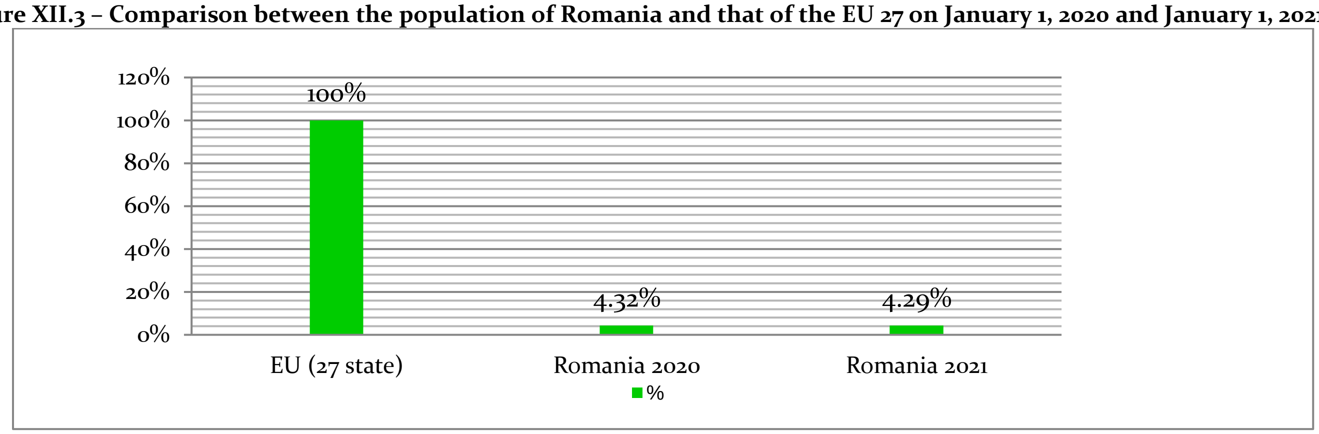
Figure XII.2 - The stable population in Romania by residence types in the period 2016-2021



Sources: NIS, online Tempo database

According to the *study carried out by Allianz International Pensions*: "In Romania, the evolution of the birth rate, which registers a downward trend, will also be associated with the aging of the population. The United Nations statistics (*Population Division, 2012 Revision*) estimate that the average age of the Romanian population will reach almost 49 years in 2050 (projection made taking into account average fertility rates), from 40 years in 2015. In addition , according to the same projections made by the UN, from a numerical point of view, Romania's population will be 17.8 million people in 2050, reaching 12.6 million in 2100. Therefore, this demographic evolution will represent a challenge for Romania too" (Source:http://www.capital.ro/).

Figure XII.3 – Comparison between the population of Romania and that of the EU 27 on January 1, 2020 and January 1, 2021, (%)



Source: ec.europa.eu/eurostat/

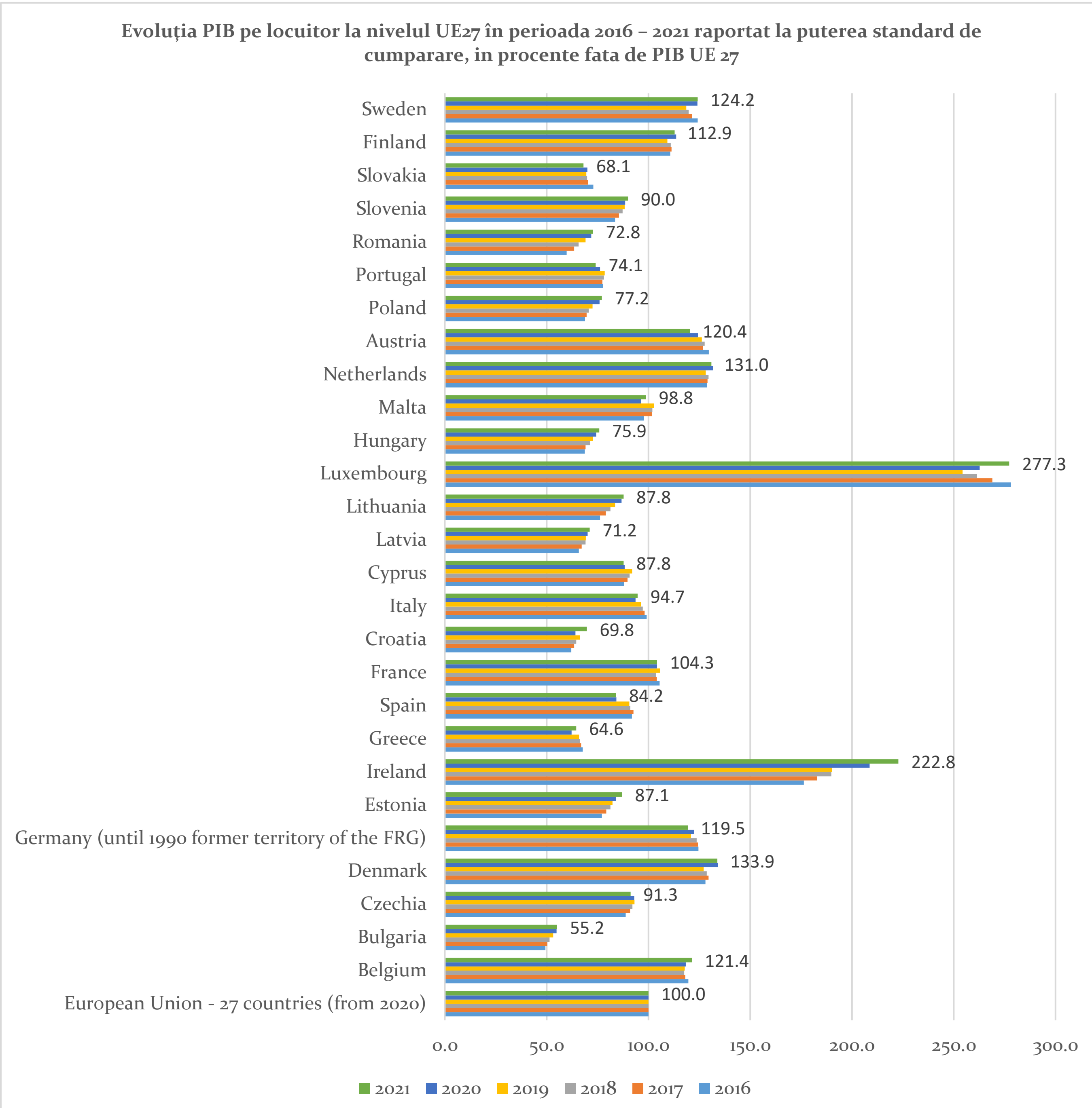
On January 1, 2020, the population of Romania represented 4.32% of the total population registered by the EU 27, and on January 1, 2021, the population of Romania represented 4.29% of the total population registered by the EU 27 *(figure XII.3)*. ***Comparatively, in 2019 and 2018, the population of Romania represented 3.80% and 3.81% respectively of the total population registered by the EU 28.***

ECONOMIC

THE EVOLUTION OF GDP AT NATIONAL LEVEL AND IN THE MAIN SECTORS OF ACTIVITY

Gross Domestic Product (GDP) is the most commonly used measure of the overall size of an economy, while GDP per capita (in euros or adjusted to account for differences in price levels between different countries) is widely used to compare living standards , or with the aim of monitoring the convergence process in the European Union. *To assess living standards, it is appropriate to use GDP per capita in terms of purchasing power standards (PPS), in other words adjusted* *to the size of an economy in terms of population and also in terms of looks at the price differences between countries (figure XII.4)*. GDP growth at the level EU-28 experienced a substantial slowdown in 2008, and in 2009 the GDP was considerably reduced as a result of the economic and financial crisis. In 2011, the level of GDP in the EU-28 recovered slightly, up to 13 217 145 million Euros, and this evolution continued at a progressive pace in the following years. In 2019, GDP at EU-28 market prices continued to grow to 16495689.6 million Euros. ***Furthermore, the GDP at market prices within the EU-27 was assessed at 14,016,453.5 billion Euros in 2019 and at 13,411,849.1 billion Euros in 2020, experiencing a significant decline due to the COVID-19 crisis, followed by a substantial recovery in 2021, reaching 14,475,095.3 billion Euros.***

Figure XII.4 - Evolution of GDP per inhabitant at EU27 level in the period 2016 – 2021



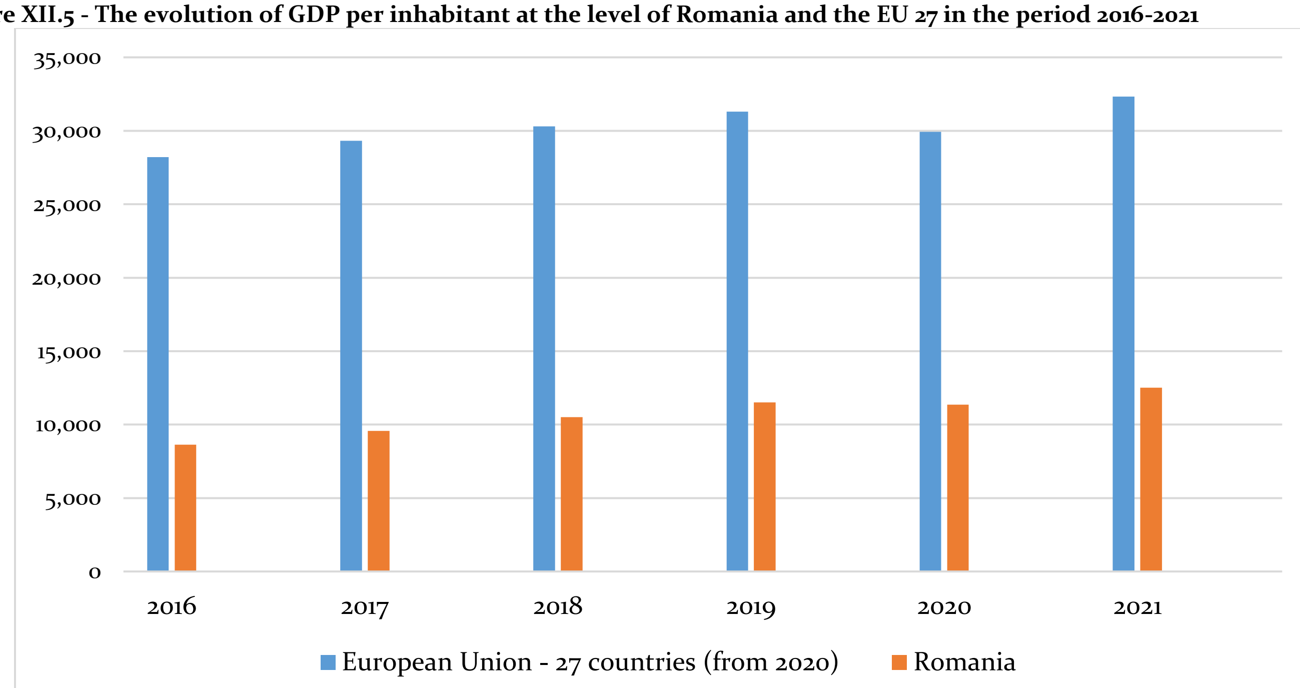
Source: Eurostat, statistical database,http://ec.europa.eu/eurostat/

In the European Union, according to preliminary data released by Eurostat for the year 2021, actual individual consumption per capita varies between 63% and 146% of the European average, marking a slight reduction in the gap between the two poles of the hierarchy compared to the previous year (61-145 in 2020) and a significant reduction compared to the gap in 2019 (59-149). **In 2021, ten states recorded actual individual consumption values above the EU average**. Luxembourg, with a level of actual individual consumption 46 percentage points above the EU average, ranked first, while Denmark and Germany exceeded the EU average by 21 and 20 percentage points, respectively, with Denmark showing a 6-point increase compared to 2019. The following positions were occupied by the Netherlands, Belgium, and Austria, Sweden, Finland, and France, with consumption levels exceeding the European average by 11-17 percentage points. In Italy, Cyprus, Lithuania, and Ireland, actual individual consumption was 3-10 percentage points below the EU average, with Ireland marking a 5-point decrease compared to 2019, and in Slovenia, the Czech Republic, Spain, and Poland, it was 13-16 percentage points below the average. **Romania equaled Malta with 18 percentage points below the average**, just after Portugal (17), but ahead of Estonia, Greece, Croatia, Latvia, Hungary, and Slovakia, and lastly, Bulgaria. Nevertheless, there is a convergence of the states at the lower end of the hierarchy towards the EU average, and Romania's rise from 78% to 82% of the European average over the last three years. In the case of GDP per capita, which measures economic activity, there are significant differences among EU member states. In 2020, GDP per capita, expressed in purchasing power standards, ranged from 55% of the EU average in Bulgaria to 263% in Luxembourg, and in 2021, the gap between Bulgaria and Luxembourg increased to 55-277% of the EU average. In 2021, 11 countries reported a GDP per capita level above the EU average, with 220% in Ireland, 134% in Denmark, 132% in the Netherlands, 124% in Sweden, 121% in Belgium, 120% in Austria, 119% in Germany, 113% in Finland, and 105% in France. In the case of Bulgaria, actual individual consumption was 37 points below the EU average, and GDP per capita was 45 points below the EU average.

In 2021, within the European Union, ***the Actual Individual Consumption (AIC) per capita expressed in Purchasing Power Standards (PPS)*** ranged from 63% of the EU average, as observed in Bulgaria, 70% in Hungary, and 82% ***of the EU average in the case of Romania***, to 146% in Luxembourg and 120% of the EU average in Germany. Romania reached 82% of the EU 28 average living standard in 2021, according to the Actual Individual Consumption (AIC) indicator published by Eurostat, surpassing the group consisting of Greece, Hungary, Slovakia, Croatia, and Bulgaria. The progress between 2015 and 2021 was 18 percentage points.

In terms of ***GDP per capita*** (Gross Domestic Product value per capita expressed in standard purchasing power parity—PPS),***in 2021 it varied from*** 55% of the EU average in the case of Bulgaria, 65% in the case of Greece, 70% in the case of Croatia and 73% ***in the case of Romania*** (*figures XII.5 and XII.6*) and up to 277% in Luxembourg and 220% in Ireland.

Figure XII.5 - The evolution of GDP per inhabitant at the level of Romania and the EU 27 in the period 2016-2021

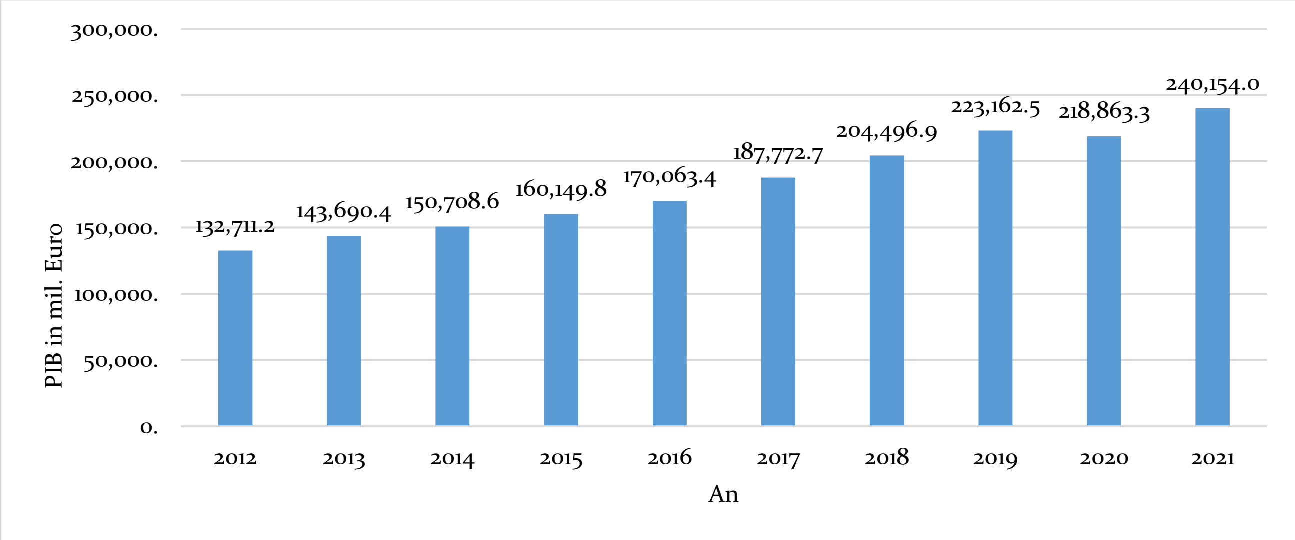


Sources: Eurostat, statistical database,http://ec.europa.eu/eurostat/

*Romania, in 2021 the **effective individual consumption**, which measures the well-being of the population, is 18 percentage points below the European average, while the GDP per capita is 27 points below this level. The indicator was expressed in*

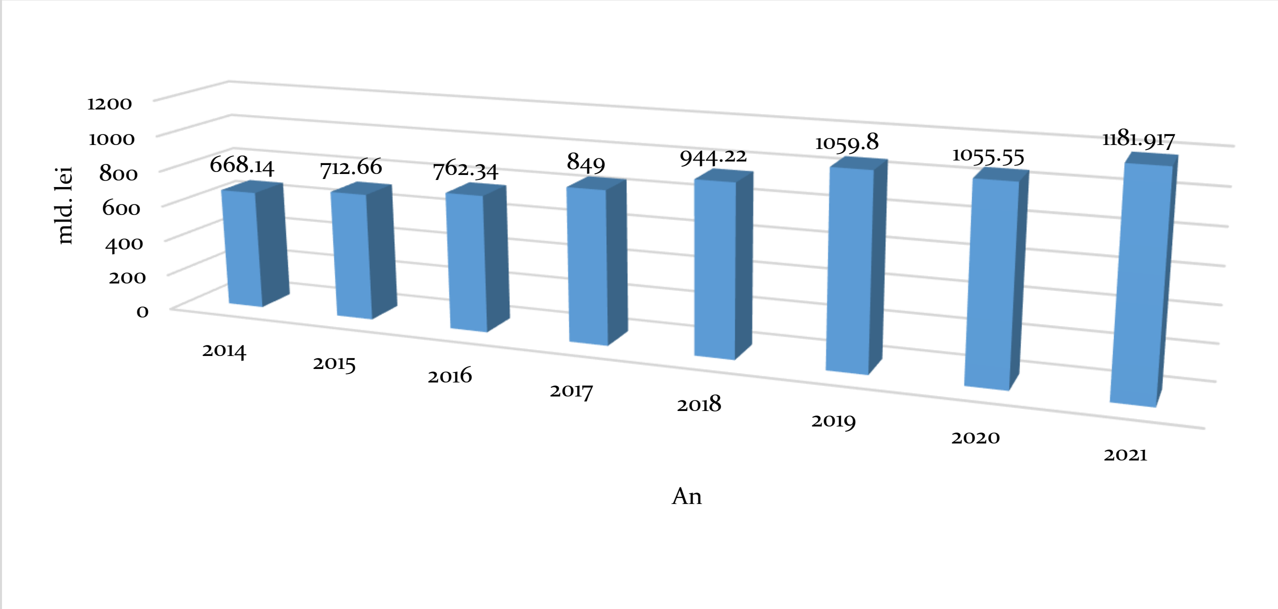
Purchasing Power Standards (PPS), an artificial currency that eliminates price differences between countries. Effective individual consumption consists of goods and services consumed by individuals regardless of whether they are bought and paid for by them, the Government or non-profit organizations.

Figure XII.6 - GDP evolution in Romania in the period 2012-2021, expressed in millions of Euros, current prices



Sources: Eurostat, statistical database,http://ec.europa.eu/eurostat/

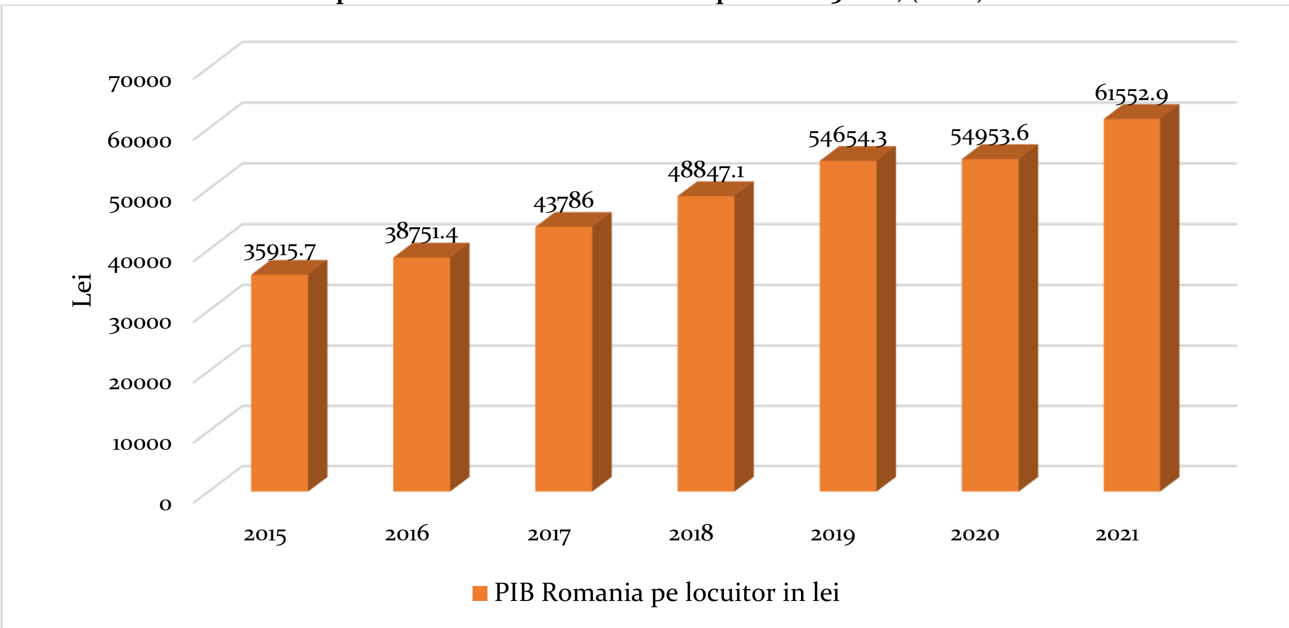
Figure XII.7 - GDP evolution in Romania in the period 2014-2021, expressed in billion lei



Sources: NIS,online Tempo database

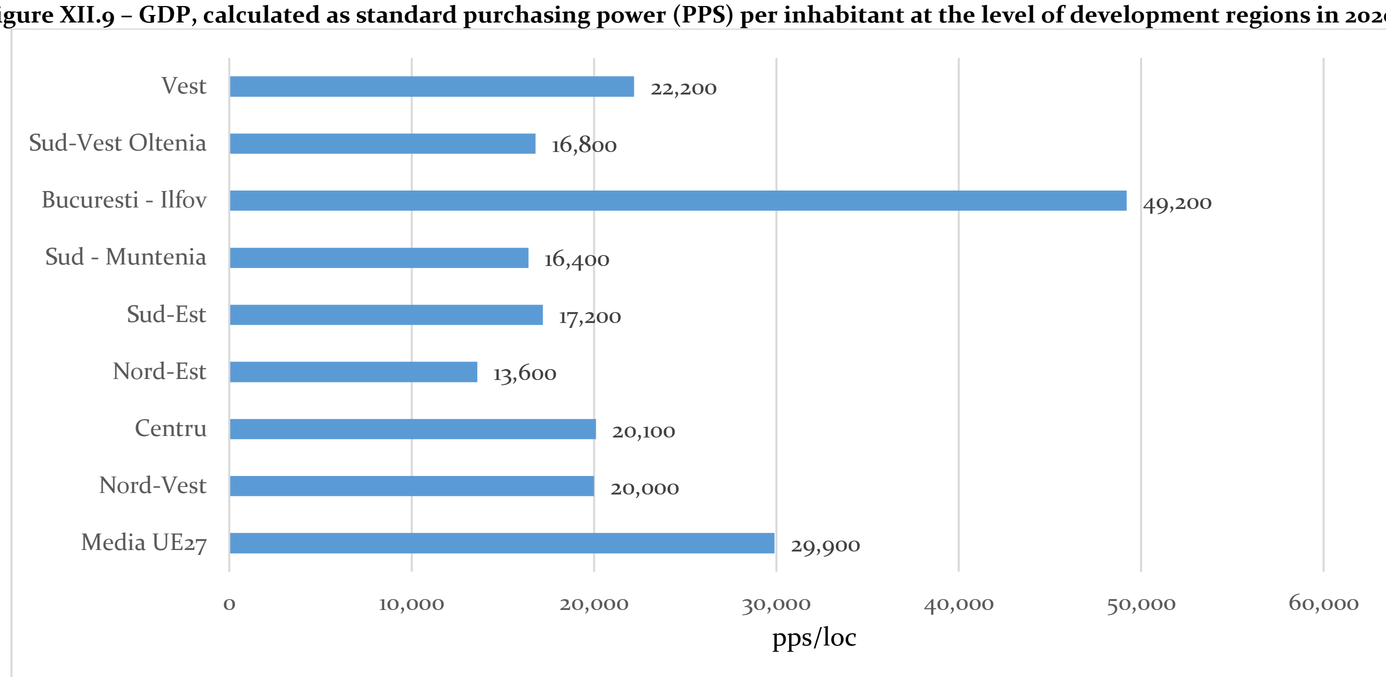
After the economic-financial crisis of 2008, Romania's GDP recorded a decrease in 2009, and from 2010 it started to increase and the same trend of progressive growth was recorded in the period 2011-2019. This trend was interrupted in 2020 by the Covid-19 crisis. ***The value of the Gross Domestic Product (GDP) in 2021 amounted to 1,181.917 billion lei at current prices, which is 126.37 billion lei more than in 2020 and 122.12 billion lei more than in the pre-COVID year 2019. The GDP growth compared to 2014 is 513.78 billion lei (see Figure XII.7)***

Figure XII.8 - The evolution of GDP per inhabitant in Romania in the period 2015-2021, (in lei)



Source:http://statistici.insse.ro/shop

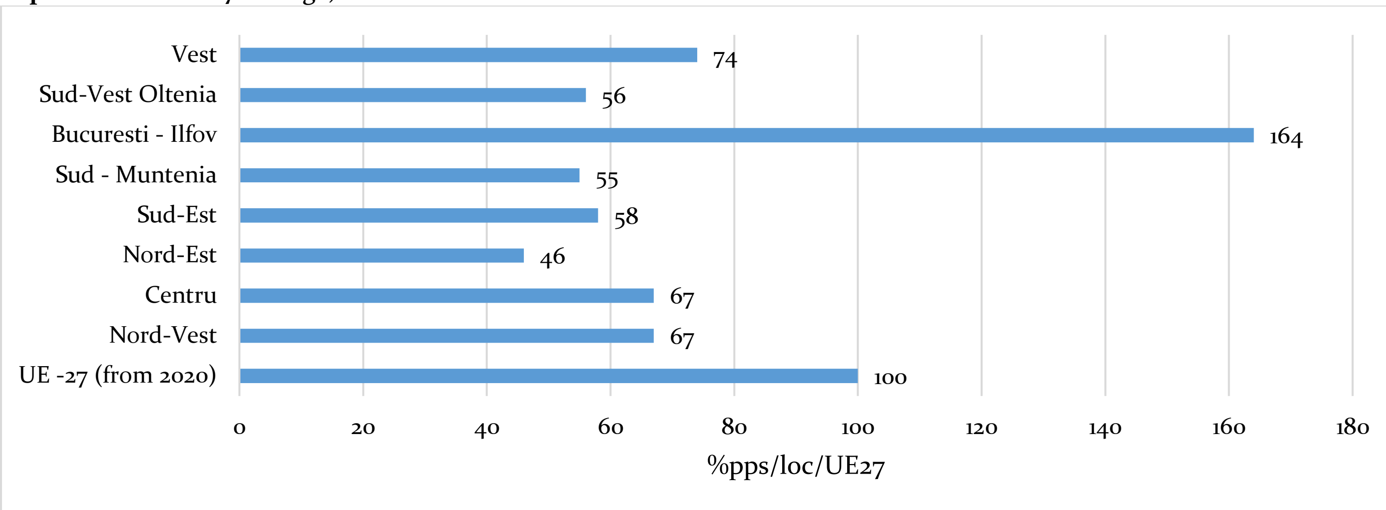
Figure XII.9 – GDP, calculated as standard purchasing power (PPS) per inhabitant at the level of development regions in 2020



Sources: Eurostat, statistical database,http://ec.europa.eu/eurostat/data available in 2022

According to data published in 2022 by the European statistical office Eurostat, in 2020 only a region in Romania, namely the North-East, had a GDP per capita below 50% of the European Union average. The North-East Region is still one of the poorest regions with 45.5% of the EU27 average, still increasing by 4 percentage points compared to 2018. It was overtaken by the South-West Oltenia Region (56.2%) and the South-Muntenia (54.8%) of the EU average. At the opposite pole was the Bucharest-Ifov region, which recorded a GDP/inhabitant of 164.5% of the EU average, followed by the West Region with 74.2% (*figures XII.9 and XII.10*)

Figure XII.10 - GDP in development regions in Romania calculated as standard purchasing power per inhabitant (%pps/place) compared to the EU 27 average, in 2020



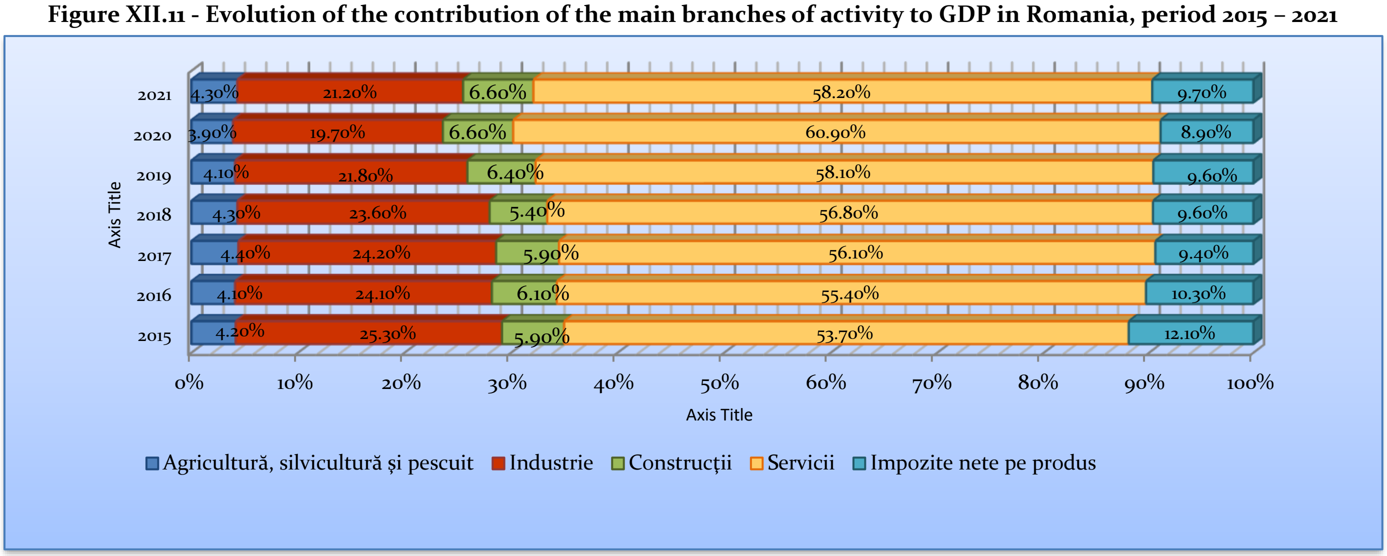
Sources: Eurostat, statistical database,http://ec.europa.eu/eurostat/dates available in August 2021

GDP evolution on the main activity sectors

In the last decades, the European economies went through a structural change, which consisted in the reorientation towards services. The development of this sector led to an increase in GDP. As the economic focus shifts from heavy industry and intensive agriculture to services, a reduction in pressure on the environment can be seen. However, this depends on the technologies used.

In the period 2015-2021, the share of the main activity sectors in achieving the gross domestic product in Romania had different developments. Thus, in the 2015-2021 period, the "*Agriculture*", "*Construction*" and "*Industry*" sectors recorded decreases in GDP shares compared to 2013, while the "*Services*" sector recorded an increase. In 2020 and 2021, the "*Construction*" sector recorded a return compared to previous years, marking a maximum of the last 5 years. The "*Services*" sector recorded in 2021 a decrease of 2.7% compared to 2020 and a progressive increase in the contribution to GDP formation, from 53.70% in 2015 to 58.20% in 2021, holding the first place in the share of GDP formation. In second place, as a share of GDP in 2021, was the "*Industry*" sector, with 21.20%, being though on a downward trend in the last 6 years. (*figure XII.11*).

Figure XII.11 - Evolution of the contribution of the main branches of activity to GDP in Romania, period 2015 – 2021



Source: NIS -http://www.insse.ro/cms/ro/content/produsul-intern-brut-date-anuale
http://www.insse.ro/cms/ro/comunicate-de-presa-view

ENVIRONMENTAL POLICIES

The environmental policy of the European Union (EU) was established through the Treaty establishing the European Community, with the aim of ensuring the sustainability of environmental protection measures. With the Maastricht Treaty, environmental protection became a key priority of the European Union, highlighting the need for integrating and implementing environmental policies within sectoral policies such as agriculture, energy, industry, and transportation. The central pillar of the environmental policy is the concept of sustainable development, which serves as a cross-cutting policy encompassing all other EU policies, emphasizing the necessity of integrating environmental protection requirements into the definition and implementation of all European policies.

In Romania, environmental strategic planning is an ongoing process that sets the direction and objectives necessary for aligning economic development with environmental protection aspects. The stages of developing and implementing a strategic plan form a continuous cycle, facilitated through a monitoring, evaluation, and updating system based on the mechanism of strategic partnership.

National and local strategies in the field of environmental protection have been developed and are continuously updated to ensure a coherent vision for Romania's environmental policy and its practical implementation. **Environmental action programs** developed in Central and Eastern European countries have aimed at several objectives, including:

- Improving environmental conditions within the community through the implementation of cost-effective action strategies;
- Raising public awareness of environmental responsibilities and garnering increased public support for the strategies and investments needed for environmental protection actions;
- Strengthening the institutional capacity of local authorities and NGOs in managing environmental protection programs and promoting partnerships among citizens, local authorities, NGOs, scientific communities, and the business sector;
- Identifying and evaluating environmental priorities based on scientific data and community resources;
- Developing an environmental action plan that identifies specific actions required to address issues and promote the community's vision - Enhancing the skills of authorities involved in identifying national and international funding sources;
- Ensuring compliance with national environmental legislation.

Environmental action plans serve as a support tool for the community in setting environmental priorities and addressing them at the national, regional, or local level. They involve the development of a collective vision by evaluating the current state of the environment, identifying existing environmental issues, determining the most suitable strategies for resolving them, and allocating implementation actions to achieve real improvements in the environment and public health**. *The*** *Environmental Action Plan* provides a starting point for the development of a sustainable community and ensures that the community has appropriately addressed and examined the key environmental aspects that adversely affect human health and the ecosystem**.** *Environmental action plans* are closely linked to other activities such as sustainable development programs, Local Agenda 21, environmental management systems, and the implementation strategies and plans related to the EU acquis, among others**.** *The Local Environmental Action Plan represents the short, medium, and long-term strategy for addressing environmental issues within a county by adhering to the principles of sustainable development and in full alignment with specific local, regional, and national plans, strategies, and legislative documents. To date, environmental action plans have been developed, updated, and revised in all eight Development Regions of Romania at the county level. At the regional level, following the dissolution of regional environmental protection agencies, regional environmental action plans are monitored until their completion.*

At the end of 2021, at the level of Romania, the situation of monitoring the actions to fulfill the objectives proposed in the environmental action plans for the 8 Development Regions (table XII.1 and figure XII.12) was presented as follows:

- **out of a total of 11067 environmental actions**:

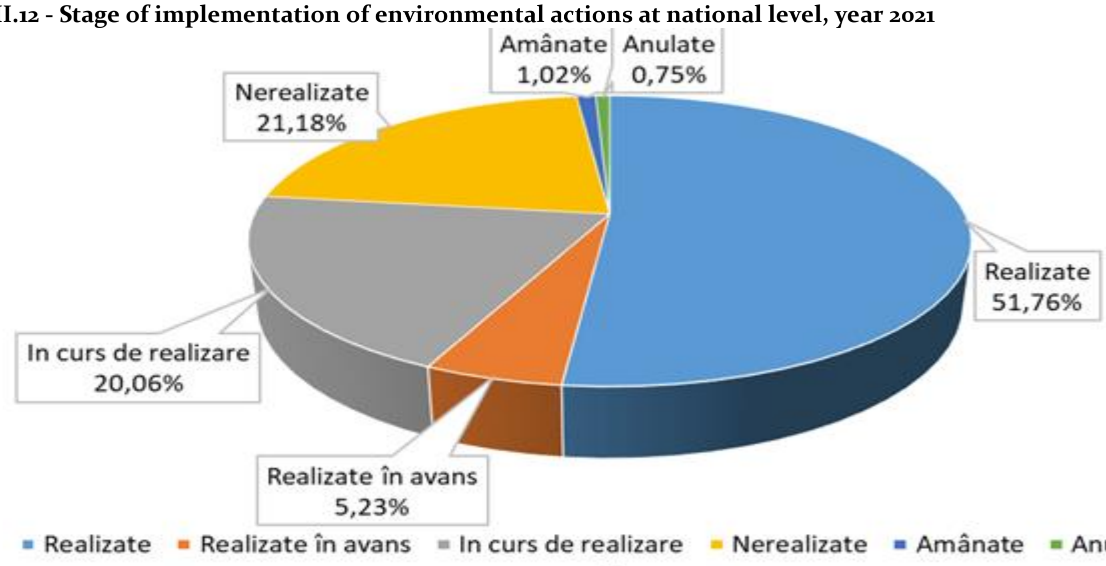
- ✓ **5728 taken**(51.76%);
- ✓ **579 carried out in advance**(5.23%);
- ✓ **2220 are in progress**(20.06%);
- ✓ **2344 unrealized actions**(21.18%)
- ✓ **113 postponed actions**(1.02%);
- ✓ **83 actions cancelled**(0.75%).

Table XII.1 - The status of monitoring actions to achieve the proposed objectives in the environmental action plans across the 8 Development Regions - year 2021

REGION	Number of actions taken	Number of actions carried out in advance	Number of actions in progress	Number of unrealized actions	Number of postponed actions	Number of canceled actions	Total actions
REGION 1 NORTH-EAST	352	30	317	622	20	5	1346
REGION 2 SOUTH EAST	572	2	312	55	42	10	993
REGION 3 SOUTH MUNTENIA	1903	459	271	1267	6	12	3918
REGION 4 SOUTH-WEST OLTENIA	303	2	205	30	12	4	556
REGION 5 WEST	560	11	309	12	7	17	916
REGION 6 NORTH-WEST	789	70	539	186	17	31	1632
REGION 7 CENTER	713	5	228	85	9	4	1044
REGION 8 BUCHAREST ILFOV	536	0	39	87	0	0	662
Total	5728	579	2220	2344	113	83	11067
Percentage (%)	51.76	5.23	20.06	21.18	1.02	0.75	100.00

Source: National Environmental Protection Agency

Figure XII.12 - Stage of implementation of environmental actions at national level, year 2021



Source: National Environmental Protection Agency

GHG EMISSION INTENSITY AND GHG EMISSIONS PER CAPITA

RO 10
Indicator code Romania: RO 10 EEA indicator code: CSI 10
TITLE: **GREENHOUSE GAS EMISSIONS TRENDS**
DEFINITION: The indicator represents the trends (total and by sector) of greenhouse gas emissions in relation to member states' obligations to comply with the objectives of the Kyoto Protocol

***Definitions (according to UNFCCC** -United Nations Framework Convention on Climate Change): Emissions*: the release of greenhouse gases and/or their precursors into the atmosphere over a certain area and period of time. Greenhouse gases: represent those gaseous components of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation. *Removal:* Any process, activity or mechanism that removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere. *Source*: any process or activity that releases a greenhouse gas, an aerosol or a precursor there of a greenhouse gas in the atmosphere. *Gases*: The greenhouse gases stipulated under the UNFCCC are: CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and NF_3. This list does not include greenhouse gases, which are also substances that deplete the ozone layer and are controlled by the Montreal Protocol. *Sources of emissions*: The indicator provides information on emissions from the main anthropogenic sources of greenhouse gases, distributed among the following emission sectors (according to the IPCC nomenclature): energy supply and use, transport, industry, agriculture, waste, etc. The indicator does not refer to emissions from international aviation and maritime transport, which are not regulated by the Kyoto Protocol. In general, these sources are not taken into account in the calculation of the total greenhouse gas emissions reported at national and European level. Also, emissions from land use, land use change and forestry (LULUCF) are not included in total greenhouse gas emissions.

[Source:*EEA, indicators,*http://www.eea.europa.eu/data-and-maps/indicators

Relevant Environmental Policies This indicator aims to support the annual evaluation by the European Commission regarding progress in reducing emissions in the EU and its Member States, in order to meet the objectives set out in the Kyoto Protocol, as part of the EU Greenhouse Gas Monitoring Mechanism (EU Regulation No. 525/2013 on a mechanism for monitoring and reporting greenhouse gas emissions, as well as reporting at national and Union level of other information relevant to climate change and repealing Decision No. 280/2004/EC). The ultimate goal of the *United Nations Framework Convention on Climate Change* (UNFCCC) is to stabilize greenhouse gas (GHG) concentrations 'at a level that prevents dangerous anthropogenic interference with the climate system.' *The Kyoto Protocol*, which succeeds the UNFCCC, is one of the most important international legal instruments in the fight against climate change. It sets mandatory targets for reducing greenhouse gas emissions for industrialized countries and the European Union. The European Union's annual inventory of greenhouse gases and the inventory report, officially submitted to the UNFCCC Secretariat, are prepared on behalf of the European Commission by the European Topic Centre on Air and Climate Change Mitigation of the European Environment Agency (ETC/ACM), supported by the Joint Research Centre and Eurostat. The EU inventory is compiled in accordance with EU Regulation No. 525/2013. The purpose of this Regulation and subsequent legislation is to:

- Monitor all anthropogenic emissions of greenhouse gases covered by the Kyoto Protocol in the Member States;
- Assess progress toward meeting GHG reduction commitments under the UNFCCC and the Kyoto Protocol;
- Implement the UNFCCC and the Kyoto Protocol regarding national programs, greenhouse gas inventories, national systems, and Union and Member State registries, as well as relevant procedures established by the Kyoto Protocol;
- Ensure that Member States and the Community provide the UNFCCC Secretariat with complete, accurate, consistent, comparable, and transparent information in a timely manner.

Law 24/1994- Romania ratified the United Nations Framework Convention on Climate Change (UNFCCC), which creates the general framework for intergovernmental actions on climate change. One of the main objectives of the UNFCCC is atmospheric stabilization by keeping greenhouse gas concentrations at a level that prevents disruption of the climate system. ***Romania was the first country, included in Annex I of the United Nations Framework Convention, to ratify through Law no. 3/2001 Kyoto Protocol, thus committing to an 8% reduction of greenhouse gases, in the period 2008-2012, compared to the base year considered to be 1989***.

The National Strategy on Climate Change and Low Carbon Economic Growth for the period 2016-2020, *adopted by Government Decision No. 739/2016*. The overall objective of this strategy is to mobilize and enable both private and public stakeholders to reduce greenhouse gas emissions resulting from economic activities in line with national targets and commitments to the EU, as well as to adapt to the impact of climate change, both current and future. The implementation of the strategy will help Romania transition to a climate-resilient economy and create a favorable situation for all parties

involved. ***The National Action Plan for the Implementation of the National Strategy on Climate Change and Low Carbon Economic Growth for the period 2016-2020***, adopted through the aforementioned Government Decision. The overall goal is to support the Romanian Government in preparing actions related to climate change, both for greenhouse gas emissions reduction policies and adaptation policies within the Operational Programs for the 2014-2020 financial cycle**.**

Directive 2003/87/EC - on establishing a greenhouse gas emissions trading scheme, transposed into Romanian legislation by Government Decision No. 780/2006, allows economic agents in sectors covered by the Directive to participate in the greenhouse gas emissions trading market, offering the opportunity to address climate change issues from an economic perspective. To implement Government Decision No. 780/2006 on establishing the greenhouse gas emissions trading scheme, ***the National Allocation Plan (NAP)*** was developed, through which the Romanian Government sets and allocates the number of greenhouse gas emissions certificates it intends to allocate at the national level. European Parliament and Council *Decision No. 406/2009/EC of April 23, 2009, sets out the effort that Member States must make to reduce greenhouse gas emissions in order to meet the Community's commitments to reduce greenhouse gas emissions by 2020.*

Specific Legislation for the National System for Estimating Anthropogenic Emissions from Sources or Removals by Sinks of all Greenhouse Gases (SNEEGES):

- *Government Decision No. 1570/2007 on the establishment of the National System for Estimating Anthropogenic Emissions from Sources or Removals by Sinks of all Greenhouse Gases,* regulated by the Kyoto Protocol, with subsequent amendments and completions;
- *Order of the Minister of Environment. 1376/2008* - approving the Procedure for reporting INEGES (National Inventory of Greenhouse Gas Emissions) and the method of responding to observations and questions arising from the review of INEGES;
- *Order of the Minister of Environment No. 1474/2008* - approving the procedure for processing, archiving, and storing specific data of the National Inventory of Greenhouse Gas Emissions.
- *Order of the Minister of Environment and Climate Change No. 1442/2014* approving the procedure for selecting estimation methods and emission factors necessary for estimating the level of greenhouse gas emissions;
- *Order of the Minister of Environment and Climate Change no. 1602/2014* approving the Plan for ensuring and controlling the quality (QA/QC) of the National Inventory of Greenhouse Gas Emissions..

The greenhouse gases subject to the UNFCCC are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). According to the provisions of this law, an annual assessment of greenhouse gas emissions is conducted..

Targets and objectives The indicator analyzes the trends of total GHG emissions in the EU since 1990 in connection with the objectives of the EU and the member states. ***The European Union and its Member States, including Romania, have independently communicated a target for the reduction of greenhouse gas emissions associated with economic activities of 20% reduction by the year 2020 compared to 1990 levels***. The emissions reduction target for Romania for the years 2013-2020 is part of the common target of the European Union. The EU's target is implemented within the framework of the EU Energy and Climate Change Package. ***At national level, the limitation and reduction of greenhouse gas emissions are achieved through the application of the Greenhouse Gas Emissions Trading Scheme (EU ETS) (the European-level target for Romania being -21% by 2020 compared to the hypothetical emissions level in the EU ETS sector in 2005) and through the provisions included in Decision No. 406/2009/EC. Taking into account the obligations to meet the annual national emission reduction targets in accordance with the provisions of Decision No. 406/2009/EC, it is necessary for each economic sector to develop strategies and action plans that identify the measures and resources required to ensure the national linear emission trajectory for the period 2013-2020***.

The national policy to reduce GHG emissions follows the European approach, i.e. on the one hand, ensuring that a part of the economic operators participate in the application of the GHG emission certificates commercialization scheme and, on the other hand, the adoption of policies and measures at the sectoral level in so that at national level the GHG emissions related to these sectors respect the linear trajectory of the emission limits established by the application of Decision no. 406/2009/EC. The GHG Emissions Certificates Trading Scheme (EU ETS) regulates emissions from installations with production capacity and considerable emissions from the Energy and Industrial Processes sectors.

To optimize the planning of greenhouse gas (GHG) emissions reductions from sources not covered by the EU Emissions Trading Scheme (EU ETS), it is necessary to align the sectoral annual emission plans from sources regulated by Decision

No. 406/2009/EC (non-EU ETS), taking into account the emissions and reduction potential of each sector, as well as national economic development priorities. Analyzing the amount of CO_2 emissions in the European Union, it has been observed that the largest quantity results from the production of electricity and heat. For example, coal-based energy production in EU states generated approximately 973 million tons of CO_2 emissions in 2005, accounting for 23% of total CO_2 emissions in the EU. Regarding Romania, CO_2 emissions generated from various sectors also highlight the significant contribution of the energy and transportation sectors, which means that measures and actions to reduce CO_2 emissions need to be implemented in these areas.

According to Romania's 2021 National Greenhouse Gas Inventory, in the year 2020, greenhouse gas (GHG) emissions from the Energy sector accounted for approximately 94.54% of the total, including LULUCF (Land Use, Land Use Change, and Forestry), and 66.25% of the total, excluding LULUCF. Within the European Union, the Transportation sector remains the sector with the largest impact on greenhouse gas emissions in terms of associated level variation, showing a tendency for growth. In 2020, emissions from the Transportation sector increased by 47.79% compared to emissions recorded in 1990, primarily due to increased demand for passenger and freight transportation, as well as a preference for road transport over other, less polluting modes of transport. Compared to 2019, emissions from the Transportation sector decreased by 2.83%.

Since 2002, Romania has been annually submitting its National Greenhouse Gas Inventory (NGHG) to the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). This inventory is prepared in accordance with relevant IPCC methodologies and in compliance with national provisions related to the National System for Estimating Greenhouse Gas Emissions (SNEEGES).
UNFCCC requests accurate and regularly updated data on greenhouse gas emissions from industrialized countries, using comparable methodologies. To estimate anthropogenic greenhouse gas emissions, all countries are required to utilize the IPCC 2006 Guidelines for National Greenhouse Gas Inventories. To be aggregated into a single figure, emissions from various individual gases are converted into CO_2 equivalents, using the Global Warming Potential (GWP) as specified in the IPCC guidelines. GWP is a measure that estimates the contribution of each greenhouse gas to global warming.

Table XII.2 – GWP for GHGs

Gas	Global Warming Potential (GWP)
carbon dioxide	1
methane	25
nitrous oxide	298
fluorinated gases (HFCs, PFCs, SF_6, NF_3)	11-22800

Source: National Environmental Protection Agency according to IPCC guidelines

HFCs and PFCs comprise a large number of different gases with different GWPs. Countries report HFCs and PFCs in CO_2 equivalent in millions of tons. Total emissions exclude greenhouse gas emissions and absorbers from land use, land use change and forestry (LULUCF), (Strategic Directions for Sustainable Development in Romania, European Institute in Romania – Strategy and Policy Studies, 2006, http://www.ier.ro/documente/SPOS2006_ro/Spos2006_studiu_3_ro.pdf.

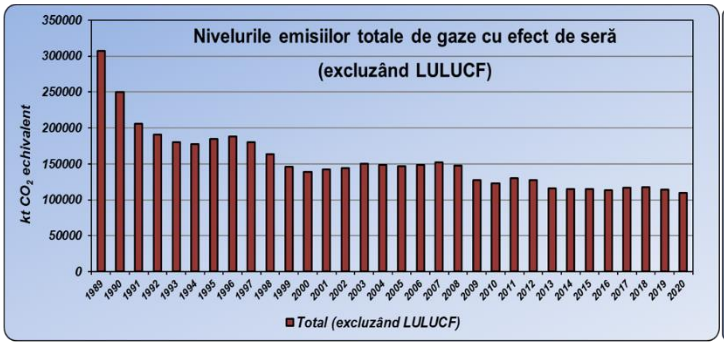
Table XII.3 and figure XII.13 show the levels of total annual greenhouse gas emissions for the period 2000 – 2020. Note: T*he differences that appear in the data from the report associated with the year 2021 compared to the data from the report associated with the year 2020 are due to the implementation of recalculations at the level of the National Inventory of Greenhouse Gas Emissions and the introduction of elements characteristic of the year 2020 [Source: Climate Change Directorate within NEPA*.

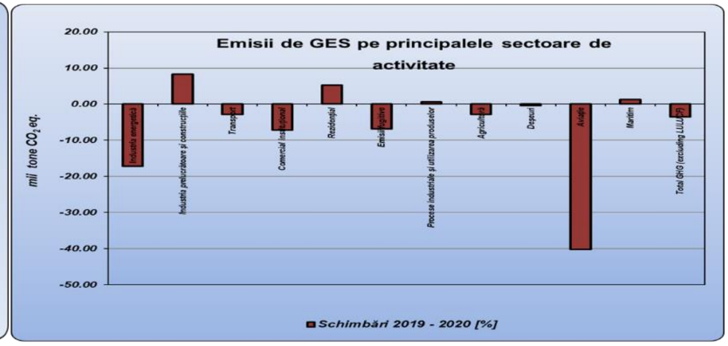
Table XII.3 - Levels of total annual emissions of greenhouse gases in the period 2000 – 2020, thousands of tons of CO_2 equivalent

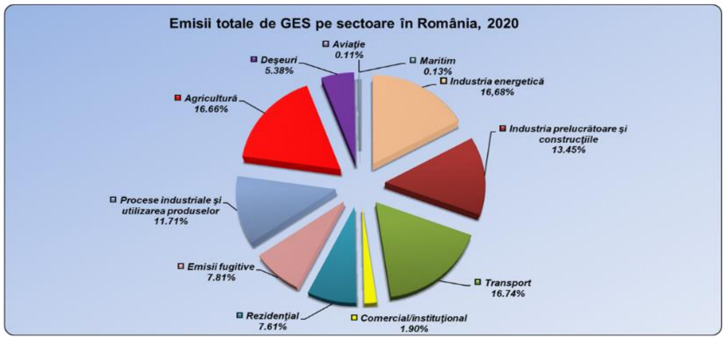
Year	Total emissions (excluding LULUCF)	Total emissions (including LULUCF)
2000	138,979.50	107,585.90
2001	142,647.77	110,335.01
2002	144,186.01	113,910.07
2003	149,901.26	119,151.23
2004	148,139.99	117,626.80
2005	146,902.60	115,092.19
2006	148,403.92	116,994.40
2007	151,887.14	119,593.25
2008	147,982.51	115,107.11
2009	127,058.67	97,436.65
2010	122,862.63	94,626.85
2011	129,627.15	101,231.29
2012	127,537.24	96,676.89
2013	116,059.32	84,865.02
2014	115,292.89	81,226.92
2015	114,817.69	81,847.13
2016	113,456.38	78,546.08
2017	116,701.16	84,179.45
2018	117,597.48	87,881.40
2019	113,939.38	85,462.70
2020	109,934.33	77,040.37

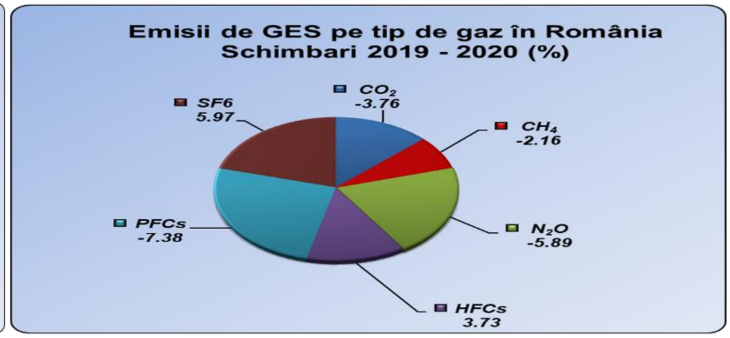
Source: National Environmental Protection Agency

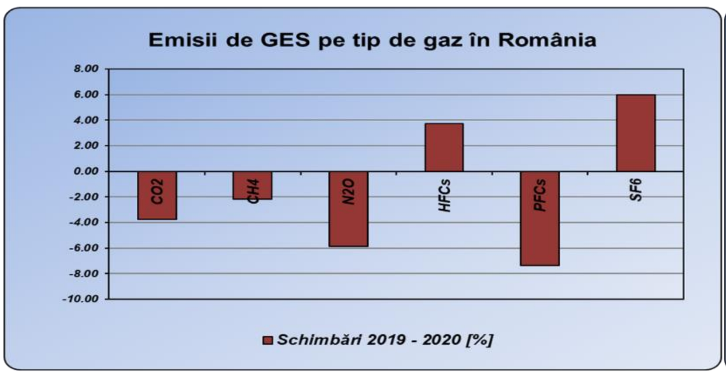
Figure XII.13 Graphical representation of the levels of total annual greenhouse gas emissions in the period 1989 – 2020 (thousands of CO_2 equivalent tons) by activity sector and per inhabitant in Romania and compared for the EU 27

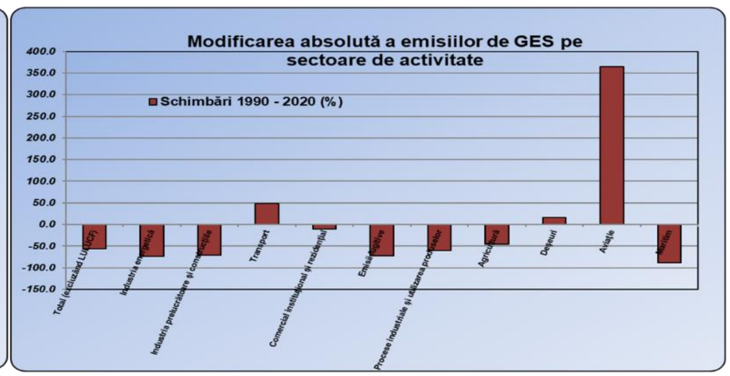


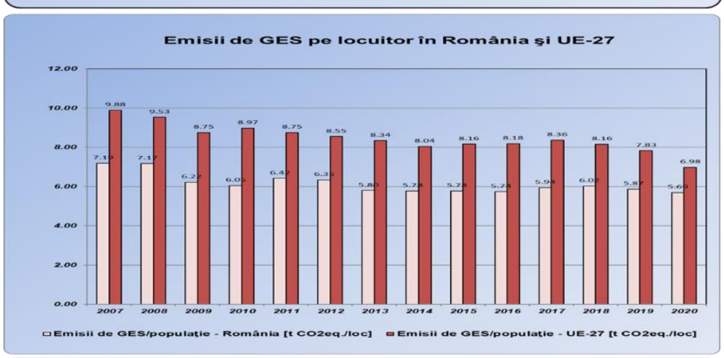


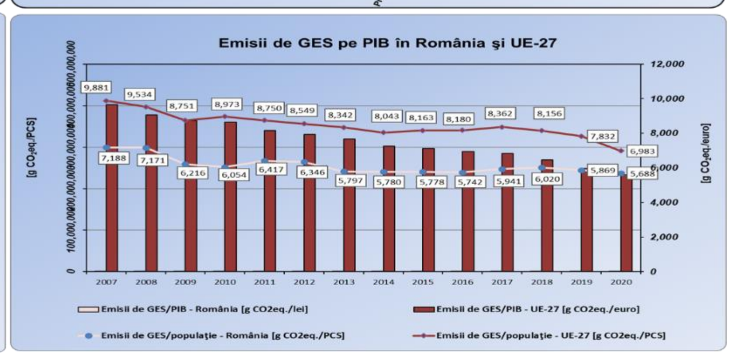


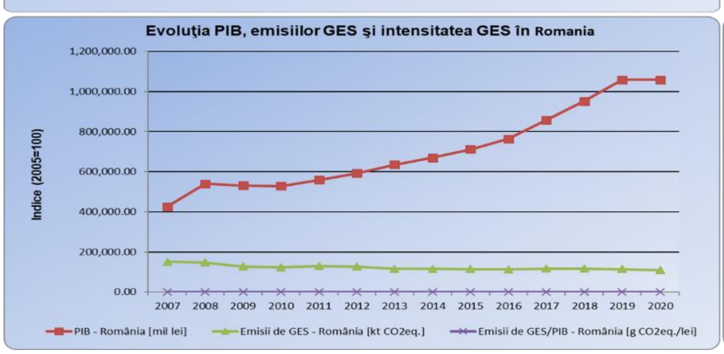


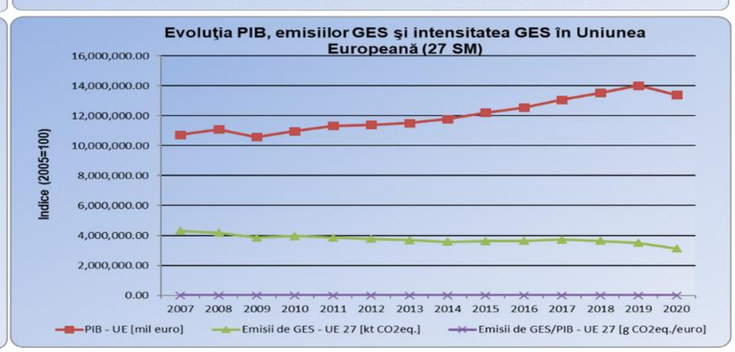












Source: National Environmental Protection Agency

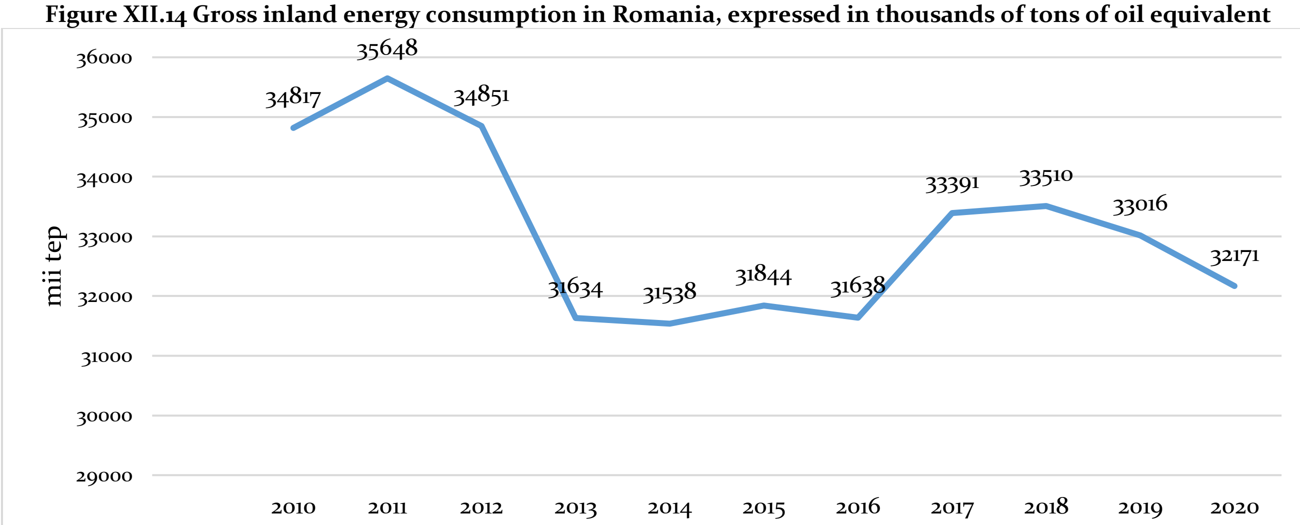
PRIMARY ENERGY INTENSITY AND TOTAL ENERGY CONSUMPTION PER INHABITANT

RO 28
Indicator code Romania: RO 28 EEA indicator code: CSI 28 / ERNER 017
TITLE: **TOTAL PRIMARY ENERGY INTENSITY**
DEFINITION: The indicator represents the ratio between gross domestic energy consumption and gross domestic product (GDP), calculated for a calendar year

In 2011, the gross inland energy consumption (GIEC) in the EU-28 was 1,707.8 million tonnes of oil equivalent (Mtoe). However, a decline in economic activity led to a decrease in this indicator in the period from 2011 to 2014, reaching a minimum of 1,613.4 Mtoe in 2014. Starting from 2015, the gross inland energy consumption (GIEC) in the EU-28 began to increase, reaching a value of 1,677.57 Mtoe in 2017. This represented a decrease of approximately 1.77% compared to 2011 but also a 3.98% increase compared to the minimum in 2014, driven by the economic activity rebound. In 2018 and 2019, GIEC decreased in the EU-28 to 1,664.4 Mtoe in 2018 and 1,636.65 Mtoe in 2019, a level that only slightly exceeded the minimum from 2014.

n Romania, the GIEC (gross inland energy consumption) in 2011 was 35,648 thousand tonnes of oil equivalent (ktoe) and represented the peak of gross inland energy consumption because it decreased to a minimum of 31,538 ktoe during the period from 2012 to 2014. From 2015 to 2018, gross inland energy consumption in Romania experienced a recovery due to economic activity, reaching 31,844 ktoe in 2015 and 33,510 ktoe in 2018. Starting from 2019, Romania's GIEC entered a new decreasing trend with values of 33,016 ktoe in 2019 and 32,171 ktoe in 2020, which is approximately 9.8% lower than in 2011 (*Figure XII.14*).

Figure XII.14 Gross inland energy consumption in Romania, expressed in thousands of tons of oil equivalent

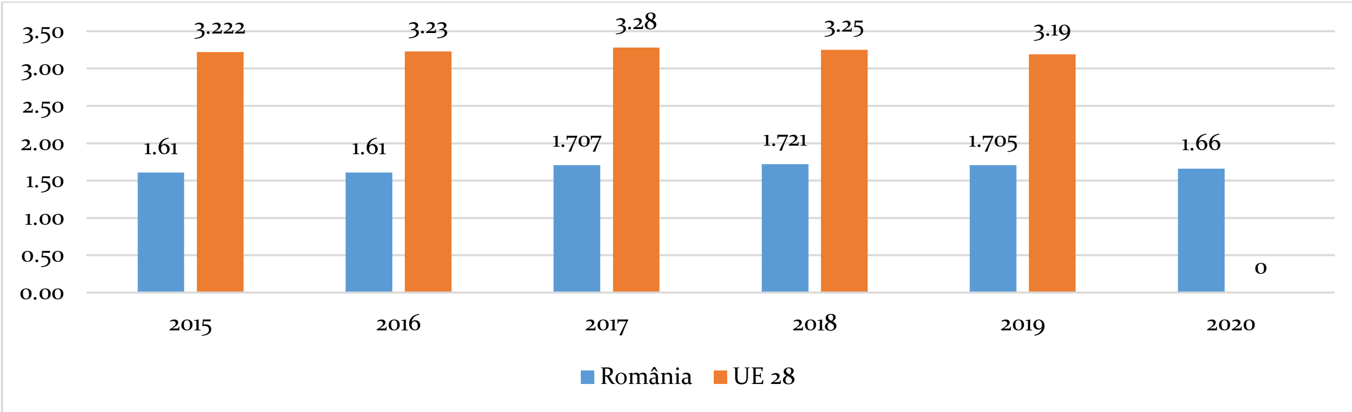


Sources: NIS, online Tempo database

Gross inland energy consumption per capita

Gross Inland Energy Consumption (GIEC) per capita represents the amount of energy per capita, where the energy amount is derived by summing up primary energy production, recovered products, imports, and the stock at the beginning of the reference period, minus exports, bunkers, and the stock at the end of the reference period. During the period from 2011 to 2014, Romania's gross inland energy consumption per capita decreased by approximately 10.46%. It then saw a slight increase in the 2015-2018 interval, reaching a value of 1.721 tonnes of oil equivalent (toe) per capita. However, in 2020, this indicator decreased to 1.66 toe per capita. In 2019, Romania was approximately at half of the average consumption in the EU-28 (53.29%). Figure XII.15 illustrates the evolution of Romania's gross inland energy consumption per capita compared to the EU-28 from 2015 to 2020, with *the note that there were no data available for 2020 in the Eurostat database*.

Figure XII.15 - Gross inland energy consumption per inhabitant at the level of Romania and EU28 in the period 2014-2020, toe/inhabitant

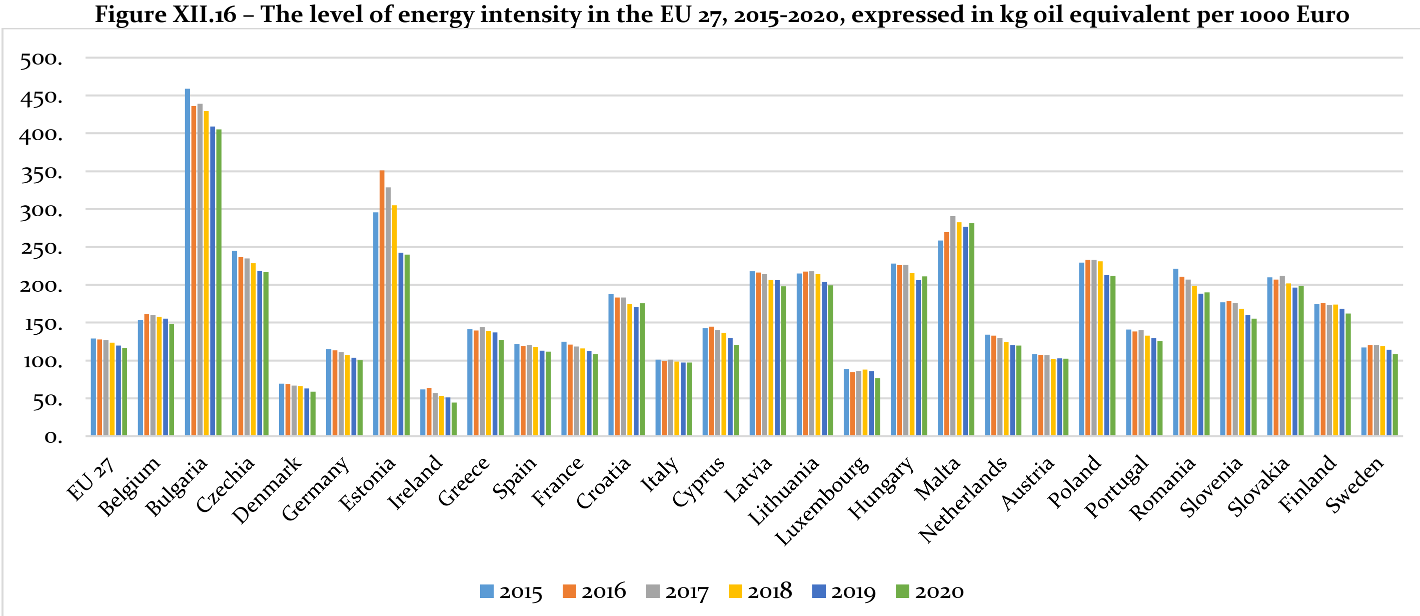


Sources: NIS, online Tempo database; Eurostat, statistical database

Gross Inland Energy Consumption (GIEC) as a share of Gross Domestic Product (GDP)

The Gross Inland Energy Consumption (GIEC) of each country largely depends on its energy system structure, the natural resources available for primary energy production, as well as the structure and level of development of its economy**. *Energy intensity*** is measured as the ratio between gross inland energy consumption and a unit of production, GDP, and is a key indicator for measuring progress under the Europe 2020 Strategy. The ratio is expressed in kilograms of oil equivalent per 1000 euros, and for ease of analysis over time, calculations are based on GDP at constant prices in the year 2010. In the event that an economy becomes more efficient in its use of energy, and the GDP remains relatively constant, then this indicator should decrease. ***In the year 2020, Romania had an energy intensity of 189.3 kg of oil equivalent per 1000 euros. In comparison, the level recorded in the EU-27 was 116.69 kg of oil equivalent per 1000 euros, placing Romania among the EU-27 member states with relatively high levels of energy intensity (ranked 17 out of 27). However, in the period from 2011 to 2020, Romania's energy intensity showed a continuous decrease, totaling a reduction of 32.17% (Figures XII.16 and XII.17). During the same period, in the EU-27, the energy intensity of the economy decreased by 16.34%.***

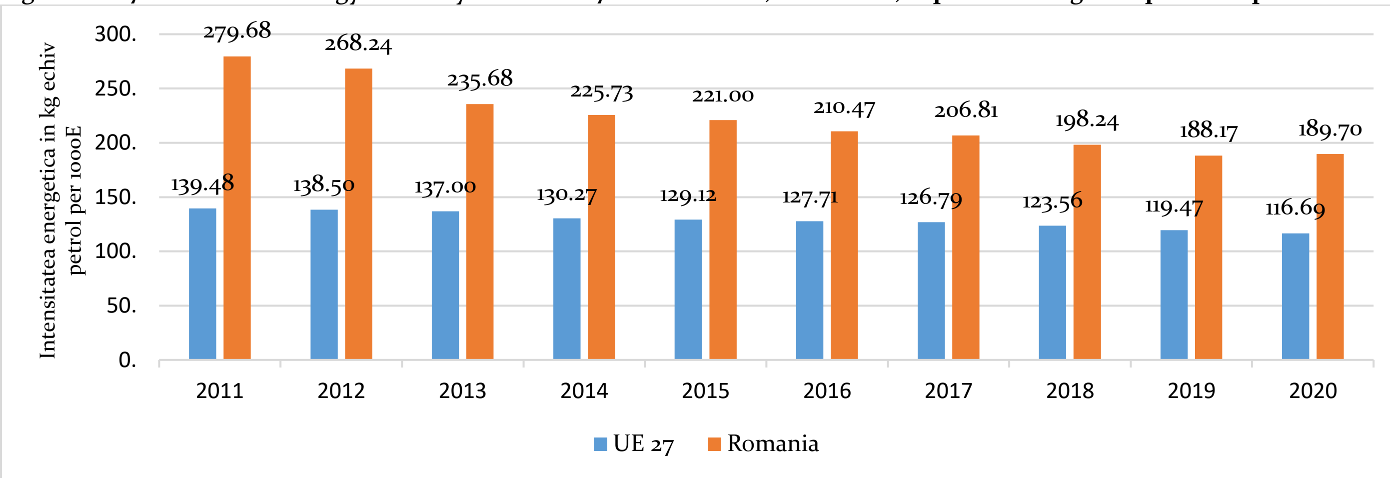
Figure XII.16 – The level of energy intensity in the EU 27, 2015-2020, expressed in kg oil equivalent per 1000 Euro



Sources: Eurostat, statistical database, http://ec.europa.eu/eurostat/ data available in 2022

It should be noted that the structure of an economy plays a significant role in determining energy intensity. Post-industrial economies with a developed services sector tend to have relatively low levels of energy intensity, whereas developing economies, where economic activities can have a significant share, are characterized by higher values of energy intensity.

Figure XII.17 The level of energy intensity in the EU 27 and Romania, 2011 – 2020, expressed in kg oil equivalent per 1000 Euro



Sources: Eurostat, statistical database,http://ec.europa.eu/eurostat/data available in 2022

ELECTRICITY FROM RENEWABLE ENERGY SOURCES

RO 31

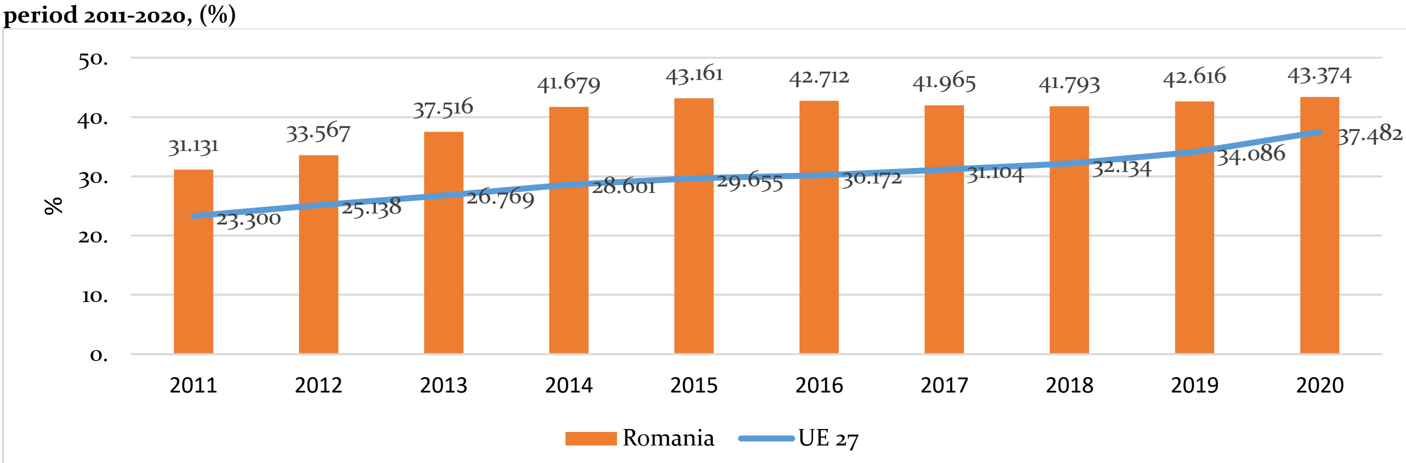
Indicator code Romania: RO 31
EEA indicator code: CSI 31

TITLE: **CONSUMPTION OF ELECTRICITY GENERATED FROM RENEWABLE ENERGY SOURCES**

DEFINITION: The indicator represents the ratio between the electricity produced from renewable energy sources and the gross internal consumption of electricity, expressed as a percentage.

The EU-27 objective for 2020 is for electricity from renewable sources to have a share of at least 21% of total electricity production. The most recent information available, for the year 2020 (see figure no.XII.18) shows that the electricity produced from renewable energy sources contributed 37.48% to the total electricity consumption in the EU-27. The increase in electricity produced from renewable energy sources in the last decade largely reflects an expansion on two renewable energy sources, namely wind energy and energy produced from biomass.

Figure XII.18 - Share of electricity from renewable energy sources in total electricity at the level of Romania and EU27 in the period 2011-2020, (%)



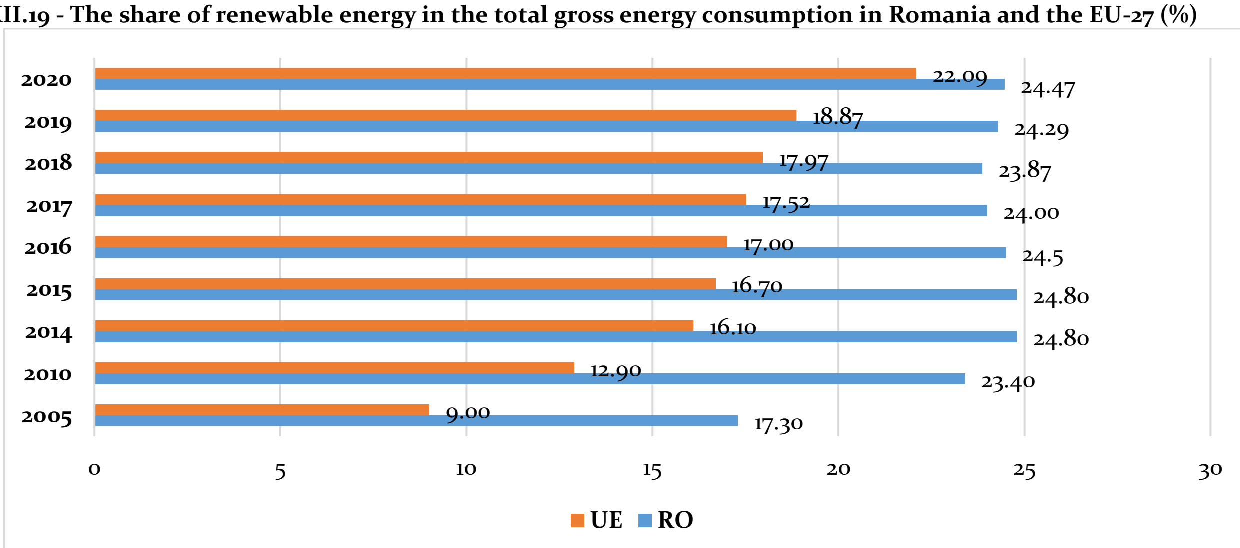
Sources: Eurostat, statistical database,http://ec.europa.eu/eurostat/data available in 2022

Between 2014 and 2020, the share of electricity from renewable energy sources in the EU-27 has shown a slight upward trend. During this period, there has been an increase in the share of electricity from renewable sources at the EU-27 level, rising from 28.6% to 37.48%. In recent years, there has been an increase in the share of electricity generated from nuclear and wind power plants. The share of electricity from renewable energy sources in Romania (see Figure No. XII.18) followed an upward trajectory from 30.38% in 2010 to 43.16% in 2015, followed by a slight decline in the years 2016-2018 to a level of 41.79%, and a slight resurgence in the last 2 years to 43.37% in 2020.

Consumption of primary energy produced from renewable sources
RO 30
Indicator code Romania: RO 30 EEA indicator code: CSI 30 / ENER 29
TITLE: **CONSUMPTION OF PRIMARY ENERGY PRODUCED FROM RENEWABLE ENERGY SOURCES**
DEFINITION: The share of renewable energy consumption represents the ratio between the gross internal consumption of energy produced from renewable energy sources and the total gross internal energy consumption, calculated for a calendar year, expressed as a percentage.

At the level of the European Union, the share of renewable energy in the total gross domestic energy consumption shows an upward evolution for the period 2005-2019, from the value of approximately 9% recorded in 2005 to the value of approximately 22.09% recorded in 2020. Also, at national level, the share of renewable energy in the total domestic gross energy consumption shows a slightly downward trend for the period 2014-2018, and in 2020 there was an increase of approximately 0.7% compared to the value established in 2019 (*Figure XII.19*)

Figure XII.19 - The share of renewable energy in the total gross energy consumption in Romania and the EU-27 (%)



Source: Eurostat https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_ind_ren&lang=en - no dates for 2021 have been identified

EMISSIONS OF SUBSTANCES WITH AN ACIDIFYING EFFECT

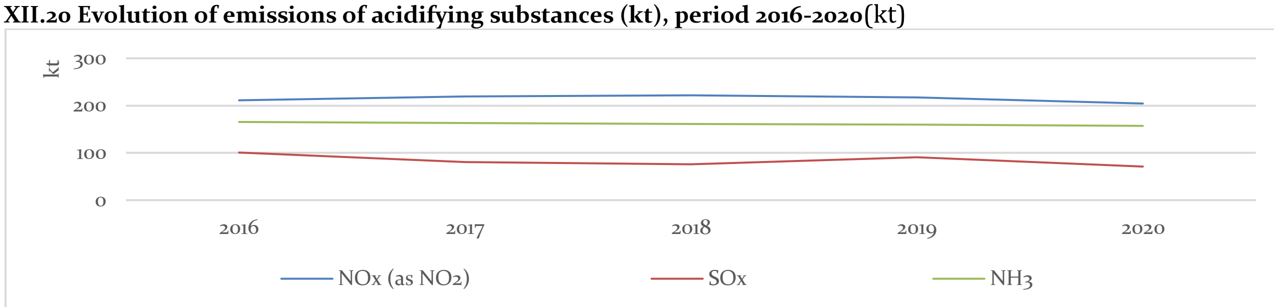
The acidity of the air is primarily determined by the presence of mineral acids that exist in the form of aerosols and originate from various chemical industries, aluminum factories, etc. Increased air acidity has implications for all environmental factors, constructions, and human health. Emissions of sulfur oxides, nitrogen oxides, and ammonia primarily result from the combustion of fossil fuels, chemical processes, and transportation. These pollutants are transported over long distances from the source of contamination, where, in contact with sunlight and water vapor, they form acidic compounds. Through precipitation, they are deposited onto the ground or become part of the water composition.

For SOx (sulfur oxides), there was a 30% decrease during the period 2016-2020, influenced by economic developments in the context of the COVID-19 pandemic, especially for those atmospheric pollutants primarily resulting from energy production, industrial processes, and road transportation. From the analysis of data regarding emissions trends from different sectors, it can be observed that the reduction in emissions of atmospheric pollutants, aimed at complying with air quality standards in specific areas, can be foreseen/anticipated as an outcome of their impact depending on the 'input' data characteristics (data complexity, organization, etc.) as well as the 'output' (***tables, graphs, see subsection 1.3 Trends and forecasts regarding ambient air pollution from Chapter I - Air Quality and Pollution***).

In the period 2008–2020, Romania reduced SOx emissions according to EU directives. This is the consequence of the environmental policy, to reduce pollutant emissions at national level from the energy, industrial, transport, agriculture and waste sectors. NOx pollutant emissions decreased by 3% and NH3 emissions decreased by 5% in 2020 compared to 2016 (*figure XII.20*)

RO 01
Indicator code Romania: RO 01
EEA indicator code: CSI 01
TITLE: **EMISSIONS OF ACIDIFYING SUBSTANCES**
DEFINITION: The indicator tracks trends in anthropogenic emissions of acidifying substances: nitrogen oxides (NOx), ammonia (NH3) and sulfur oxides (SOX, SO2) for each of them taking into account its acidifying potential.The indicator also provides information on changes in emissions from the main source sectors: energy production and distribution; energy use in industry; industrial processes; road transport; non-road transport; the commercial, industrial and household sector; use of solvents and products; agriculture; waste; others.

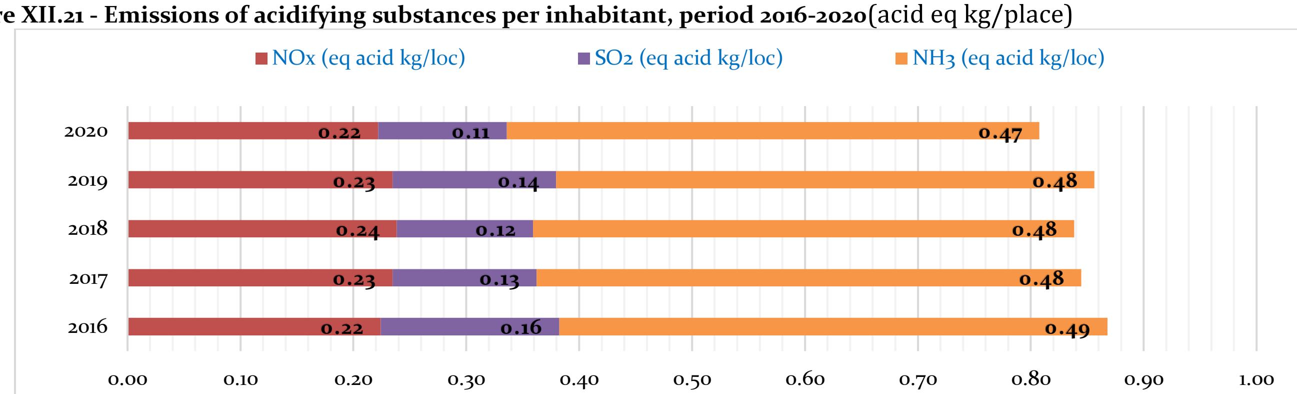
Figure XII.20 Evolution of emissions of acidifying substances (kt), period 2016-2020(kt)



NEPA source - Inventory of Atmospheric Pollutant Emissions

In 2020, the total level of emissions of atmospheric pollutants with an acidifying effect per capita in Romania was 0.82 kg acid equivalent/inhabitant, down 5%, compared to 2019, when the level was 0, 87 acid equivalent kg/inhabitant. *Figure XII.21* shows the evolution of emissions of acidifying substances in *acid eq kg/inhabitant* in the period 2016-2020, which decreased from 0.88 *total acid eq kg/inhabitant* in 2016 to 0.82 *total acid eq kg/ inhabitant* in 2020, meaning -7%

Figure XII.21 - Emissions of acidifying substances per inhabitant, period 2016-2020(acid eq kg/place)



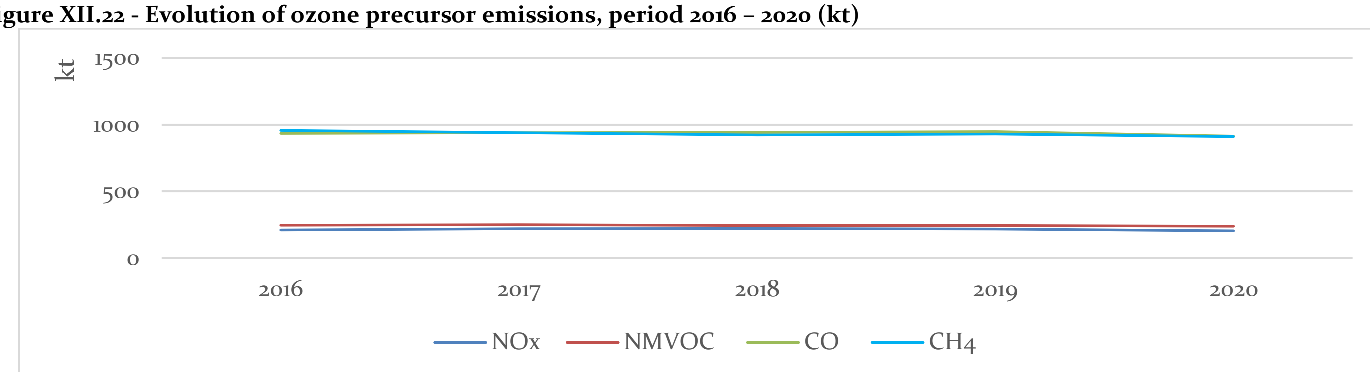
NEPA source - Inventory of Atmospheric Pollutant Emissions, 2020 edition

EMISSIONS OF OZONE PRECURSORS

RO 02
Indicator code Romania: RO 02
EEA indicator code: CSI 02
TITLE: **EMISSIONS OF OZONE PRECURSORS**
DEFINITION: The indicator monitors trends in anthropogenic emissions of ozone precursor pollutants: nitrogen oxides (NOX), carbon monoxide (CO), methane (CH_4), and non-methane volatile organic compounds (NMVOCs) originating from the following sectors: energy production and distribution; energy use in industry; industrial processes; road transportation; non-road transportation; commercial, industrial, and residential sector; use of solvents and products; agriculture; waste; and others.

In 2020, emissions of atmospheric pollutants responsible for the formation of tropospheric ozone exhibited variations ± depending on the impact of activities in the energy, industry, transportation, and agriculture sectors due to the COVID-19 pandemic. The overall trend in 2020 compared to 2019 showed a decrease in NOx emissions by -5.9%, NMVOC emissions by -2.2%, CO emissions by -3.6%, and CH_4 emissions by -2.1%, as shown in *Figure XII.22*.

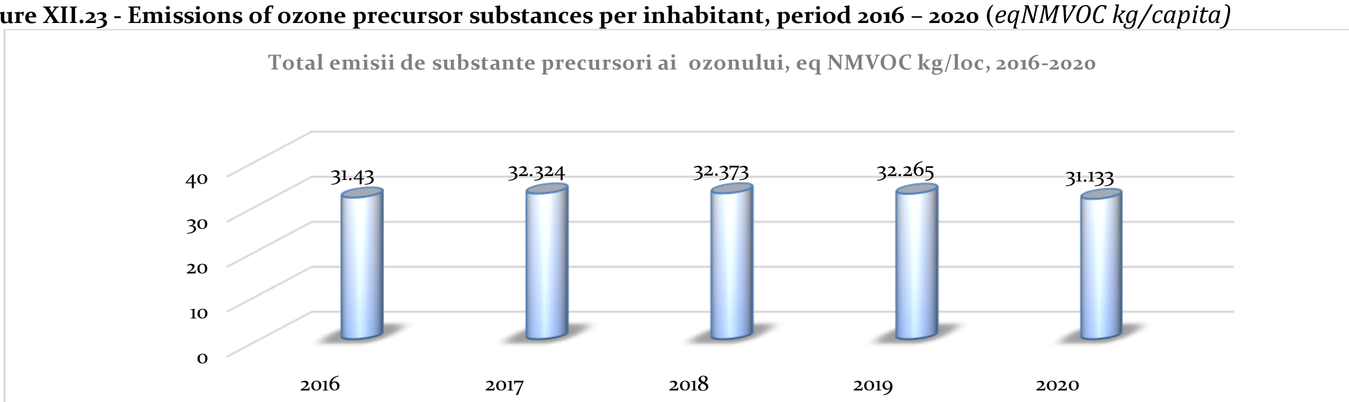
Figure XII.22 - Evolution of ozone precursor emissions, period 2016 – 2020 (kt)



NEPA source - Inventory of Atmospheric Pollutant Emissions, revised edition

The evolution of emissions of ozone precursor substances (expressed in kg NMVOC equivalent - potential indicator of tropospheric ozone formation: NOx - 1.22, CO - 0.11, CH_4 - 0.014) per capita in Romania (total kg eqNMVOC per capita) decreased by -3.51% in 2020 compared to 2019, from 32.26 *eqNMVOC kg per capita* in 2019 to 31.13 *eqNMCOV kg per capita* in 2020. *Figure XII.23* presents the trend in total emissions of ozone precursor substances in eqNMVOC kg per capita in Romania from 2016 to 2020, where small fluctuations of both increase and decrease can be observed during this period.

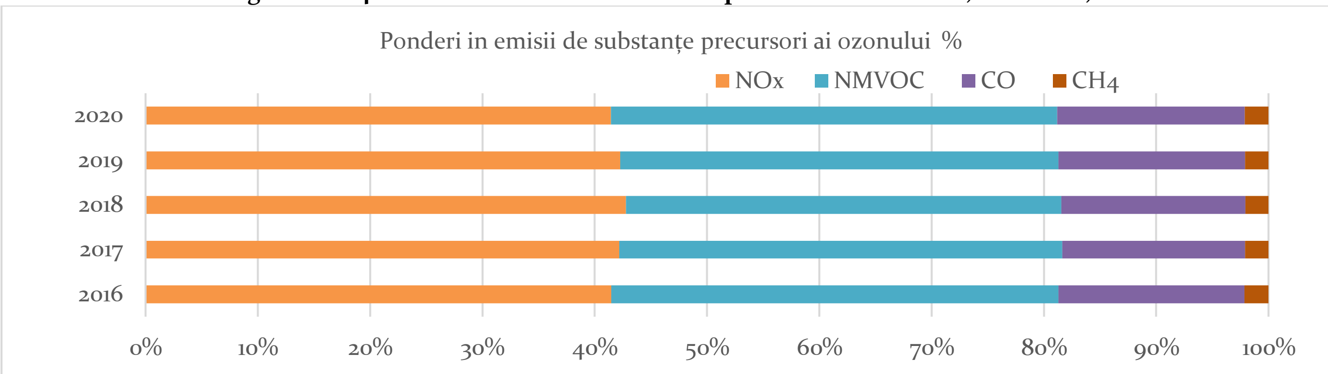
Figure XII.23 - Emissions of ozone precursor substances per inhabitant, period 2016 – 2020 (*eqNMVOC kg/capita)*



NEPA source - Inventory of Atmospheric Pollutant Emissions, revised edition

The largest shares of emissions of ozone precursor substances are found to be those originating from NOx emissions, followed by CO emissions, with CH_4 emissions having the smallest shares.

Figure XII.24 - Shares of emissions of ozone precursor substances, 2016-2020, %



NEPA source - Inventory of Atmospheric Pollutant Emissions, revised edition

Emissions of pollutant substances released into the atmosphere have a general trend of reduction as a result of the implementation of sustainable development principles and the adoption of environmental policies, such as: the production of green electricity - wind energy, photovoltaic energy, hydro, etc.; reducing the sulfur content in fuels and introducing biodiesel and bioethanols into fuels; replacing traditional household heating methods in rural areas (wood-burning stoves) with installations using pellets or natural gas as fuel; introducing hybrid and electric vehicles into operation; providing economic and financial mechanisms that allow the replacement of environmentally impactful installations with less polluting ones; equipping facilities with pollution control, capture, and storage systems (e.g., carbon capture and storage at large combustion plants, electrostatic filters, low NOx burners, scrubbers, etc.).

FREIGHT TRANSPORT DEMAND

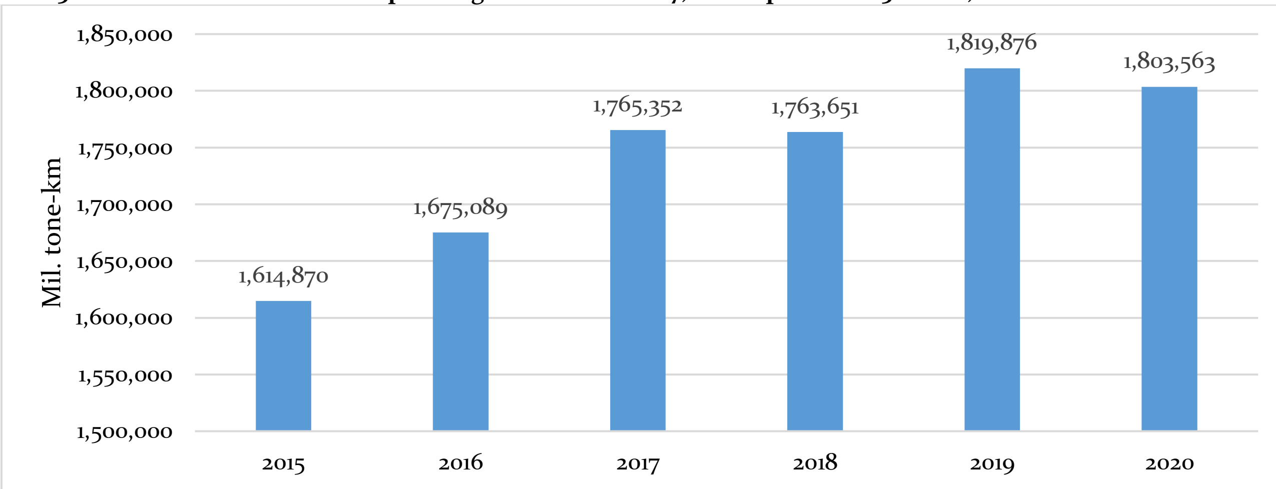
Freight transport demand per unit of GDP

RO 36
Indicator code Romania: RO 36
EEA indicator code: CSI 36
TITLE: **FREIGHT TRANSPORT DEMAND**
DEFINITION: The indicator is defined by the quantity of goods transported within the country (road, rail, and inland waterway transport), expressed in tonne-kilometres traveled domestically each year.

The level of domestic freight transport (measured in tonne-kilometres) can be expressed in relation to GDP. This indicator provides information about the relationship between the demand for freight transport and the size of the economy, allowing the monitoring of the intensity of freight transport demand in relation to economic developments.

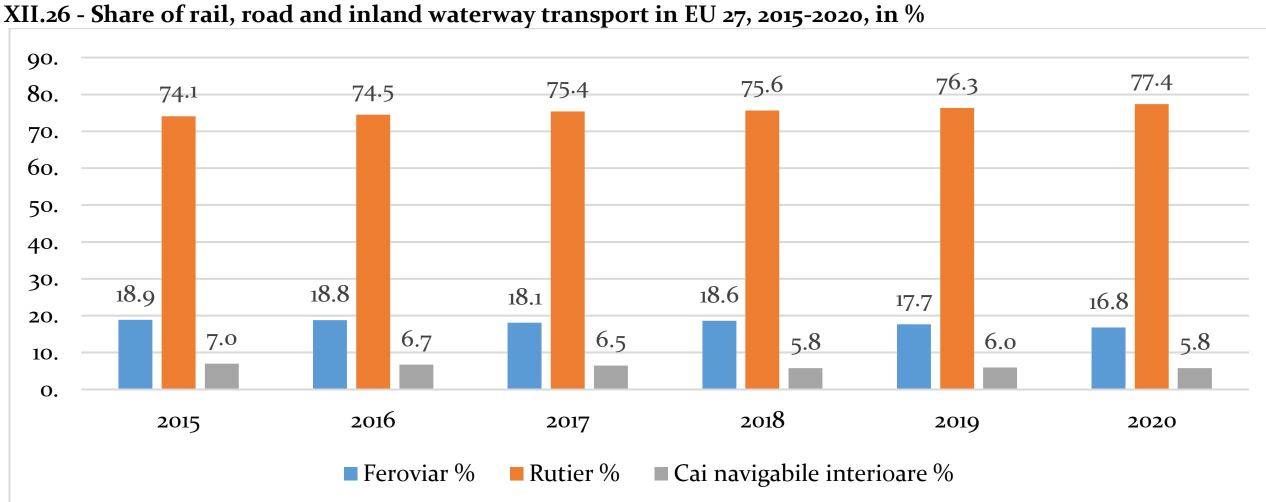
In 2020, the share of domestic road freight transport in the EU accounted for over three-quarters (77.4%) of the total domestic freight transport (measured in tonne-kilometres performed). With the exception of a slight decrease in the period 2010-2012 (by 2.3 percentage points) from the total freight transport, the share of domestic road freight transport in the EU continuously increased from 74.1% in 2015 to its peak of 77.4% in 2020, the last year with available data. After a sharp decline in 2010 (from 52.4% in 2009 to 36.9% in 2010), road freight transport in Romania experienced a resurgence in the period 2011-2020, rising from 36.9% to 45.5%, with an isolated setback in 2015 to 38%. Rail freight transport in the EU-27, during the period 2011-2020, gradually decreased from 18.7% to 16.8%. Similarly, rail freight transport in Romania experienced a decline in the same period, going from 35.4% to 25.8%. Freight transport on inland waterways saw a gradual reduction in its share of total freight transport from 7.4% to 5.8% during the period 2012-2020 *(see Figure XII.25).*

Figure XII.25 - Performance of road transport of goods in the EU-27, in the period 2015 – 2020, in million tonne-km



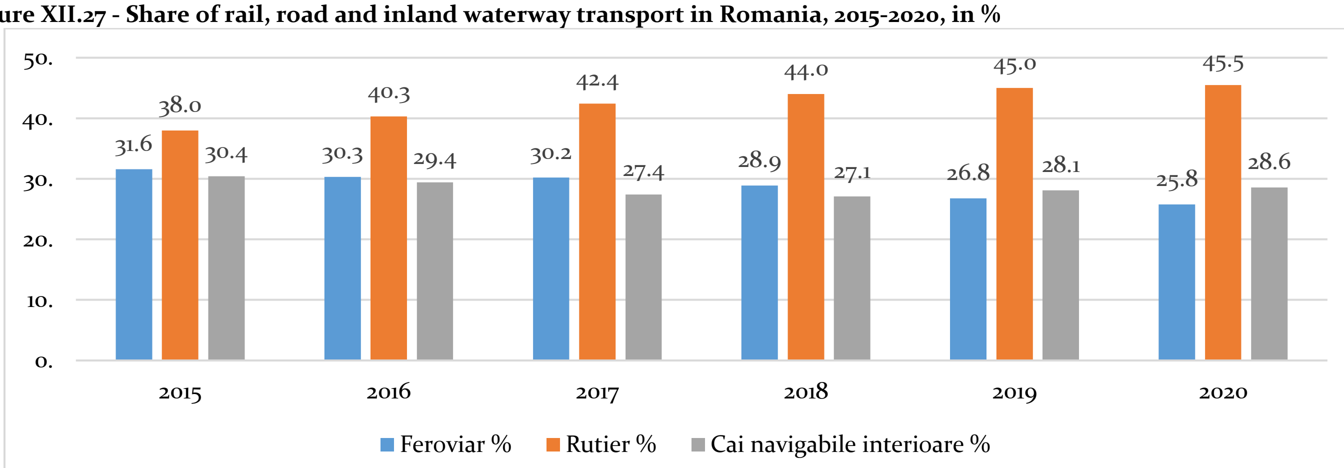
Source: Eurostat, statistical database http://ec.europa.eu/eurostat/data available in 2022. There is no data on rail transport at EU27 level

Figure XII.26 - Share of rail, road and inland waterway transport in EU 27, 2015-2020, in %



Sources: Eurostat, statistical database, http://ec.europa.eu/eurostat/data available in 2022

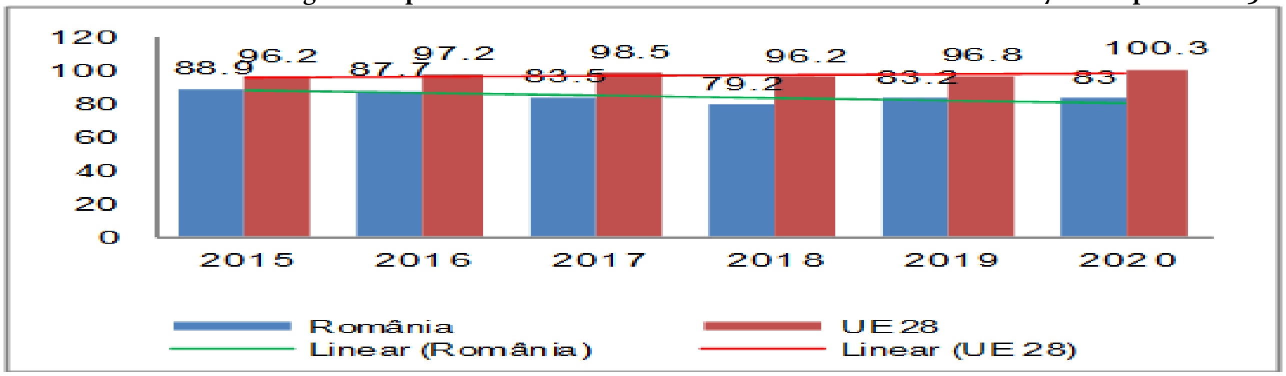
Figure XII.27 - Share of rail, road and inland waterway transport in Romania, 2015-2020, in %



Sources: Eurostat, statistical database, http://ec.europa.eu/eurostat/data available in 2022

The evolution of the ratio between the volume of domestically transported goods and GDP (expressed in constant euros, at the exchange rate of the reference year 2005) shows a slight downward trend for this indicator in Romania, with exceptions in the years 2015 and 2019 when increases were recorded. Thus, in the period 2015-2020, the level of domestically transported goods reported to GDP in Romania decreased by 6.6%. In the EU-27, after the increase recorded in 2011, the volume of transported goods decreased in 2012, fluctuating in the following years in the range of 95.5-97.6. A significant increase occurred in 2020, with a value of 100.3 for the index of the volume of domestic freight transport reported to GDP, with 2010=100. The evolution of the ratio between the volume of domestically transported goods and GDP (expressed in current prices and in euros 2005) in Romania and the EU-27 is presented in *Figure XII.28.*

Figure XII.28 – The volume of freight transport in relation to GDP at the level of Romania and EU-27 in the period 2015-2020



Sources: Eurostat, statistical database, http://ec.europa.eu/eurostat/data available in 2022

Freight transport demands

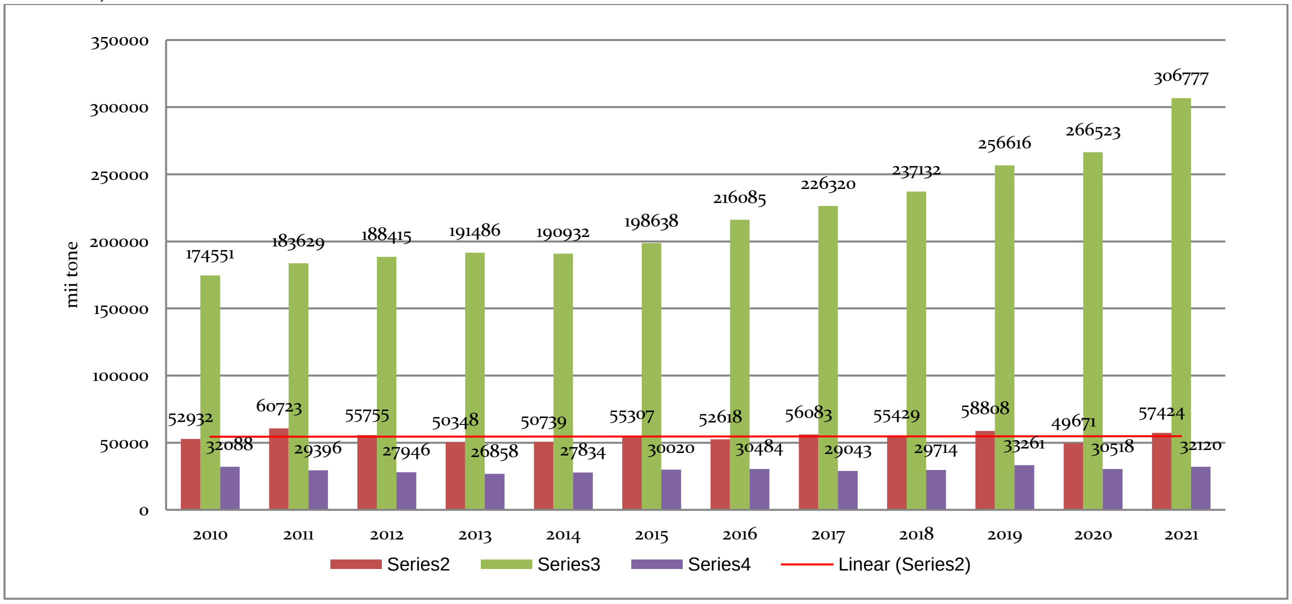
The volume of goods transported internally, in 2021, in Romania registered a significant increase of 49,609 thousand tons (14.3%) compared to the previous year (probable effect of the recovery after the first year of the pandemic crisis) and an increase of 47,636 thousand tons (13.66%) compared to 2019, respectively by 112356 thousand tons (39.57%) compared to 2015. (table XII.4 and figure XII.29)

Table XII.4 – Data on the volume of goods transported in Romania, by mode of transport, 2010-2021, thousands of tons

YEAR	MODE OF TRANSPORT		
	Railway (thousand tons)	Road (thousand tons)	Waterways (thousands of tons)
2010	52932	174551	32088
2011	60723	183629	29396
2012	55755	188415	27946
2013	50348	191486	26858
2014	50739	190932	27834
2015	55307	198638	30020
2016	52618	216085	30484
2017	56083	226320	29043
2018	55429	237132	29714
2019	58808	256616	33261
2020	49671	266523	30518
2021	57424	306777	32120

Sources: National Institute of Statistics Tempo-online

Figure XII.29 - The volume of goods transported in Romania, by rail, road and inland waterways, in the period 2010 – 2021 (thousand tons)



Source: National Institute of Statistics ,Tempo - online

AREA INTENDED FOR ECOLOGICAL AGRICULTURE

RO 26
Indicator code Romania: RO 26
EEA indicator code: CSI 26
TITLE: **AREA INTENDED FOR ECOLOGICAL AGRICULTURE**
DEFINITION: The indicator expresses the share of the area dedicated to organic agriculture (the sum of the current areas with organic agriculture and the areas undergoing transformation) from the total area used in agriculture

Organic agriculture is a production system that places significant emphasis on environmental and animal protection by reducing or eliminating genetically modified organisms and synthetic chemicals such as fertilizers, pesticides, and growth regulators. Organic agriculture is a dynamic sector in Romania that has experienced significant growth in recent years. In 2011, the total area cultivated using organic production methods in Romania was 229.95 thousand hectares, while in 2021, it reached 580.819 thousand hectares, representing an increase in organic cultivation areas by 23.87% compared to 2020 and a 152.58% increase compared to 2011 (*Table XII.5 and Figures XII.30, XII.31, and XII.32*).

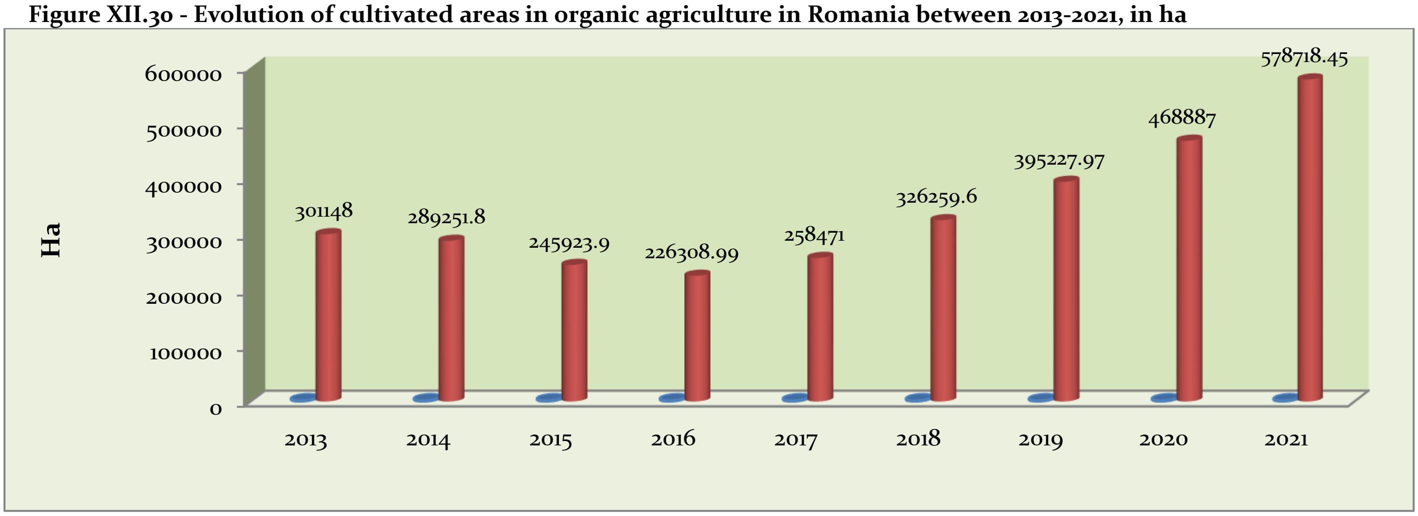
Table XII.5 - The dynamics of operators and areas in organic farming during the period 2013-2021

Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
The total number of certified operators in organic farming	15194	14470	12231	10562	8434	9008	9821	10210	12231
Total area in organic farming (ha)	301148	289251.79	245923.9	226309	258470.927	326259.55	395227.97	468887.05	578718.45
Cereals (ha)	109105	102531.47	81439.5	75198.3	84925.51	114427.49	126842.95	134170.21	139378.17

Dry legumes and oilseeds for grain production (including seeds and mixtures of cereals and legumes) (ha)	2397.34	2314.43	1834,352	2203.78	4994.66	8751.13	7411.05	5709.97	5852.99
Tuberous and root crops total (ha)	740.75	626.99	667,554	707,026	665.54	505.66	515.63	387.30	269.17
Industrial crops (ha)	51770.8	54145.17	52583.11	53396.86	72388.33	80193.08	78350.29	91638.97	114407.78
Green harvested plants (ha)	13184.1	13493.53	13636.48	14280.55	20350.75	28253.75	37660.85	53718.20	74703.17
Other crops on arable land (ha)	263.95	29.87	356.22	258.47	88.25	112.79	1774.15	0	190.17
Fresh vegetables (including melons and strawberries) (ha)	1067.67	1928,36	1210.08	1175.33	1458.78	983.10	804.29	847.79	1227.27
Permanent crops orchards, vines, fruit bushes, nuts, etc. (Ha)	9400.31	9438.53	11117.26	12019.81	13165.41	18569.27	22143.43	22219.42	21233.35
Permanent crops pastures and meadows (ha)	103702	95684.78	75853.57	57611.65	50685.74	66890.44	115420.14	155038.18	214657,2192
Uncultivated land (ha)	9516.33	9058.66	7225.852	9457.20	9747.94	7572.80	6077.27	5157.18	6799.16

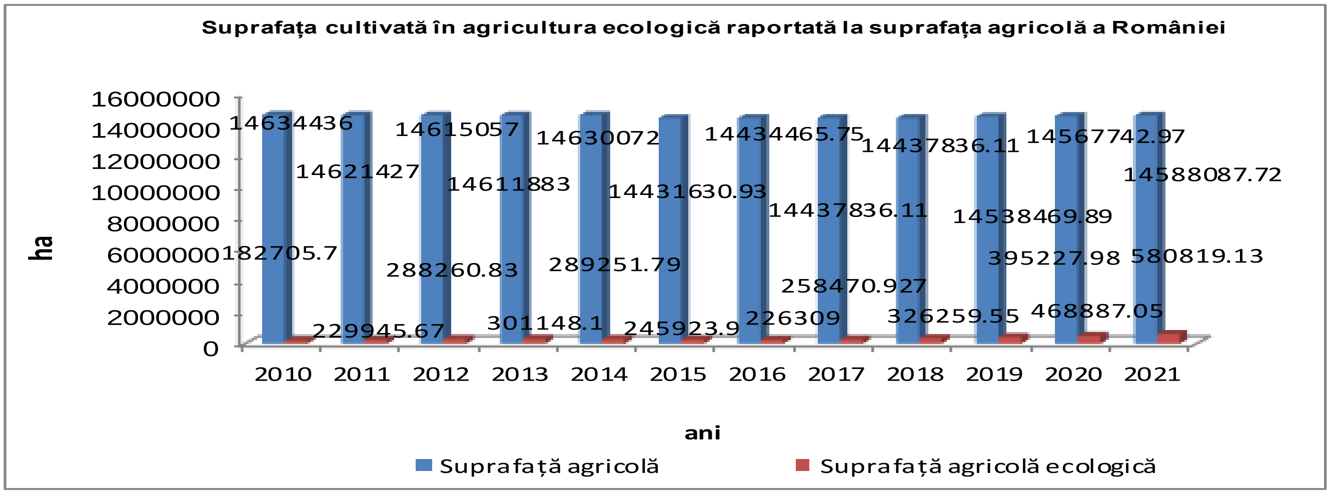
Source: MARD – Data communicated by control bodies approved by MARD (updated situation MARD October 2022)

Figure XII.30 - Evolution of cultivated areas in organic agriculture in Romania between 2013-2021, in ha



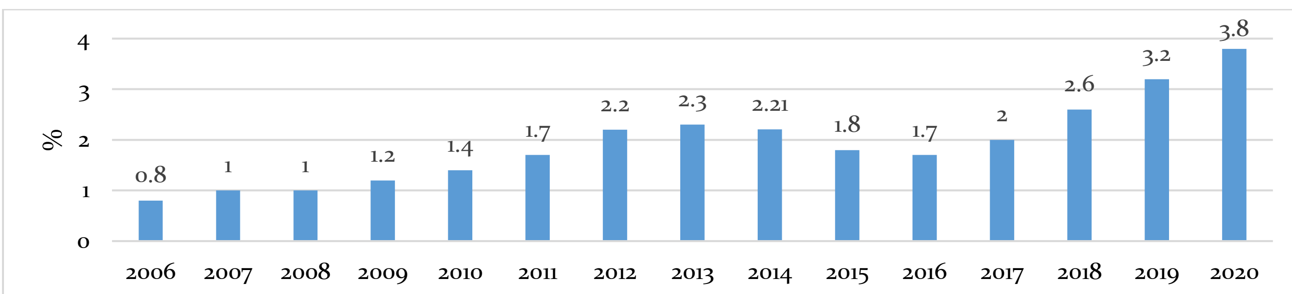
Source: MARD - Data communicated by control bodies approved by MARD (updated situation MARD October 2022) evolution of cultivated areas in ecological agriculture, recorded significant increases in the period 2017-2021 compared to previous years. Thus, during this period, the areas cultivated in ecological agriculture doubled, with a 156.65% increase between 2016 and 2021.

Figure III.31 - The cultivated area in organic agriculture reported to Romania's agricultural area, 2010 – 2021, ha



Source: ICPA, MARD

Figure XII.32 – The share of organic agricultural production in the total agricultural production of Romania, 2006 – 2020, %



Data source: NIS TempoOnline database

The certified organic livestock had fluctuating developments, with increases in bee and poultry sectors, but also decreases in livestock numbers in other sectors *(Table XII.6)*

Table XII.6 -The evolution of certified organic livestock, 2010 – 2021

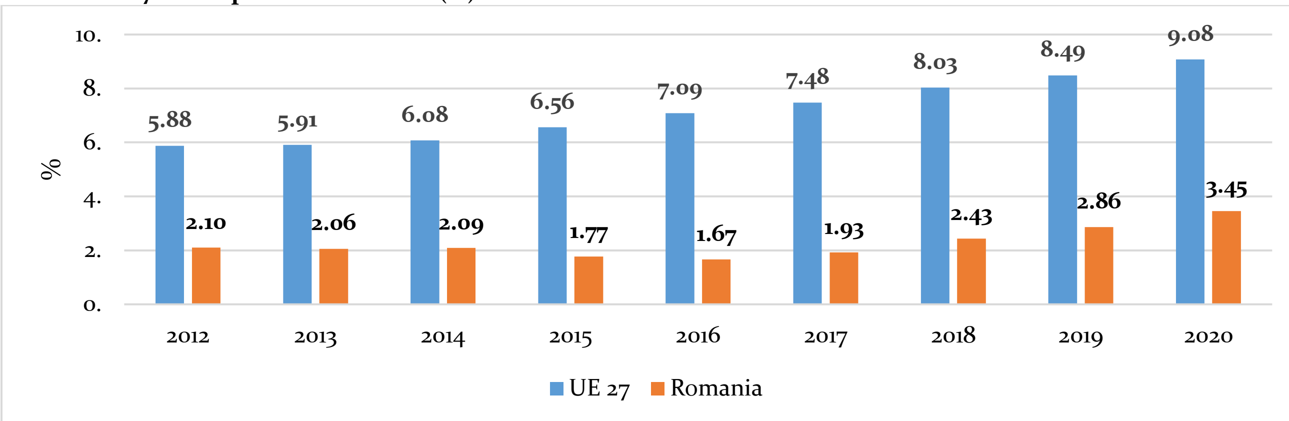
Indicator	UM	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cattle (total)	heads	5358	6894	7044	20113	33782	29313	20093	19939	16890	19419	19870	23339
Cattle for slaughter	heads	0	314	745	1101	244	491	478	481	701	482	690	922
Dairy cows	heads	3026	3599	2643	10088	23906	21667	15171	12472	10694	15724	12837	14807
Other cattle	heads	2332	2981	3656	8924	9632	7155	4444	6386	5495	3213	6343	7610

Swine (total)	heads	320	414	344	258	126	86	20	20	9	9	14	9
Fattening pigs	heads	0	201	212	125	18	43	13	17	-	9	0	0
Breeding sows	heads	30	89	42	77	33	14	7	3	-	0	0	0
Other pigs	heads	290	124	90	56	75	29	0	0	9	0	14	9
Sheep (total)	heads	18883	27389	51722	72193	114843	85419	66401	55483	32579	19367	13189	13837
Breeding ewes	heads	11285	21945	-	47472	96737	-	-	-	-	14832	11509	10941
Other sheep	heads	7598	5444	_	24721	18106	-	-	-		4535	1680	2896
Goats (total)	heads	1093	801	1212	3032	6440	5816	2618	1653	1360	8161	830	1080
Breeding goats	heads	966	596	-		5637	-	-	-	-	8112	808	1032
Other goats	heads	127	205			803	-	-			49	22	48
Poultry (total)	heads	21580	46506	60121	74220	57797	107639	63254	78681	83859	128596	171391	214104
Broilers	heads	0	150	37	-	-	-	-	285			27045	27405
Laying hens	heads	21580	46356	60064	-	57797	-	60220	77096		127136	143198	186699
Breeding poultrys	heads	-	-	-	-	-	-	-	-	-	-	0	0
Turkeys	heads	-	-	20	-	-	-	-	-	-	1460	1148	0
Ducks	heads	-	-	-	-	-	-	-	-	-	-	-	-
Geese	heads	-	-	-	-	-	-	-	-	-	-	-	-
Horses	heads	284	282	142	two hundred	626	485	-	202	-	297	506	55
Bees (number of hives)	families of bees	64836	77994	85225	81772	81583	-	86195	108632	138557	175959	170789	171564

Source: MARD-Communications control bodies approved by MARD

At the EU 27 level, the share of areas intended for organic agriculture in the total area used in agriculture registered a continuous increase, from 5.88% in 2012 to 9.08% in 2020. In Romania, the share of the area dedicated to organic agriculture increased in 2012 to 2.1% from 1.7% in 2011, followed by a decrease in 2015-2016 to 1.67% and a resumption of growth in 2017-2020 to 2.86 %. In figure XII.33. the evolution of the share of the area intended for ecological agriculture from the total area used in agriculture in the period 2012-2020 in Romania and in the European Union is presented.

Figure XII.33 - The share of the area intended for ecological agriculture from the total area used in agriculture at the level of Romania and EU-27 in the period 2012 – 2020 (%)



Source: Eurostat, statistical database

GENERATION OF MUNICIPAL WASTE

RO 16
Indicator code Romania: RO 16
EEA indicator code: CSI 16
TITLE: **GENERATION OF MUNICIPAL WASTE**
DEFINITION: The indicator expresses the total amount of municipal waste generated per capita (kg per capita and year)

In accordance with the provisions of the National Waste Management Plan, approved by Government Decision No. 942/2017, "*municipal waste consists of household waste and other waste which, by nature or composition, is similar to household waste*." ***According to Emergency Ordinance No. 92/2021 regarding waste management***, *municipal waste means: a) mixed waste and separately collected waste from households*, including paper and cardboard, glass, metals, plastics, biodegradable waste, wood, textiles, packaging, electrical and electronic equipment waste, battery and accumulator waste, and bulky waste, including mattresses and furniture; b) *mixed waste and separately collected waste from other sources*, in cases where such waste is similar in nature and composition to household waste. *Municipal waste does not include* waste generated from production, agriculture, forestry, fishing, septic tanks, sewage and treatment networks, including sewage sludge, vehicles taken out of use, or waste generated from construction and demolition activities. This definition applies even when waste management responsibilities are shared between public and private entities. *The collection of municipal waste* is the responsibility of municipalities, which can fulfill these duties either directly (through specialized services within Local Councils) or indirectly (by outsourcing this responsibility through contracts with specialized and authorized sanitation companies).

Generated municipal waste

The value was calculated by summing the quantities generated for the following types of waste:

- household and assimilated waste and from municipal services collected by sanitation operators, excluding inert waste;
- household waste generated and not collected by sanitation operators;
- recyclable waste from the population, collected through authorized economic operators, other than sanitation operators (paper and cardboard, metals, plastic, glass, wood, textiles, WEEE, waste batteries and accumulators).

It includes bulky waste, waste from parks, gardens and street cleaning, including the contents of street waste bins, as well as electrical and electronic equipment waste from households.

Excluded are: Sludges from urban wastewater treatment; Construction and demolition waste.

According to the method of collection, municipal waste is:

- Collected by or on behalf of municipalities;
- Collected directly by private economic operators - valid for WEEE and other types of recyclable waste;

- Generated and not collected by a sanitation operator, but managed directly by the generator.

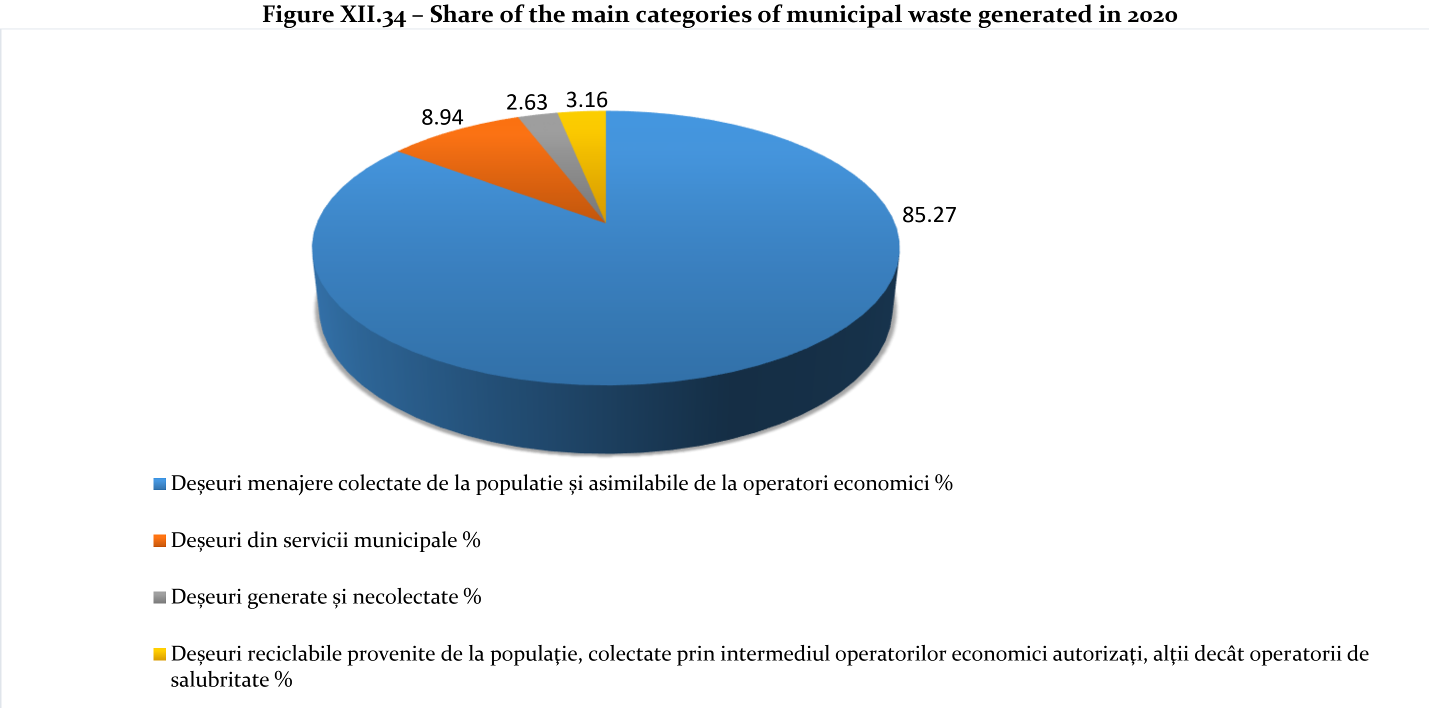
The amounts of waste generated by the population not served by sanitation services are calculated using the generation indices provided for in the *National Waste Management Plan*. For the year 2020, the generation indices taken into account are: 0.61 kg/capita/day for the urban environment and 0.29 kg/capita/day for the rural environment. *Table XII.7* shows the amounts of municipal waste generated by waste category in the period 2016-2020.

Table XII.7 – Quantities of municipal waste generated during 2016-2020

Indicator name	2016	2017	2018	2019	2020
Amount of municipal waste generated (tons)	5142542	5333171	5296239	5430341	5587893
From which:					
- Domestic waste collected from the population and assimilated from economic operators (tons)	3894853	4162921	4249988	4632802	4764923
- Waste from municipal services (tons)	454170	400228	430097	419429	499450
- Generated and uncollected waste (tons)	523670	419444	314022	178470	146873
- Recyclable waste from the population, collected through authorized economic operators, other than sanitation operators (tons)	269849	350578	302132	199640	176647
-Municipal waste generation indicator (kg/capita/year)	261	272	272	280	289

Source: National Environmental Protection Agency

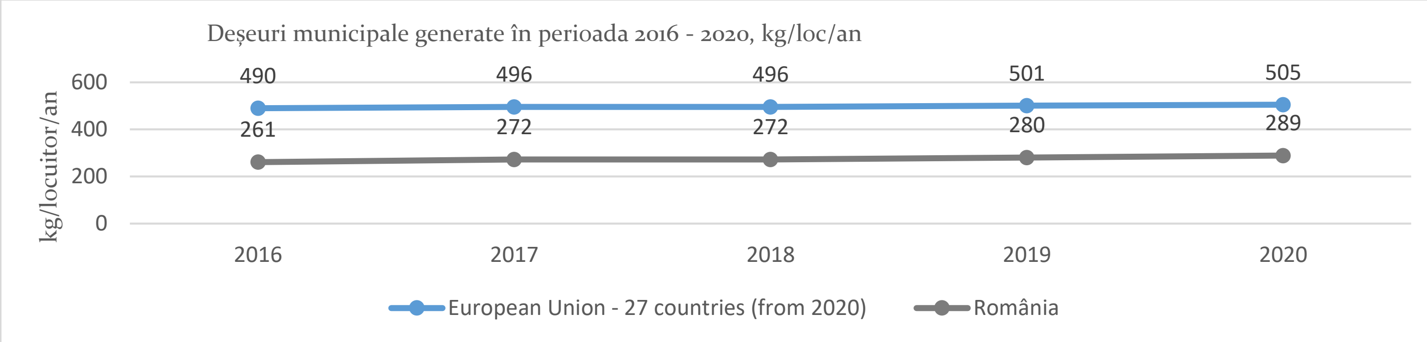
Figure XII.34 – Share of the main categories of municipal waste generated in 2020



Source: National Environmental Protection Agency

Figure XII.35 shows the evolution of the municipal waste generation indicator in Romania compared to the average recorded in the European Union.

Figure XII.35 - Evolution of municipal waste generation indicator in Romania compared to the EU average, 2016 - 2020, Kg/capita/year



Source: EUROSTAT and the National Environmental Protection Agency - 2022

Sustainable development indicators regarding municipal waste

Sustainable development indicators regarding municipal waste refer to:
- Municipal waste generated;
- Municipal waste treated by: recycling (exclusive of composting and anaerobic digestion), composting, energy recovery and storage.

Taking into consideration the above, based on the data reported by waste management operators, authorized waste collection operators other than waste management operators, and authorized waste treatment operators, the following sustainable development indicators for municipal waste have been calculated at national level.:
- Degree of connection to the sanitation service
- Amount of municipal waste collected separately
- Amount of municipal waste recycled (including composting)
- Degree of recycling achieved for municipal waste
- Amount of municipal waste used for energy
- Amount of biodegradable waste stored

The specific indicators of sustainable development *regarding municipal waste are presented in table XII.8.*

Table XII.8 – Specific information on municipal waste in the period 2016-2020

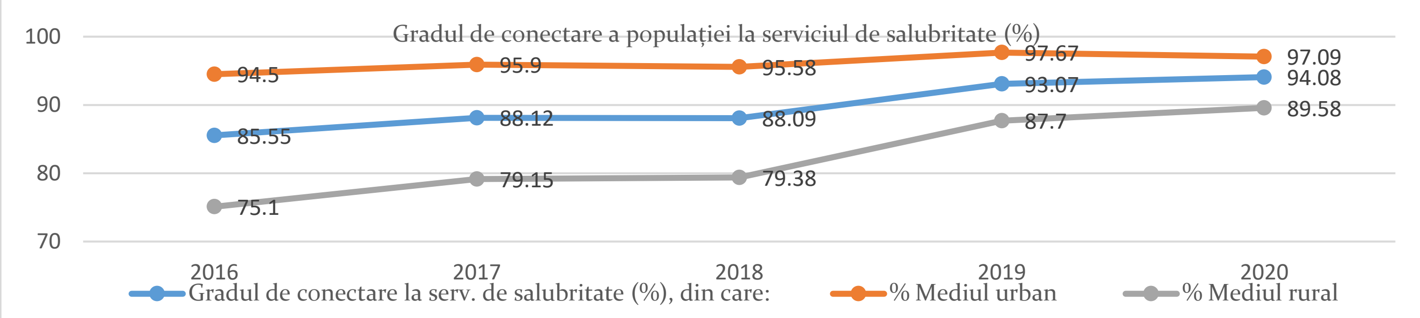
Indicator name	2016	2017	2018	2019	2020
Degree of connection to the sanitation service (%)	85.55	88.12	88.09	93.07	94.08
- Urban area	94.5	95.9	95.58	97.67	97.09
- Rural area	75.1	79.15	79.38	87.7	89.58
Amount of municipal waste collected separately (tons)	580602	696742	634536	576816	685092
Amount of municipal waste recycled * (tons)	689443	745427	586406	623214	662979
Degree of recycling achieved for municipal waste (%)	13.41	13.98	11.07	11.48	11.86
Amount of municipal waste used for energy (tons)	219608	227280	241445	251277	298421
Amount of biodegradable waste from the stored municipal waste (tons)	1913329	2159103	2068288	2120022	2077089
Number of compliant municipal warehouses in operation	37	42	43	44	46
Number of transfer stations in operation	51	52	53	84	95
Number of sorting stations in operation	101	103	105	103	107

**recycled waste comes from both separate collection and waste collected in a mixture, entered into treatment processes*

Source: National Environmental Protection Agency

According to what is presented in the table above, at national level, in 2020 the degree of connection of the population to the sanitation service increased to 94%. In the urban environment it is approximately 97% and in the rural environment it has increased to approximately 90%. *Figure XII.36* shows the evolution of the degree of connection to the sanitation service in the period 2016-2020.

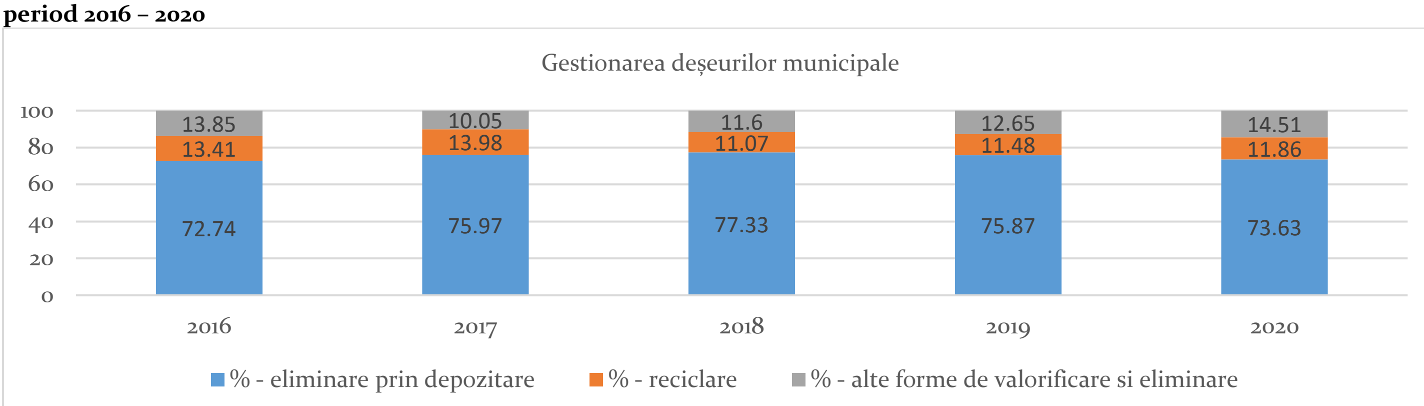
Figure XII.36 - The degree of connection of the population to the sanitation service in the period 2016-2020



Source: National Environmental Protection Agency

Municipal waste management involves the collection, transportation, recycling, and disposal of such waste, including overseeing these operations and maintaining the disposal sites**. The responsibility for municipal waste management lies with local government authorities,** which, either through their own means or by delegating sanitation services to an authorized operator, must ensure the collection (including separate collection), transportation, and treatment of these wastes. For certain waste streams falling under the category of municipal waste, collection is allowed from both the general population and authorized economic operators. Some of the collected municipal waste is sent directly for final recycling (material or energy) or disposal, while another portion is directed to intermediate treatment facilities (sorting stations, composting) - *see Figure XII.37*. ***The disposal of municipal waste is exclusively carried out through landfilling. To date, Romania has not put into operation facilities for municipal waste incineration. At the end of 2020, there were 46 authorized and operational landfill sites for municipal waste*.**

Figure XII.37 - Share of the main municipal waste management activities, in relation to the amount of waste generated, in the period 2016 – 2020



Source: National Environmental Protection Agency

Note: The decrease in the share of recycled waste starting from 2018 is determined by the change in the calculation methodology - starting this year, the amount of individually composted biodegradable waste was no longer considered recycled, taking into account the provisions of PNGD and European legislation

Figure XII.37 shows that in 2020 there was a slight reduction in the amount of municipal waste stored. However, the amount of stored waste still remains high, which is inconsistent with the principles and objectives adopted by the EU through the circular economy legislative package.

Reducing the amount of stored biodegradable waste

Biodegradable waste, according to the legislative provisions on waste storage, represents any waste that can undergo aerobic or anaerobic decomposition, such as food products, garden waste, paper or cardboard.

According to the terms of OG no. 2/2021 on waste storage, the amount of biodegradable waste stored for the year 2020

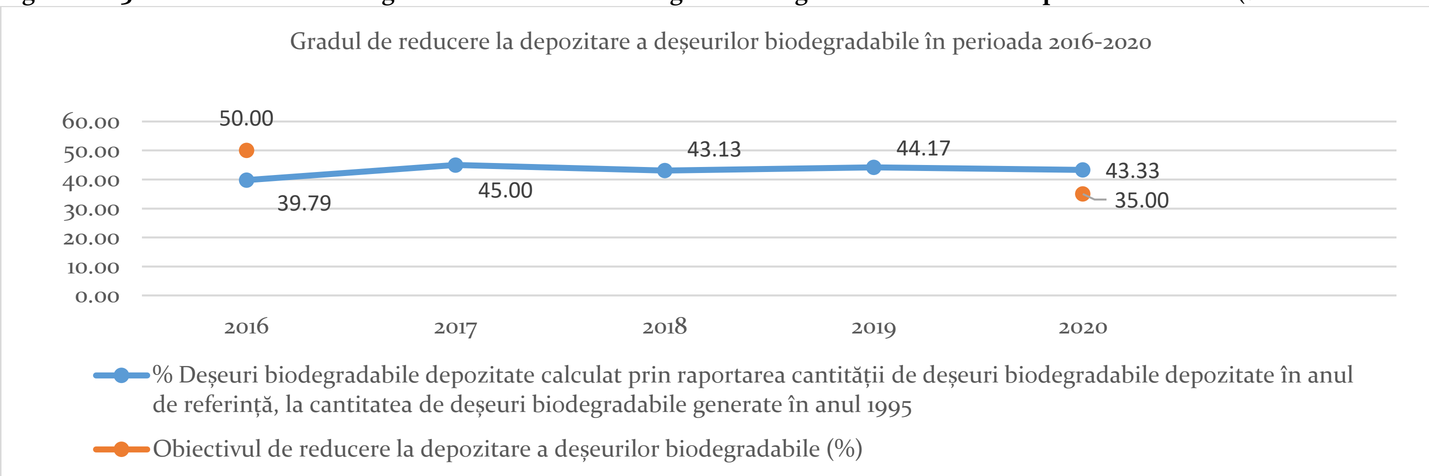
must be a maximum of 35% of the total amount, expressed gravimetrically, produced in 1995. *Table XII.9* shows the amounts of biodegradable waste generated and stored during the period 2016-2020.

Table XII.9 –The quantities of biodegradable waste generated and stored during 2016-2020

Indicator name	1995	2016	2017	2018	2019	2020
Amount of biodegradable waste generated (million tons)	4.80	2.64	2.89	2.81	2.99	3.00
Amount of stored biodegradable waste (million tons)		1.91	2.16	2.07	2.12	2.08
Biodegradable waste deposited compared to 1995 (%)		39.79	45.00	43.13	44.17	43.33

Source: National Environmental Protection Agency

Figure XII.38 - Evolution of the degree of reduction in storage of biodegradable waste in the period 2016-2020 (%



Source: National Environmental Protection Agency

USE OF FRESHWATER RESOURCES

RO 18
Indicator code Romania: RO 18
EEA indicator code: CSI 18
TITLE: **USE OF FRESHWATER RESOURCES**
DEFINITION: The Water Exploitation Index (WEI) represents the annual average total freshwater withdrawal divided by the annual average total renewable water resources at the national level, and it is expressed in percentages

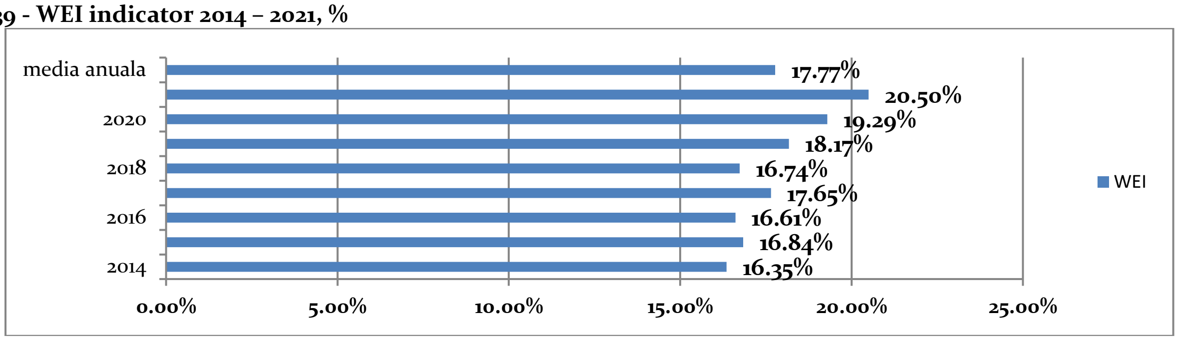
A concept used in water resource management is that of *water pressure*. It is generally directly related to an overexploitation of water exceeding the available resources in certain areas. The ratio between the total withdrawals of freshwater and the total resources generally indicates the presence of pressure on water resources and is called the *Water Exploitation Index (WEI)*. According to the document elaborated by the European Commission in 2009 on Water Scarcity & Drought, if this indicator is below 10%, then it is considered that water resources are not under pressure. If this indicator falls between 10% and 20%, then it is considered that water resources are under low pressure. Values of the exploitation index exceeding 20% indicate the presence of pressure on water resources, and an index above 40% is a sign of severe stress on water resources. The WEI (%) values for the period 2014-2021 (represented in *Table XII.10 and Figure XII.39*) are below 20%, so ***it can be considered that Romania's water resources are under low exploitation pressure.***

Table XII.10 - Time evolution of water consumption in Romania 2014-2021 (billion m3)

Years	2014	2015	2016	2017	2018	2019	2020	2021	Average years 2014 - 2021
Usable resource billion m3	38.35	38.35	38.35	38.35	38.35	38.35	38.35	38.35	38.35
Total water withdrawal billion m3	6.27	6.46	6.37	6.77	6.42	6.97	7.40	7.86	6,815
WEI indicator, %	16.35%	16.84%	16.61%	17.65%	16.74%	18.17%	19.29%	20.49%	17.776%

Source: NEPA processing based on the data provided by the National Administration "Romanian Waters"

Figure XII.39 - WEI indicator 2014 – 2021, %



Source: NEPA processing based on the data provided by the National Administration "Romanian Waters"

Natural water resources at the level of 2021 and for the interval 2016 - 2021

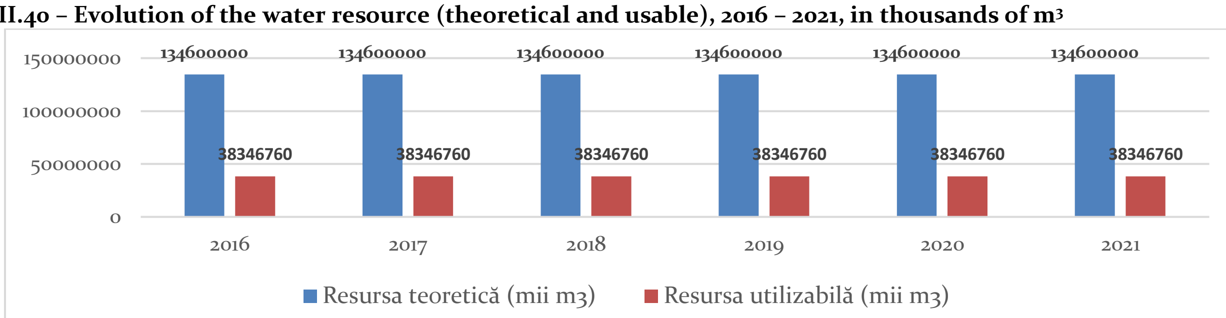
Natural water resources represent the surface and groundwater reserves of a territory that can be used for various purposes. *The natural resource* is the quantity of water expressed in volume units accumulated in bodies of water over a given period of time, in this case, during the year 2021. *The theoretical resource* is determined by the average annual stock representing the total natural water resources, both surface and underground. *The technically usable resource* is the portion of the theoretical resource that can be withdrawn to meet the water demands of the economy.

Table XII.11 – Potential and technically usable water resources (theoretical and usable), 2016 – 2021, in thousands of m3

Years	The theoretical resource (thousand m3)	Usable resource (thousand m3)
2016	134600000	38346760
2017	134600000	38346760
2018	134600000	38346760
2019	134600000	38346760
2020	134600000	38346760
2021	134600000	38346760

Source: National Administration "Romanian Waters", INHGA

Figure XII.40 – Evolution of the water resource (theoretical and usable), 2016 – 2021, in thousands of m3



Source National Administration:"Romanian Waters", INHGA

The usable resource, according to the level of development of the hydrographic basins, also includes the resource related to the coastal lakes, as well as the resource ensured by indirect external reuse along the river.

Surface water resources of Romania, 2016 - 2021

Romania's surface water resources come from two categories of sources: inland rivers (including natural lakes) and the Danube River. For users in Romania, the primary source of water supply is inland rivers. Natural lakes have limited water volumes, with the exception of the coastal lakes in the Razelm-Sinoe lagoon system, which, although having substantial volumes, contain brackish water due to their connections to the Black Sea. The Danube River, despite having the largest total volume of resources, is located eccentrically relative to the national territory and is less commonly used as a source of usable water. To date, the only utilization of water resources provided by the Danube has been in agriculture (for irrigation).

The natural water resource from inland rivers in the year 2021 amounted to a discharge volume of 39,354 * 10^6 m^3, which is 2.6% above the calculated multi-year average volume for an extended period, specifically 38,364 * 10^6 m^3, and approximately 6% higher than the assured resource regarding the degree of development of the hydrographic basins, which is 37,160 * 10^6 m^3 determined for the year 2021. ***In this context, the year 2021 can be considered a normal year***. *Compared to the last 5 years (2016 - 2020), the discharge volume in 2021 is higher than the multi-year average of the annual stock (35,516 * 10^6 m^3) discharged during the mentioned period (see Table XII.12 and Figure XII.41).*

Table XII.12 – Water resources in 2021, compared to the period 2016 – 2020, by river basins

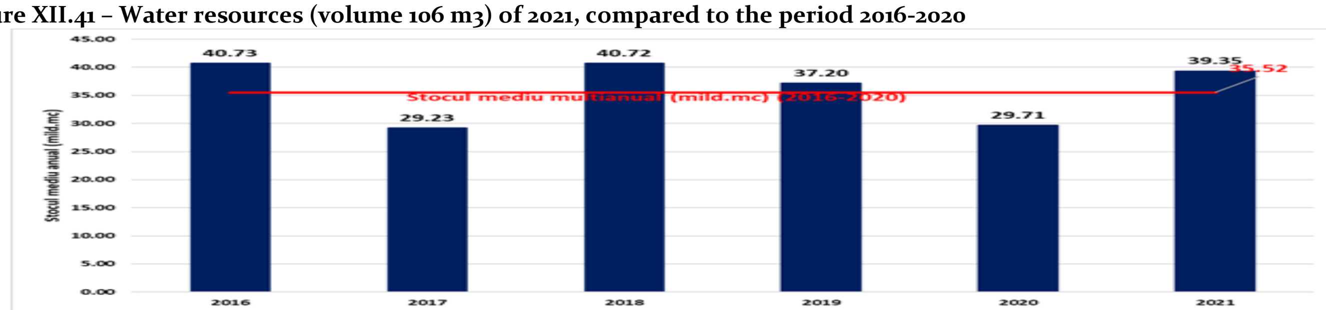
River basin	Parameter	F (km^2)	Annual avg Q (m^3/s)							Q_{2021}/Q_{avg} (%)
			2016	2017	2018	2019	2020*	MED 2016-2020	2021	
TISA*	Q	4540	62.2	74.57	70.7	65.87	62.1	67.1	73.8	110
	V		1980	2352	2230	2077	1964	2121	2327	
SOMEȘ	Q	17840	129.8	95.21	93.21	109.38	80.3	102	136.1	134
	V		4105	3003	2939	3450	2539	3207	4290	
CRIȘURI	Q	14860	90.4	64.92	81.48	79.88	52.1	73.8	87.6	119
	V		2859	2047	2569	2519	1648	2328	2762	
MUREȘ	Q	29390	176.4	116.1	159.4	139.2	135.2	145	161.4	111
	V		5578	3661	5027	4391	4275	4586	5090	
BEGA – TIMIȘ - CARAȘ	Q	13060	78.85	46.61	66.3	80.86	65.9	67.7	98.4	145
	V		2487	1470	2091	2550	2084	2136	3103	
NERA - CERNA	Q	2740	35.8	19.38	33.01	32.4	31.1	30.3	35.4	116
	V		1132	611	1041	1022	983	958	1115	
JIU	Q	10080	154	70.8	111	92.7	79.0	102	123.7	122
	V		4870	2233	3500	2923	2498	3205	3901	
OLT	Q	24050	162	134	205	156	135	158	189	119
	V		5123	4226	6465	4920	4269	5001	5960	
VEDEA	Q	5430	15.9	7.15	25.1	10.28	4.81	12.6	9.72	77.0
	V		503	225	791	324	152	399	307	
ARGEȘ	Q	12550	75	57.68	74.85	89.27	48.8	69.1	70.4	102
	V		2372	1819	2361	2815	1543	2182	2221	
IALOMITA	Q	10350	45.1	40.2	45	33	28.8	38.4	45.4	118
	V		1426	1268	1419	1041	911	1213	1432	
DUNĂREA	Q	34141	33.1	23.55	35.17	32.09	21.1	29.0	29.9	103
	V		1047	743	1109	1012	667	916	943	
SIRET	Q	42890	217	160.3	272.57	241.45	187.2	216	176.2	81.7
	V		6862	5055	8596	7614	5920	6809	5560	
PRUT**	Q	10990	7.39	13.72	15.16	15,363	6.86	11.7	9.55	81.6
	V		234	433	478	484	217	369	301	
DOBROGEA	Q	5480	4.88	2.63	3.34	1.67	1.12	2,728	1.33	48.8
	V		154	82.8	105	53	35	86.0	42.0	
Total	Q	238391	1288	926.83	1291.29	1179.45	939.39	1125	1247.9	111

Romania without the Danube River	V		40732	29228	40722	37195	29705	35516	39354	

Source: "Romanian Waters" National Administration "Romanian Waters", INHGA

Note: Q - Flow rate Q (m³/s), V - total volume (106m³)
** - does not include the flow and volume of the Tisa River*
*** does not include the flow and volume of the Prut River, which is a border watercourse*

Figure XII.41 – Water resources (volume 106 m3) of 2021, compared to the period 2016-2020



Source: National Administration"Romanian Waters", INHGA

Extending the analysis of the comparative evolution of the resource related to the year 2021 at the level of the main basins, we find that at national level, the volume drained in 2021 was about 4% higher compared to the multi-annual average of the last 5 years. The lowest value of the annual average stock (below 50% of the multiannual average of the last 5 years) was recorded in the Dobrogea river basin (48.8%) (*see table XII.12*). The hydrographic basins in the west of the country, namely Someș (134%), Crișuri (122%), Jiu (122%), Olt (119%), Ialomița (118%), Tisa (110%) and Bega - Timiș - Caraș (110 %) recorded multi-year average stock values above the multi-year average stock values determined for the period 2015-2019, the increases being between 10% and 34%. In conclusion, the year 2021 was a normal to rainy year in terms of the amount of total water resource from inland rivers. The Danube River presents a situation similar to that recorded on the inland river courses, the volume flowing at the entrance to the country (St. Baziaș) and that recorded at the exit from the country (St. Isaccea) being below the average level calculated for the last 5 years (*see table XII.13*). The corresponding resource of the Danube river at the entrance to the country is 80007 mid.m³ in 2021 (respectively, 75624 billion m³ in the period 2016-2020), about 6% higher than the multi-annual average of the river which, for the last 60 years, is approx. 85,000 billion m³ (the values represent 50% of the volumes flowing down the Danube at the entrance to the country, related to Romania, the other half belonging to the Republic of Serbia).

Table XII.13 – Water resources of of the Danube river in 2021, compared to the period 2016-2020

Hydrometric control stations on the Danube river	Param.	$Q_{annual\ avg}$(m³/s)							Q_{2021}/Q_{med} (%)
		2016	2017	2018	2019	2020*	AVG 2016-2020	2021	
Baziaș	Q	5410	4530	5072	4813	4419	4849	5074	106
	V	170610	142858	159950	151783	139738	152988	160015	
	V 1/2	85305	71429	79975.3	75891.5	69869	75624	80007	
Isaccea	Q	6470	5210	6499	5593	4893.5*	5943	6022	105
	V	204038	164303	204952	176381	154742	180883	189910	

Source: National Administration "Romanian Waters", INHGA

***Note**: Q - Flow Q (m³/s), V - total volume (106 m³), V 1/2 - the values represent 50% of the volumes flowing on the Danube at the entrance to the country, related to Romania, the other half belonging to the Republic of Serbia*
** - as a result of inconclusive data from the Isaccea hydrometric station, the water resource of the Danube River at the exit from the country was determined for the year 2020 by summing the water stock determined at the Grindu hydrometric station on the Danube River with the sum of the water stock of the Prut River determined at the Oancea hydrometric station.*

Compared to the total volume of resources provided by inland rivers (39,354 $*10^6$ m³), at the country's exit (Isaccea hydrometric station), the Danube had a runoff volume approximately five times larger (189,910 $*10^6$ m³). However, the significant resource represented by the Danube River is less accessible due to water pollution and its position eccentricity relative to potential users in Romania. The average resource in Romania is approximately 0.165 million m³/km². In 2021, the richest water resources were found in the Tisa, Someș, Crișuri, Mureș, and the watersheds of Banat, Jiu, Olt, Argeș, Ialomița, while the rivers in the Dobrogea region were the most deficient in this regard. Furthermore, Romania had a specific resource from inland rivers in 2021 of 2,071 m³/person/year, relative to a population of 19,003,002 people (Romania's population in 2021 according to https://www.worldometers.info/world-population/romania-population/). Expanding the analysis, the specific resource was calculated for each analyzed hydrographic basin. Thus, using GIS techniques, the population corresponding to each hydrographic basin was determined based on the "Localities" shapefile, with the "Population" field created using data from the 2011 Population and Housing Census (http://www.recensamantromania.ro/). The obtained data are presented in Table XII.14.

Table XII.14 – The specific resource calculated by hydrographic basins based on data from the 2011 Population and Housing Census

River basin	F (km²)	Average annual volume (mil.m³)	No. inhabitants (2011)	Theoretical specific resource (m³/inhabitant/year)
TISA	4540	2327	300747	7737
SOMEȘ	17840	4290	1505499	2850
CRIȘURI	14860	2762	853134	3237
MUREȘ	29390	5090	1902949	2675
BEGA – TIMIȘ - CARAȘ	13060	3103	874429	3549
NERA - CERNA	2740	1115	52651	21177
JIU	10080	3901	929184	4198
OLT	24050	5960	1892452	3149
VEDEA	5430	307	360155	852
ARGEȘ	12550	2221	3379628	657
IALOMIȚA	10350	1432	1279917	1119
DUNĂREA	34141	943	1537039	614
SIRET	42890	5560	3563802	1560
PRUT	10990	301	1072436	281
DOBROGEA	5480	42	617565	68.0
Total Romania without the Danube River	238391	39354	20121587	1956

Source: National Administration "Romanian Waters", INHGA

Note: The values of the volumes from 2021 were reported to the data from the Population and Housing Census from 2011

Groundwater Resources of Romania 2016 - 2021

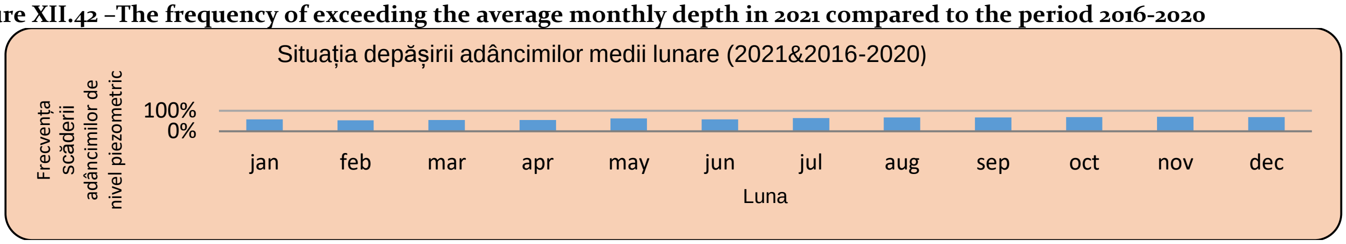
Groundwater resources represent the volume of water that can be extracted from an aquifer, in other words, the exploitable water volume. This concept is complex because the amount of water that can be provided by an aquifer depends on the volume of reserves and is limited by technical and economic possibilities, as well as by conservation and protection of resources**. Groundwater reserves** represent the volume of gravitational water stored in a specific period or at a specific moment in an aquifer or rock formation. Reserves are conditioned by the geological structure, meaning the geometry of the aquifer and the effective porosity or storage coefficient, a factor that expresses the volume of free water in the rock formation. Reserves depend solely on volumetric data and are expressed in units of volume (usually in cubic meters, m³). ***The total groundwater resources in Romania were estimated at 9.68 billion cubic meters per year, of which 4.74 billion cubic meters per year were from shallow groundwater and 4.94 billion cubic meters per year from deep groundwater, representing approximately 25% of surface water***. In Romania, the identification and delimitation of groundwater bodies were carried out in accordance with the specific methodology for groundwater characterization developed within the National Institute of Hydrology and Water Management (INHGA), taking into account the provisions of the Water Framework Directive 2000/60/EC and the guidelines developed within the Common Implementation Strategy for the WFD. Groundwater bodies were delineated for areas with significant aquifers, defined as those with exploitable yields greater than 10 cubic meters per day. In the rest of the territory, even though there may be local conditions for groundwater accumulation, they do not qualify as groundwater bodies according to the provisions of the Water Framework Directive. In Romania, a total of 143 groundwater bodies were identified, delineated, and characterized. Among these,

115 represent shallow groundwater bodies, while 28 are deep groundwater bodies. Generally, groundwater from the first aquifer encountered at depth is used for irrigation and industrial purposes, while water for domestic use is typically obtained from springs and deep wells. The quality of the water is determined by the mineralogical and chemical composition of the rock in which the groundwater is located, as well as regional and/or local tectonic evolution. Consequently, there are deep groundwater sources with high mineralization levels, such as those in the northern part of Moldova (where deposits consist mainly of sandy clays and fine sands, with aquifers having low discharge capacity and thickness), the central-northern part of the Transylvanian Depression, or in the Carpathian bend region (due to outcrops at or near the surface). These qualitative aspects often render the groundwater unsuitable for human consumption.
In the Transylvanian Depression, the Western Plain, and western Oltenia, deep groundwater naturally contains high levels of ammonia, making them non-potable, and necessitating treatment measures.

Analysis of the evolution of shallow groundwater levels in the period 2016-2021

The daily data (with 10 measurements per month) obtained from a selection of 267 monitoring wells, chosen as representative for the Monthly Hydrogeological Bulletin transmission program, were statistically processed and graphically represented to highlight the groundwater flow regime in shallow aquifers in the year 2021 compared to the previous five years. Since the number of monitoring points represents approximately 10% of the National Hydrogeological Network, this analysis serves an informational purpose. In 2021, compared to the period of 2016-2020, the frequency of monthly average groundwater level decreases exceeded 50% nationwide, reaching a maximum of 70% in November (*Figure XII.42*). In the hydrographic basins located in the north-western and central parts of the country, the period from February to May 2021 was characterized by piezometric levels exceeding those of the previous five years, in accordance with cumulative monthly precipitation maps (source: A.N.M.). For the rest of the territory, this characteristic was observed only locally.

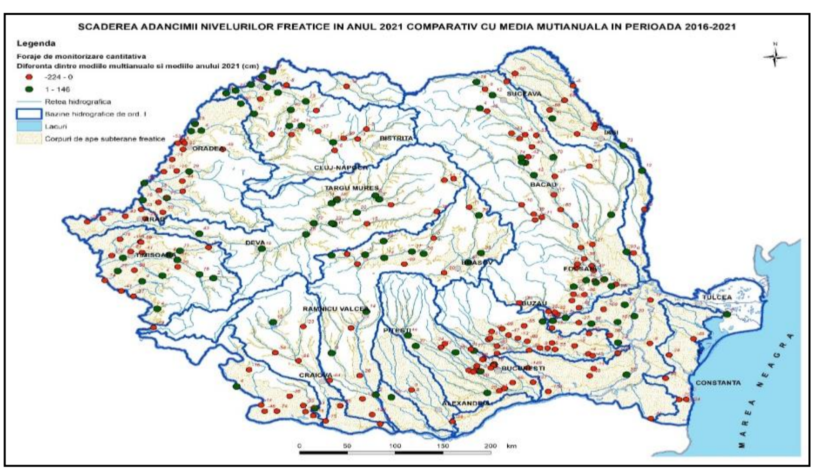
Figure XII.42 –The frequency of exceeding the average monthly depth in 2021 compared to the period 2016-2020



Source: NMA, INHGA

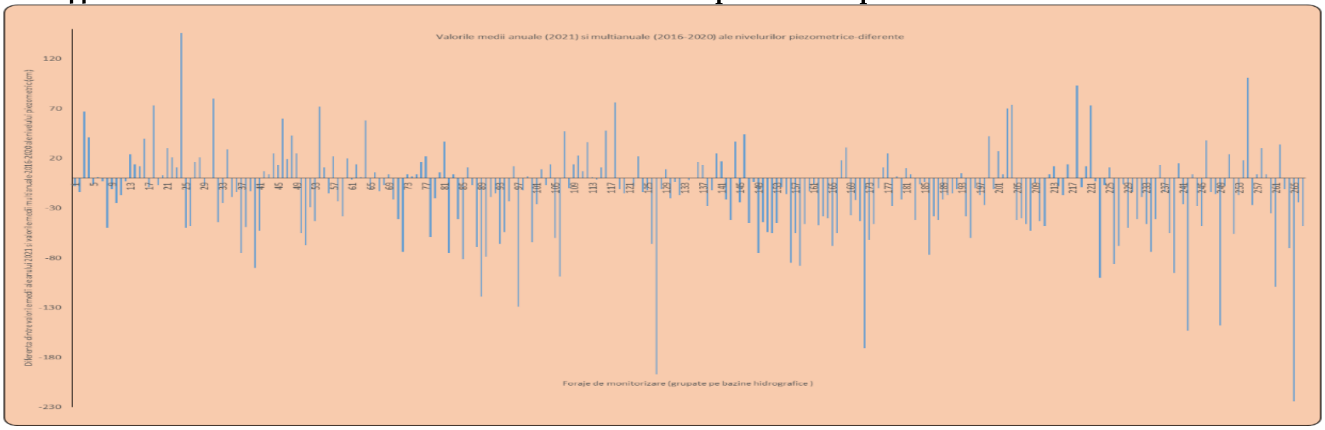
The difference in centimeters between the average values of the year 2021 and the multi-year average values for the analyzed period is presented in *Figures XII.43 and XII.44*. Negative values, indicating a decrease in the piezometric level in monitoring wells, are represented in red and account for approximately 61% of the situations. The range of values varies from -224 cm (Black Sea water basin) to 146 cm (Tisa River water basin). The comparative situation is presented by basins/hydrographic areas in *Table XII.15*, highlighting the maximum and minimum recorded values and the proportions of level increases/decreases.

Figure XII.43 – The situation of the monthly average depth of piezometric levels in the year 2021 compared to the multi-year average of the period 2016-2020



Source: NMA

Figure XII.44 –Piezometric level increases and decreases in 2021 compared to the period 2016-2020



Source: NMA, INHGA

Table XII.15 – The comparative situation of the differences in the 2021 annual and multi-year average values (2016-2020)

Hydrographic basin	Increases (cm)/ Location	Deacreases (cm)/ Location	Increases (%)	Decreases (%)
Someş-Tisa hydrographic area	146 (Oar, C. Joasă a Someşului, ROSO01)	50 (Reteag, Culoarele Someşelor Mic şi Mare, ROSO09)	55	45
Crişuri	80 (Vărşand, C. Joasă a Crişurilor, ROCR01)	90 (Oradea, C. Joasă a Crişurilor, ROCR01)	45	55
Mureş	72 (Mihalţ, Culoarul Aiudului, ROMU03)	67 (Nădlac, C. Nădlac, ROMU20)	50	50
Banat hydrographic area	37 (Silha, C. Timişanei, ROBA04)	119 (Pişchia, C. Vingăi, ROMU02)	19	81
Jiu	12 (Teleşti, Depresiunea Tg. Jiu, ROJI05)	67 (Filiaşi, Culoarul Jiului, ROJI05)	20	80
Olt	76 (Sânsimion, Depresiunea Tuşnad, ROOT01)	129 (Hoghiz, Olt superior, ROOT07)	57	43
Argeş-Vedea hydrographic area	44 (Ştefăneşti-Argeş, ROAG05)	197 (Nana, C. Nana, ROAG03)	41	59
Ialomiţa	18 (Cioranca, C. Urziceni, ROIL08)	88 (Radila, Glacisul Valea Călugărească, ROIL15)	5	95
Siret	74 (Girov, Culoarul Siretului, ROSI03)	171 (Vipereşti, Depresiunea Cislău, ROIL10)	31	69
Prut	93 (Băleni, Colinele Bălăbăneşti, ROPR06)	100 (Moimeşti, Colinele Gloduri, ROPR07)	38	62
Dunăre	101 (Viziru, C. Viziru, ROIL17)	153 (Spanţov, C. Nana, ROIL17)	32	68
Dobrogea-Litoral		224 (Techirghiol, Podişul Mangaliei, RODL10)		100

Source: NMA, INHGA

CONCLUSIONS *The analysis of the evolution of piezometric levels in the period 2016-2021 was conducted based on data from representative monitoring wells in the Monthly Transmission Program, which accounts for approximately 10% of the total number of wells managed by the Water Basin Administrations. Therefore, its nature is informational. According to the summarized results, the analyzed period is characterized, in terms of the trend in piezometric levels, by pronounced decreases in the aquifers of the Dobrogea-Litoral, Ialomița, Banat, and Jiu hydrographic basins. Local but significant increases were recorded in the Olt, Someș-Tisa, Crișuri, and Mureș hydrographic basins. The basins located in the northern and eastern parts of Romania present a satisfactory situation throughout the year, thanks to the cumulative rainfall in July, August, and*

December, with most areas receiving over 50 mm. These values were estimated in the monitoring wells according to maps provided by the National Meteorological Administration.

Use of water resources

At national level, Romania's water resources are relatively poor and unevenly distributed in time and space. These theoretically add up to approximately 134.6 billion cubic meters and consist of surface water, including rivers, lakes, the Danube River, and groundwater. Among these, the usable water resource, according to the degree of watershed development, amounts to 38.35 billion cubic meters. Compared to 2016, the water demand in Romania increased by 1.42 billion cubic meters in 2021, from 6.72 billion cubic meters in 2016 to 8.14 billion cubic meters. This increase is broken down into the three categories of users as follows: for the **population**, 1.29 billion cubic meters of water in 2021 compared to 1.12 billion cubic meters in 2016; for **agriculture**, 2.16 billion cubic meters of water in 2021 compared to 1.4 billion cubic meters in 2016; and 4.7 billion cubic meters of water for the **industrial sector** in 2021 compared to 4.2 billion cubic meters in 2016. Compared to the previous year, the total water demand increased by 0.236 billion cubic meters in 2021, with the only decrease being in the industrial category (-0.14 billion cubic meters). The volume of water withdrawn (used) in 2021 was 7.86 billion cubic meters, an increase of 1.49 billion cubic meters compared to 2016 when the volume of water withdrawn was 6.37 billion cubic meters.

Broken down by the three categories of users (population, industry, agriculture):

- **for the population** the volume of water taken in 2021 was approx. 1.27 billion cubic meters, increasing compared to the one taken in 2016 (1.05 billion cubic meters);
- **the industrial sector** consumed 4.11 billion cubic meters in 2021, an insignificant increase compared to the consumption of 4.08 billion cubic meters recorded in 2016;
- the volume of water taken in the **agricultural sector** increased from 1.24 billion cubic meters in 2016 to 2.48 billion cubic meters in 2021. This is the sector with the most important increase in water consumption in recent years.

The explained situation is presented in *tables XII.16, XII.17 and figure XII.45 (Source: National Administration "Romanian Waters")*.

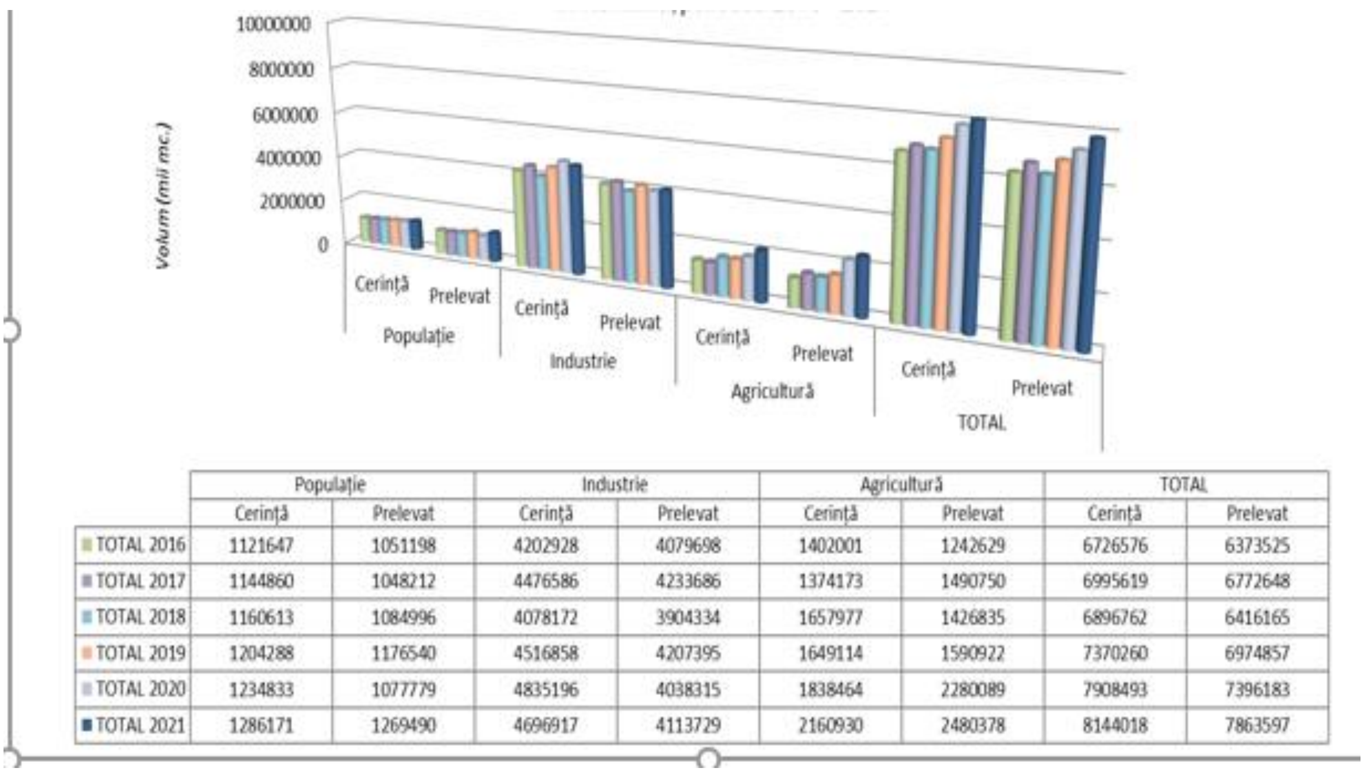
Table XII.16 - The evolution of water demand compared to the collected volumes by user categories in Romania, 2016-2021 (thousand m^3)

Source	*Population*		*Industry*		*Agriculture*		*TOTAL*	
	Demand	*Collected*	*Demand*	*Collected*	*Demand*	*Collected*	*Demand*	*Collected*
Area	579424	536969	1690074	1244955	998258	888659	3267756	2670583
	594990	535160	1707998	1350532	942300	1035709	3245288	2921401
	593806	557945	1307286	1255395	1099659	951952	3000751	2765292
	615797	612211	1730382	1322859	1120766	1028841	3466945	2963911
	627178	593018	1909807	1155263	1171368	1135911	3708353	2884192
	606789	663620	1735509	1219753	1271531	1396849	3613829	3280222
Underground	472993	454977	166987	140553	40674	39518	680654	635048
	482213	452958	162548	147014	44805	46458	689566	646430
	498167	467129	167239	159826	55458	51737	720864	678692
	521195	492378	184000	159092	60841	53341	766036	704811
	539058	411372	195651	198892	67492	185296	802201	795560
	598991	535101	201856	194748	87979	75896	888826	805745
Danube	69170	59187	2336364	2684657	363069	314452	2768603	3058296
	67599	60042	2595753	2725887	387068	408583	3050420	3194512
	68575	59876	2593468	2479875	502860	423146	3164903	2962897
	67222	71904	2592137	2719039	467507	508740	3126866	3299683
	68523	73362	2720136	2676840	599604	958882	3388263	3709084

	80274	70729	2742255	2691300	801420	1007633	3623949	3769662
Black Sea	60	65	9503	9533			9563	9598
	58	52	10287	10253			10345	10305
	65	46	10179	9238			10244	9284
	74	47	10339	6405			10413	6452
	74	27	9602	7320			9676	7347
	117	40	17297	7928			17414	7968
TOTAL 2016	***1121647***	***1051198***	***4202928***	***4079698***	***1402001***	***1242629***	***6726576***	***6373525***
TOTAL 2017	***1144860***	***1048212***	***4476586***	***4233686***	***1374173***	***1490750***	***6995619***	***6772648***
TOTAL 2018	***1160613***	***1084996***	***4078172***	***3904334***	***1657977***	***1426835***	***6896762***	***6416165***
TOTAL 2019	***1204288***	***1176540***	***4516858***	***4207395***	***1649114***	***1590922***	***7370260***	***6974857***
TOTAL 2020	***1234833***	***1077779***	***4835196***	***4038315***	***1838464***	***2280089***	***7908493***	***7396183***
TOTAL 2021	***1286171***	***1269490***	***4696917***	***4113729***	***2160930***	***2480378***	***8144018***	***7863597***

Source: National Administration "Romanian Waters"

Figure XII.45 – The evolution of water demand compared to the collected volumes by categories of users in Romania, 2016-2021 (thousand m³)



Source: National Administration "Romanian Waters"

Table XII.17 - Evolution of the water demand compared to the collected volumes in Romania, degree of achievement (%), 2016-2021

Sursa	*Anii*	*Populație*			*Industrie*			*Agricultură*			*TOTAL*		
		Cerință	*Prelevat*	*Grad de realizare (%)*	*Cerință*	*Prelevat*	*Grad de realizare (%)*	*Cerință*	*Prelevat*	*Grad de realizare (%)*	*Cerință*	*Prelevat*	*Grad de realizare (%)*
Suprafață	2016	579424	536969	92.7%	1690074	1244955	73.7%	998258	888659	89.0%	3267756	2670583	81.7%
	2017	594990	535160	89.9%	1707998	1350532	79.1%	942300	1035709	109.9%	3245288	2921401	90.0%
	2018	593806	557945	94.0%	1307286	1255395	96.0%	1099659	951952	86.6%	3000751	2765292	92.2%
	2019	615797	612211	99.4%	1730382	1322859	76.4%	1120766	1028841	91.8%	3466945	2963911	85.5%
	2020	627178	593018	94.6%	1909807	1155263	60.5%	1171368	1135911	97.0%	3708353	2884192	77.8%
	2021	606789	663620	109.4%	1735509	1219753	70.3%	1271531	1396849	109.9%	3613829	3280222	90.8%
Subteran	2016	472993	454977	96.2%	166987	140553	84.2%	40674	39518	97.2%	680654	635048	93.3%
	2017	482213	452958	93.9%	162548	147014	90.4%	44805	46458	103.7%	689566	646430	93.7%
	2018	498167	467129	93.8%	167239	159826	95.6%	55458	51737	93.3%	720864	678692	94.1%
	2019	521195	492378	94.5%	184000	159092	86.5%	60841	53341	87.7%	766036	704811	92.0%
	2020	539058	411372	76.3%	195651	198892	101.7%	67492	185296	274.5%	802201	795560	99.2%
	2021	598991	535101	89.3%	201856	194748	96.5%	87979	75896	86.3%	888826	805745	90.7%
Dunăre	2016	69170	59187	85.6%	2336364	2684657	114.9%	363069	314452	86.6%	2768603	3058296	110.5%
	2017	67599	60042	88.8%	2595753	2725887	105.0%	387068	408583	105.6%	3050420	3194512	104.7%
	2018	68575	59876	87.3%	2593468	2479875	95.6%	502860	423146	84.1%	3164903	2962897	93.6%
	2019	67222	71904	107.0%	2592137	2719039	104.9%	467507	508740	108.8%	3126866	3299683	105.5%
	2020	68523	73362	107.1%	2720136	2676840	98.4%	599604	958882	159.9%	3388263	3709084	109.5%
	2021	80274	70729	88.1%	2742255	2691300	98.1%	801420	1007633	125.7%	3623949	3769662	104.0%
Marea Neagră	2016	60	65	108.3%	9503	9533	100.3%				9563	9598	100.4%
	2017	58	52	89.7%	10287	10253	99.7%				10345	10305	99.6%
	2018	65	46	70.8%	10179	9238	90.8%				10244	9284	90.6%
	2019	74	47	63.5%	10339	6405	61.9%				10413	6452	62.0%
	2020	74	27	36.5%	9602	7320	76.2%				9676	7347	75.9%
	2021	117	40	34.2%	17297	7928	45.8%				17414	7968	45.8%
TOTAL	2016	*1121647*	*1051198*	*93.7%*	*4202928*	*4079698*	*97.1%*	*1402001*	*1242629*	*88.6%*	*6726576*	*6373525*	*94.8%*
TOTAL	2017	*1144860*	*1048212*	*91.6%*	*4476586*	*4233686*	*94.6%*	*1374173*	*1490750*	*108.5%*	*6995619*	*6772648*	*96.8%*
TOTAL	2018	*1160613*	*1084996*	*93.5%*	*4078172*	*3904334*	*95.7%*	*1657977*	*1426835*	*86.1%*	*6896762*	*6416165*	*93.0%*
TOTAL	2019	*1204288*	*1176540*	*97.7%*	*4516858*	*4207395*	*93.1%*	*1649114*	*1590922*	*96.5%*	*7370260*	*6974857*	*94.6%*
TOTAL	2020	*1234833*	*1077779*	*87.3%*	*4835196*	*4038315*	*83.5%*	*1838464*	*2280089*	*124.0%*	*7908493*	*7396183*	*93.5%*
TOTAL	2021	*1286171*	*1269490*	*98.7%*	*4696917*	*4113729*	*87.6%*	*2160930*	*2480378*	*114.8%*	*8144018*	*7863597*	*96.6%*

Source: National Administration "Romanian Waters"

Specialists from the National Institute of Hydrology and Water Management (INHGA) indicate that the average annual river discharge will decrease by 20-30% in the period from 2021 to 2050 and by 30-40% by 2071-2100. The changes in river discharges necessitate a series of adaptation measures to ensure water resources for the population, industry, and agriculture. Therefore, new criteria and techniques for dam and construction design are needed, as well as the development of new water management system operation procedures that take into account the degree of uncertainty in hydrological regime evolution.

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III). LEGISLATION

- *Commission Directive (EU) 2015/996 of 19 May 2015* establishing common noise assessment methods in accordance with Directive 2002/49/EC of the European Parliament and of the Council
- *Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016* on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC
- *Directive 1999/13/EC* regarding the reduction of volatile organic compounds emissions due to the use of organic solvents in certain activities and installations
- *Directive 2000/60/EC* of the European Parliament and the Council regarding the establishment of a community policy framework in the field of water
- *Directive 2000/76/EC* regarding waste incineration
- *Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001* regarding the assessment of the effects of certain plans and programs on the environment
- *Directive 2001/80/EC (LCP)* regarding the limitation of atmospheric emissions of certain pollutants from large combustion plants (LCP)
- *Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002* on the assessment and management of ambient noise
- *Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003* establishing a system for trading greenhouse gas emission quotas within the Community and amending Council Directive 96/61/EC
- *Directive 2004/107/EC* of the European Parliament and the Council on arsenic, cadmium, mercury, nickel, polycyclic aromatic hydrocarbons in the ambient air
- *Directive 2004/37/EC of the European Parliament and of the Council of 29 April 2004* on the protection of workers against the risks related to exposure to carcinogenic or mutagenic agents at work [sixth special directive within the meaning of Article 16(1) of Council Directive 89/391/EEC
- *Directive 2006/118/EC of the European Parliament and of the Council of 12 December* 2006 on the protection of groundwater against pollution and deterioration
- *Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006* on the management of bathing water quality and repealing Directive 76/160/EEC Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain hazardous substances discharged into the aquatic environment of the Community
- *Directive 2007/60/EC* of the European Parliament and of the Council of 23 October 2007 on flood risk assessment and management
- *Directive 2008/1/EC* on integrated pollution prevention and control (IPPC)
- *Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008* regarding environmental quality standards in the field of water, amending and repealing Council Directives 82/176/CEE, 83/513/CEE, 84/156/CEE, 84/491/CEE, 86/280/CEE and amendment of Directive 2000/60/EC
- *Directive 2008/50/EC* of the European Parliament and the Council on ambient air quality and cleaner air for Europe
- *Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008* establishing a framework for community action in the field of marine environment policy (Strategy-framework directive for the marine environment)
- *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008* on waste and repealing certain directives
- *Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009* establishing a framework for community action for the sustainable use of pesticides
- *Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds*
- *Directive 2010/75/EU* on industrial emissions (IED)
- *Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013* amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy
- *Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014* establishing a framework for the development of maritime space
- *Directive 78/176/EC* on waste from the titanium dioxide industry
- *Directive 82/883/EC* regarding the methods of supervision and control of the areas where there are emissions from the titanium dioxide industry
- *Directive 91/271/EEC of 21 May 1991* regarding the treatment of urban waste water
- *Council Directive 91/676/EEC of 12 December 1991* on the protection of waters against nitrate pollution from agricultural sources
- *Directive 92/112/EC* on the procedures for harmonizing programs to reduce, in order to eliminate, pollution caused by waste from the titanium dioxide industry
- *Directive 92/43/EEC* of the Council of 21 May 1992 on the conservation of natural habitats and species of wild fauna and

flora

- *Directive 94/63/EC of the European Parliament and of the Council of 20 December 1994* on the control of emissions of volatile organic compounds (VOC) resulting from the storage of fuels and their distribution from terminals to fuel distribution stations
- *Commission Directive 98/15/EC of 27 February 1998* amending Council Directive 91/271/EEC with regard to certain requirements set out in Annex I
- *Council Directive 98/24/EC of 7 April 1998* on the protection of the health and safety of workers against the risks related to the presence of chemical agents in the workplace
- *Directive 98/83/EEC* of the European Council regarding the quality of water intended for human consumption
- *European Council Directive 79/409/EEC* on the protection of wild birds
- *European Council Directive 80/68/EEC* regarding the protection of groundwater against pollution caused by certain dangerous substances
- *Government Decision no. 1005/2012 of October 17, 2012 regarding the organization and operation of the National Environmental Guard*
- *Government Decision no. 780/2006 of June 14, 2006* on the establishment of the greenhouse gas emission certificates trading scheme, with subsequent amendments and additions
- *Government Decision no. 770/2016 of October 19, 2016 regarding some measures for the application of Regulation (EU) no. 649/2012 of the European Parliament and of the Council of July 4, 2012 on the export and import of chemical products that pose a risk*
- *Government Decision no. 1015/2004 of June 25, 2004* regarding the approval of the Regulation on the organization and functioning of the National Committee of the Coastal Zone, with subsequent amendments and additions
- *Government Decision no. 1048 of December 11, 2013 for the approval of the Management Plan and the Regulations of the Portile de Fier Natural Park*
- *Government Decision no. 1066* of October 20, 2010 regarding the establishment of the natural protected area regime on some areas of the "Danube Delta" Biosphere Reserve and their inclusion in the category of scientific reserves
- *Government Decision no. 1074 of December 11, 2013* for the approval of the Management Plan of the Macin Mountains National Park
- *Government Decision no. 1143* of September 18, 2007 regarding the establishment of new protected natural areas
- *Government Decision no. 1217* of December 2, 2010 regarding the establishment of the natural protected area regime for the Cefa Natural Park
- *The Government Decision No. 1283/2021 of December 22, 2021,* amending and supplementing the Government Decision No. 183/2020 regarding the approval of the lease of certain immovable assets belonging to the public property of the state, under the administration of the National Administration "Apele Române" (Romanian Waters)
- *Government Decision no. 135/2019* for the approval of the National Action Plan on reducing the risks associated with the use of plant protection products
- *Government Decision no. 140/2008* regarding the establishment of measures for the application of the provisions of Regulation (EC) of the European Parliament and of the Council no. 166/2006 on the establishment of the European Register of Pollutants Emitted and Transferred and amending Council directives 91/689/EEC and 96/61/CE
- *Government Decision no. 148/2020 of February 20, 2020* regarding the approval of the method of determining and calculating the ecological flow
- *Government Decision no. 1581* of December 8, 2005 regarding the establishment of the protected natural area regime for new areas
- *Government Decision no. 170/2004* regarding the management of used tires
- *Government Decision no. 183/2020 of March 10, 2020* regarding the approval of the lease of public property of the state, under the administration of the "Romanian Waters" National Administration
- *Government Decision no. 188 of February 28* 2002 for the approval of some rules regarding the discharge conditions of waste water into the aquatic environment
- *Government Decision no. 2151* of November 30, 2004 regarding the establishment of the protected natural area regime for new areas
- *Government Decision no. 349/2016* regarding the declaration of the "Văcărești Accumulation" natural area as a natural park and the establishment of the protected natural area regime
- *Government Decision no. 352 of April 21, 2005* regarding the amendment and completion of Government Decision no. 188/2002 for the approval of some rules regarding the conditions for discharging waste water into the aquatic environment
- *Government Decision no. 436/2018 of June 21, 2018 regarding* approval of the Methodology for the development of the maritime space development plan
- *Government Decision no. 459 of May 16, 2002* regarding the approval of the Quality Norms for water in natural areas designed for bathing, with subsequent amendments and additions

- *Government Decision no. 526/2020 of July 9, 2020* for the amendment and completion of article 6 of the Regulation on the organization and operation of the National Committee of the Coastal Zone, approved by Government Decision no. 1.015/2004
- *Government Decision no. 538 of May 18, 2011* for the approval of the Management Plan of the Balta Mică a Brăilei Natural Park
- *Government Decision no. 546 of April 7, 2004* regarding the approval of the Methodology for the delimitation of the public domain of the state in the coastal area
- *Government Decision no. 546 of May 21, 2008* regarding the management of bathing water quality, with subsequent amendments and additions
- *Government Decision no. 570/2016 of August 10, 2016* regarding the approval of the Program for the gradual elimination of discharges, emissions and losses of priority hazardous substances and other measures for the main pollutants
- *Government Decision no. 587/2021 of May 27, 2021* for the amendment and completion of the annex to Government Decision no. 964/2000 on the approval of the Action Plan for the protection of waters against nitrate pollution from agricultural sources
- *Government Decision no. 683/2015 of August 19, 2015* regarding the approval of the National Strategy and the National Plan for the Management of Contaminated Sites in Romania, with subsequent amendments and additions
- *Government Decision no. 707/2018* for the approval of the Methodological Norms for the application of Law no. 62/2018 regarding the fight against ragweed
- *Government Decision no. 739/2016 780/2006 of June 14, 2006 on the establishment of the commercialization scheme of greenhouse gas emission certificates*
- *Government Decision no. 739/2016 of October 5, 2016* for the approval of the National Strategy on climate change and economic growth based on low carbon emissions for the period 2016 - 2020 and the National Action Plan for the implementation of the National Strategy on climate change and economic growth based on low carbon emissions for the period 2016 - 2020
- *Government Decision no. 749 of May 14, 2004* regarding the establishment of the responsibilities, criteria and delimitation method of the strip of land located in the immediate vicinity of the coastal zone, in order to preserve the environmental conditions and the heritage and landscape value of the areas located near the shore
- *Government Decision no. 793/2016 of October 26, 2016* for the approval of the National Program for the Rehabilitation of the Main Irrigation Infrastructure in Romania, with subsequent amendments and additions
- *Government Decision no. 80 of January 26, 2011* for the approval of the National Management Plan related to the portion of the international river basin of the Danube River that is included in the territory of Romania
- *Government Decision no. 83/2019 of February 15, 2019* regarding the establishment and operation of the National Registry of health risks in relation to environmental factors
- *Government Decision no. 846 of August 11, 2010* for the approval of the National Flood Risk Management Strategy in the medium and long term
- *Government Decision no. 859/2016 of November 16, 2016* for the approval of the updated national management plan for the part of the international river basin of the Danube river that is included in the territory of Romania
- *Government Decision no. 876 of August 1, 2007* for establishing and sanctioning contraventions to the naval transport regime, with subsequent amendments and additions
- *Government Decision no. 942/2017 of December 20, 2017* regarding the approval of the National Waste Management Plan
- *Government Decision no. 964/2000 of October 13, 2000* regarding the approval of the Action Plan for the protection of waters against nitrate pollution from agricultural sources, with subsequent amendments and additions
- *Government Decision no. 972/2016 of December 21, 2016* for the approval of flood risk management plans related to the 11 water basin administrations and the Danube River on the territory of Romania
- *Law no. 1/2000 of January 11, 2000* for the reconstitution of ownership rights over agricultural and forest lands
- *Law no. 104/2011* on ambient air quality, with subsequent amendments and additions
- *Law no. 107/1996 of September* 251996 - Water Law, with subsequent amendments and additions
- *Law no. 121/2019 of July 3, 2019 regarding the assessment and management of ambient noise*
- *Law no. 17/1990 of August 7, 1990 *** Republished* regarding the legal regime of inland maritime waters, the territorial sea, the contiguous zone and the exclusive economic zone of Romania, with subsequent amendments and additions
- *Law no. 220/2019 of November 15, 2019* regarding the modification and completion of some normative acts in the field of environmental protection
- *Law no. 24 of January 15, 2007 *** Republished regarding the regulation and administration of green spaces in the urban areas*
- *Law no. 241/2006 of June 22, 2006 *** Republished Law on water supply and sewerage service*
- *Law no. 278/2013* on industrial emissions, with subsequent amendments and additions
- *Law no. 280 of June 24, 2003* for the approval of Government Emergency Ordinance no. 202/2002 on the integrated management of the coastal zone

- *Law no. 313 of October 12, 2009 for the amendment and completion of Law no. 24/2007 regarding the regulation and administration of green spaces in urban areas*
- *Law no. 326 of December 3, 2013* regarding the approval of the Government Emergency Ordinance no. 60/2013 for completing art. 4 para. (1) from Law no. 349/2007 regarding the reorganization of the institutional framework in the field of chemical substance management
- *Law no. 458/2002 of July 8, 2002 *** Republished* regarding the quality of drinking water
- *Law no. 46/2008 - Forestry Code*, republished, with subsequent changes and additions
- *Law no. 49 of April 7, 2011* for the approval of Government Emergency Ordinance no. 57/2007 regarding the regime of natural protected areas, conservation of natural habitats, flora and fauna
- *Law No. 5 of January 25, 1991, for Romania's accession to the Convention on Wetlands of International Importance, especially as Waterfowl Habitat.*
- *Law no. 5/2000 of March 6, 2000* regarding the approval of the National Territorial Development Plan, with subsequent amendments and additions
- *Law no. 50/1991 of July 29, 1991 *** Republished* regarding the authorization of the execution of construction works
- *Law no. 51/2006 of March 8, 2006 *** Republished Law on community services of public utilities*
- *Law no. 62/2018* regarding the fight against ragweed
- *Law no. 74/2019* regarding the management of potentially contaminated and contaminated sites
- *Law no. 88/2017 of April 28, 2017* for the approval of Government Ordinance no. 18/2016 regarding the development of the maritime space
- *Law no. 95/2016 regarding the establishment of the National Agency for Protected Natural Areas and for the amendment of the Government Emergency Ordinance no. 57/2007 regarding the regime of natural protected areas, conservation of natural habitats, flora and fauna*
- *Order of the Minister of Agriculture and Rural Development No. 895 of August 19, 2016,* approving the rules on the organization of the inspection and certification system, the approval of inspection and certification bodies/control bodies, and the supervision of the activities of control bodies in organic farming, with subsequent amendments and completions
- *Order of the Minister of Environment, Water and Forests no. 1060/2016* regarding the approval of the Management Plan and Regulations of the Cozia National Park and the Natura 2000 sites in its area ROSCI0046 Cozia and ROSPA0025 Cozia – Buila – Vânturarița
- *Order of the Minister of Environment, Water and Forests no. 1121/2016* regarding the approval of the Management Plan and the Regulations of the Domogled National Park - Valea Cernei and the Natura 2000 sites ROSCI0069 and ROSPA0035
- *Order of the Minister of Environment, Water and Forests no. 1151/2016* regarding the approval of the Management Plan and the Regulations of the Buila-Vânturarița National Park, of the Natura 2000 sites ROSCI0015 Buila – Vânturarița, ROSPA0025 Cozia-Buila-Vânturarița and of the protected natural areas included in them
- *Order of the Minister of Environment, Water and Forests no. 1157/2016* regarding the approval of the Management Plan and the Regulations of the Maramureş Mountains Natural Park, of the site of community importance ROSCI0124 Maramureş Mountains, of the special avifaunistic protection area ROSPA0131 Maramureş Mountains and of the overlapping protected natural areas of national interest
- *Order of the Minister of Environment, Water and Forests no. 1224/2016* regarding the approval of the Management Plan and the Regulations of the Lunca Mureşului Natural Park
- *Order of the Minister of Environment, Water and Forests no. 1246/2016* regarding the approval of the Management Plan and the Regulations of the Vânători Neamţ Natural Park and the Natura 2000 sites ROSCI0270 Vânători Neamţ and ROSPA0107 Vânători Neamţ
- *Order of the Minister of Environment, Water and Forests no. 1523/2016* regarding the approval of the Management Plan and the Regulations of the Cheile Bicazului - Hășmaș National Park and of the Natura 2000 sites ROSCI0027 and ROSPA0018 Cheile Bicazului - Hășmaș
- *Order of the Minister of Environment, Water and Forests no. 1642/2016* regarding the approval of the Management Plan and the Regulations of the Cheile Nerei - Beuşnita National Park and of the Natura 2000 sites ROSCI0031 Cheile Nerei - Beuşnita and ROSPA0020 Cheile Nerei - Beuşnita
- *Order of the Minister of Environment, Water and Forests no. 296/21 February 2020* regarding the approval of the Management Plan and the Regulations of the Piatra Craiului National Park and the Natura 2000 site ROSCI0194 Piatra Craiului
- *Order of the Minister of Health no. 119/2014 of February 4, 2014* for the approval of the Hygiene and Public Health Norms regarding the living environment of the population
- *Order of the Deputy Prime Minister, Minister of the Environment no. 307/2019* regarding the approval of the Management Plan and the Regulations of the Rodnei Mountains National Park, of the ROSCI0125 of the Rodnei Mountains, of the ROSPA0085 of the Rodnei Mountains and of the other protected natural areas of national interest included

- *The order to the Deputy Prime Minister, the Minister of the Environment, and the Minister of Public Finance no. 1214/3729/2018 of November 15, 2018* regarding the methods of carrying out the control of the export and import of chemical products that pose a risk, as well as the methods of collaboration between the authorities, according to Government Decision no. 770/2016 regarding some measures for the application of Regulation (EU) no. 649/2012 of the European Parliament and of the Council of July 4, 2012 on the export and import of chemical products that pose a risk
- *Order of the Minister of Environment and Forests no. 1978/2010* regarding the approval of the Regulation on the organization and operation of the National Network for the Supervision of Environmental Radioactivity
- *Emergency Government Ordinance no. 19/2006 of February 22, 2006* regarding the use of the Black Sea beach and control *of the activities carried out on the beach, with subsequent amendments and additions*
- *Emergency Government Ordinance no. 195/2005 of December 22, 2005*on environmental protection, with subsequent amendments and additions
- *Emergency Government Ordinance no. 34/2000 of April 17, 2000 regarding* ecological agro-food products, with subsequent amendments and additions
- *Emergency Government Ordinance no. 57/2007 of June 20, 2007* regarding the regime of natural protected areas, conservation of natural habitats, flora and fauna, with subsequent amendments and additions
- *Emergency Government Ordinance no. 92/2021 of August 19, 2021* regarding the waste regime
- *Government Ordinance no. 18/2016 of August 24, 2016* regarding the arrangement of the maritime space
- *Regulation (EC) no. 648/2004 of the European Parliament and of the Council of March 31, 2004* regarding detergents
- *Regulation (EC) no. 1005/2009 of the European Parliament and of the Council of 16 September 2009* on substances that deplete the ozone layer
- *Regulation (EC) no. 1107/2009 of the European Parliament and of the Council of October 21, 2009* regarding the introduction of phytosanitary products on the market and the repeal of Council Directives 79/117/CEE and 91/414/CEE
- *Regulation (EC) no. 1272/2008 of the European Parliament and of the Council of 16 December 2008* on the classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, as well as amending Regulation (EC) no. 1907/2006
- *Regulation (EC) no. 1881/2006 of the Commission of December 19, 2006* establishing maximum levels for certain contaminants in foodstuffs
- *Regulation (EC) no. 1882/2003 of the European Parliament and of the Council of 29 September 2003* adapting to Council Decision 1999/468/EC the provisions on committees assisting the Commission in the exercise of executive powers provided for by acts subject to the procedure referred to in Article 251 of the EC Treaty
- *Regulation (EC) no. 1907/2006 (REACH)* regarding the registration, evaluation, authorization and restriction of chemical substances (REACH), establishing the European Agency for Chemical Products, amending Directive 1999/45/EC and repealing Regulation (EEC) no. 793/93 of the Council and Regulation (CE) no. 1488/94 of the Commission, as well as of Council Directive 76/769/CEE and Commission Directives 91/155/CEE, 93/67/CEE, 93/105/CE and 2000/21/EC
- *Regulation (EC) no. 2150/2002 of the European Parliament and of the Council of November 25, 2002* regarding waste statistics
- *Regulation (EC) no. 338/97 of the Council of December 9, 1996* on the protection of wild fauna and flora species by controlling their trade
- *Regulation (EC) no. 834/2007 of the Council of June 28, 2007* regarding organic production and labeling of organic products, as well as repealing Regulation (EEC) no. 2092/91.
- *Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on the mandatory annual reduction of greenhouse gas emissions by the Member States in the period 2021-2030 in order to contribute to climate actions to comply with the commitments assumed pursuant to the Paris Agreement and amending Regulation (EU) no. 525/2013*
- *Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020* regarding the minimum requirements for water reuse
- *EC Regulation no. 1143/2014* on the prevention and management of the introduction and spread of invasive alien species
- *Commission Implementing Regulation (EU) 2019/627 of 15 March 2019* establishing uniform practical procedures for carrying out official controls on products of animal origin intended for human consumption in accordance with Regulation (EU) 2017/625 of the European Parliament and of the Council and amending Regulation (EC) no. 2074/2005 of the Commission regarding official controls.

GLOSSARY OF TERMS

AEM/ EEA– European Environment Agency;
EPA- Environmental Protection Agency;
NEPA– National Environmental Protection Agency;
polluting activity -any activity that causes negative changes regarding the natural characteristics of the quality of the geological environment;
Ambient air -tropospheric air, exclusive of workplaces;
Ecological accident- event produced as a result of large and unforeseen spills/emissions of dangerous/polluting substances or preparations, in the form of vapors or energy resulting from uncontrolled/sudden anthropogenic activities, which damage or destroy natural and anthropogenic ecosystems;
Regulatory acts- environmental approvals, Natura 2000 approval, environmental agreement, non-CITES plant and/or wild animal import/export agreement, CITES permit, import agreement for genetically modified organisms, authorization/integrated environmental authorization, authorization regarding activities with genetically modified organisms;
Environmental agreement- technical-legal act establishing the conditions for the realization of the project, from the point of view of environmental protection; the environmental agreement represents the decision of the competent authority for environmental protection, which gives the right to the project owner to carry out the project from the point of view of environmental protection;
Adaptation– the ability of natural and anthropogenic systems to respond to the effects of climate change, including climate variability and extreme weather phenomena, in order to reduce potential damage, take advantage of opportunities or cope with the consequences of climate change;
Agglomeration- area that represents a conurbation with a population of over 250,000 inhabitants or, where the population is less than or equal to 250,000 inhabitants, having a population density per km^2 greater than 3,000 inhabitants;
Locations of urban background- places in urban areas where the levels are representative for the exposure, in general, of the urban population;
Coastal waters: The surface waters located within a line whose points are entirely at a distance of l nautical mile seaward from the nearest point of the baseline from which the breadth of the territorial waters is measured, with the extension of the boundary, where applicable, up to the outer limit of transitional waters
Surface waters: internal waters with the exception of underground waters; transitional waters and coastal waters, except for the chemical state for which the waters must be included territorial.
Inland waters: all standing and flowing surface and underground waters inside the base line, from which the extent of territorial waters is measured.
Groundwater: the waters below the soil surface in the saturated zone and in direct contact with the soil or the subsoil.
Transient waters: bodies of surface water in the vicinity of river mouths, which are partly saline as a result of proximity to coastal waters, but which are strongly influenced by freshwater streams.
Residual water -waste water, resulting from industrial/technological processes or household activities, which contains various impurities or harmful toxic substances, pathogenic microorganisms, etc.
Area/site- precisely delimited geographically defined area;
Natural protected area- terrestrial, aquatic and/or underground area, with a legally established perimeter and having a special protection and conservation regime, where there are wild plant and animal species, biogeographical, landscape, geological, paleontological, speleological or other nature elements and formations , with special ecological, scientific or cultural value;
Arsenic, cadmium, nickel and benzo(a)pyrene from PM_{10} - the total amount of these elements and their compounds contained in the PM_{10} fraction;
Environment authorization- technical-legal act issued by the competent authorities for the protection of the environment, by which the operating conditions and/or parameters of an existing activity or a new activity with a possible significant impact on the environment, necessary for putting it into operation, are established;
Integrated environmental authorization- technical-legal act issued by the competent authorities, according to the legal provisions in force regarding the prevention and integrated control of pollution;
Competent authority for environmental protection- the central public authority for environmental protection, the National Environmental Protection Agency or, as the case may be, the territorial public authorities for environmental protection, respectively the regional agencies for environmental protection, the county agencies for environmental protection, the "Danube Delta" Biosphere Reserve Administration, as well as the National Guard of the Environment and its subordinate structures;

Environment approval- the administrative act issued by the competent authority for environmental protection, which confirms the integration of environmental protection aspects into the plan or program subject to adoption;
Bio= biological elements;
B= (ecological status) good;
B.h= hydrographic basin;
Environmental balance sheet- work prepared by natural or legal persons certified according to the law, in order to obtain the opinion for the establishment of environmental obligations or the environmental authorization, and which contains the elements of the technical analysis through which information is obtained on the causes and consequences of the cumulative negative effects, previous, present and anticipated activity, in order to quantify the actual environmental impact on a site; if a significant impact is identified, the balance sheet is completed with a risk assessment study;
Biodiversity- variability of organisms within terrestrial, marine, continental aquatic ecosystems and ecological complexes; this includes intraspecific, interspecific and ecosystem diversity;
Biosecurity-all the measures taken to reduce or eliminate the potential risks that may arise as a consequence of the use of genetically modified organisms, which could have adverse effects on human health and on the conservation and sustainable use of biological diversity;
Biotechnology -technological application in which biological systems, living organisms, their components or derivatives are used, for the creation or modification of products or processes with specific use;
CA = water body;
CAA = artificial water body;
CAPM = heavily modified water body;
CMA = Maximum Permissible Concentration.
Best Available Techniques- the most advanced and efficient stage of development recorded in the development of an activity and exploitation method, which demonstrates the practical possibility of constituting the reference for establishing emission limit values for the purpose of prevention, and in the event that this fact is not possible, for to reduce overall emissions and impact on the environment as a whole:

- the techniques refer both to the technology used and the way in which the installation is designed, built, maintained, exploited, as well as to its decommissioning and site remediation, according to the legislation in force;
- available refers to those requirements that have registered a stage of development that allows their application in the respective industrial sector, under viable economic and technical conditions, taking into account the costs and benefits, regardless of whether or not these techniques are used or realized at national level, provided that these techniques are accessible to the operator;
- the best - refers to the most effective techniques for achieving a high level of environmental protection as a whole;

Certificate of greenhouse gas emissions -the title that confers the right to emit one ton of equivalent carbon dioxide in a defined period, valid only for the fulfillment of the purpose of GD no. 780/2006 and which is transferable under the conditions provided by the previously mentioned Decision;
CITES– Convention on International Trade in Species of Wild Fauna and Flora – international agreement between governments whose purpose is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.
Co-incineration/combustion -the use of used oils as fuel, with adequate recovery of the generated heat;
Contributions from natural sources- emissions of pollutants that do not result directly or indirectly from human activities, including natural events such as volcanic eruptions, seismic activities, geothermal activities, wildland fires, storms, marine aerosols, resuspension or transport in the atmosphere of natural particles originating from dry regions;
Volatile organic compounds VOCs- organic compounds from anthropogenic and biogenic sources, other than methane, which can produce photochemical oxidants by reaction with nitrogen oxides in the presence of sunlight;
DCA = Water Framework Directive (2000/60/EC);
Waste - any substance, preparation or any object from the categories established by the specific legislation regarding the waste regime, which the holder throws away, intends to or has the obligation to throw away;
WEEE (waste of electrical and electronic equipment) –electrical and electronic equipment that constitute waste according to the provisions of Government Emergency Ordinance no. 78/2000 regarding the waste regime, approved with amendments and additions by Law no. 426/2001, including all components, subassemblies and consumable products, an integral part of the equipment when they become waste;
Total or accumulated deposits- the total amount of pollutants that is transferred from the atmosphere to surfaces such as soil, vegetation, water, buildings, etc., with a certain area, in a certain time interval;
Recyclable waste- waste that can constitute raw material in a production process to obtain the initial product or for other purposes;
Dangerous waste- waste classified generically, according to the specific legislation on the waste regime, in these types or categories of waste and which have at least one constituent or a property that makes them dangerous;

Environmental damage- alteration of the physico-chemical and structural characteristics of the natural and anthropogenic components of the environment, reduction of biological diversity or productivity of natural and anthropogenic ecosystems, damage to the natural environment with effects on the quality of life, mainly caused by water, atmosphere and soil pollution, overexploitation of resources, their deficient management and capitalization, as well as through improper planning of the territory;
Sustainable development- development that meets the needs of the present, without compromising the possibility of future generations to meet their own needs;
Watershed district: the area of land or sea constituted in one or more contiguous river basins together with associated coastal waters, which is identified as a main unit of river basin management.
EQS= (eng,) Environmental Quality Standard;
Ecological balance- the set of states and interrelations between the component elements of an ecological system, which ensure the maintenance of its structure, functioning and ideal dynamics;
Ecosystem- dynamic complex of communities of plants, animals and microorganisms and the abiotic environment, which interact in a functional unit;
Ecotourism- form of tourism in which the main objective is the observation and awareness of the value of nature and local traditions and which must meet the following conditions:

- to contribute to the conservation and protection of nature;
- to use local human resources;
- to have an educational character, respect for nature - the awareness of tourists and local communities;
- to have an insignificant negative impact on the natural and socio-cultural environment;

Effluent- any form of discharge into the environment, point or diffuse emission, including through leakage, jets, injection, inoculation, storage, emptying or vaporization;
Emission- the direct or indirect discharge of substances, vibrations, electromagnetic and ionizing radiation, heat or noise into the air, water or soil, which can produce an impact on the environment and is measured at the place of departure from the source;
Fugitive emissions- undirected emissions, released into the surrounding air through windows, doors and other openings, ventilation or opening systems, which do not normally fall into the category of directed sources of pollution;
Emissions from fixed sources- emissions released into the surrounding air by machinery, installations, including ventilation, from construction activities, from other fixed works that produce or through which polluting substances are discharged;
Emissions from mobile pollution sources- emissions released into the surrounding air by road, rail, naval and air means of transport, non-road mobile equipment equipped with internal combustion engines
Emissions from diffuse pollution sources- emissions released into the surrounding air from non-directed emission sources of atmospheric pollutants, such as fugitive emission sources, natural emission sources and other sources that have not been specifically defined
EU TEPI WP-5: Purified water – Collected water
Ecological label- a graphic symbol and/or a short descriptive text applied on the packaging, in a brochure or other informative document, which accompanies the product and which provides information about at least one and at most three types of impact on the environment;
Eurostat ETE: Population connected to urban wastewater treatment plants
Fb= phytobenthos;
VG = (ecological status) very good;
FCG= general physico-chemical elements;
Extreme weather phenomena– weather events significantly different from average or usual weather patterns, due to which natural disasters occur (eg floods, heat waves, tornadoes);
FP= phytoplankton;
Anthropogenic factor: factor represented by human action on the environment.
Biotic factor: factor represented by the action of an organism on the environment or on other organisms.
Abiotic factors: the non-living components of the environment. They are grouped into climatic, edaphic (structure, texture, humus content, etc.), orographic (relief) factors, etc.
Water uses: water services together with any activity identified as having a significant impact on the state of the waters
Greenhouse gases -the gases provided in annex no. 2 to GD no. 780/2006, amended and supplemented by GD no. 133/2006: carbon dioxide (CO_2), methane (CH_4), nitrogen oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6);
Waste management -the collection, transport, recovery and disposal of waste, including the supervision of these operations and the subsequent maintenance of disposal sites, including actions undertaken by a trader or broker;
GD= Government Decision;

Natural habitat- terrestrial, aquatic or underground area, in a natural or semi-natural state, which is differentiated by geographical, abiotic and biotic characteristics;
Natural habitat of community interest- that type of habitat which:

- is in danger of extinction in its natural range; or
- has a reduced natural area either as a result of its restriction or due to the fact that its surface is naturally reduced; or
- presents representative samples with typical characteristics for one or more of the five biogeographical regions: alpine, continental, pannonian, steppe and pontic;

Priority natural habitats -the types of natural habitats in danger of extinction, for whose conservation the European Community has a special responsibility, due to the small proportion of their area on the territory of the European Union;
Habitat of a species- the natural or semi-natural environment defined by abiotic and biotic factors in which a species lives in any stage of its biological cycle;
Environmental impact– any change brought to the environment, beneficial or harmful, resulting in part or in whole from the activities, products or services of an organization;
DD-NIRD= "Danube Delta" National Institute for Research and Development
Environmental information- any written, visual, audio, electronic or in any material form information about;

a) the state of the environmental elements, such as air and atmosphere, water, soil, land surface, landscape and natural areas, including wetlands, marine and coastal areas, biological diversity and its components, including genetically modified organisms and the interaction between these elements;

b) factors, such as substances, energy, noise, radiation or waste, including radioactive waste, emissions, spills and other discharges into the environment, which affect or may affect the environmental elements provided for in letter a);

c) measures, including administrative measures, such as policies, legislation, plans, programs, agreements concluded between public authorities and natural and/or legal persons regarding environmental objectives, activities that affect or may affect the elements and factors provided for in letter a) and b), as well as the measures or activities intended to protect the elements provided for in letter a);

d) reports on the implementation of environmental protection legislation;

e) **cost-benefit analyzes or other economic analyzes and forecasts** used within the measures and activities provided for in letter c);

f) the state of human health and safety, including the contamination, whenever relevant, of the food chain, human living conditions, cultural areas and constructions, to the extent that they are or may be affected by the state of the environmental elements provided for in letter a) or, through these elements, by the factors, measures and activities provided for in letter b) and c);

Plant- any stationary or mobile technical unit as well as any other activity directly related, from a technical point of view, to the activities of stationary/mobile units located on the same site, which may produce emissions and effects on the environment;
Global warming- temperature increase at the level of the earth's surface
ME –Ministry of the Environment
MEWF -Ministry of Environment, Waters and Forests
MEF –Ministry of Environment and Forests
MECC- Ministry of Environment and Climate Change
Environment- the set of conditions and natural elements of the Earth: air, water, soil, subsoil, the characteristic aspects of the landscape, all atmospheric layers, all organic and inorganic matter, as well as living beings, natural systems in interaction, including the previously listed elements, including some material and spiritual values, quality of life and conditions that can influence human well-being and health;
Fixed measurements- measurements taken at fixed points, either continuously or by random sampling, to determine levels, in accordance with the relevant data quality objectives;
Indicative measurements- measurements that comply with less strict data quality objectives than those required for measurements at fixed points;
Tolerance margin -percentage of the limit value by which it can be exceeded, under the conditions specified by the legislation in force;
M= (ecological status) moderate;
AA= annual average (arithmetic);
MZB= macrozoobenthos (benthic macroinvertebrates);
Micro-organism- any microbiological entity, cellular or non-cellular, capable of replication or transfer of genetic material, including viruses, viroids and plant and animal cells in cultures;
Environmental monitoring- supervision, forecasting, warning and intervention in order to systematically evaluate the dynamics of the qualitative characteristics of environmental elements, in order to know the state of quality and their

ecological significance, the evolution and social implications of the changes produced, followed by the necessary measures;

Natural monument- rare or endangered plant and animal species, isolated trees, geological formations and structures of scientific or landscape interest;

Nature 2000– European network of protected natural areas created in 1992 from the need to protect nature and to maintain in the long term the natural resources necessary for socio-economic development;

NFR- The Nomenclature for Reporting as defined in the reporting guidelines to the LRTAP Convention (Convention on Long-range Transboundary Air Pollution);

N= nutrients;

Genetically modified organism- any organism, with the exception of human beings, in which the genetic material has been modified in a way that does not occur naturally through mating and/or natural recombination;

Obligation regarding exposure concentration- the level established on the basis of the average exposure indicator in order to reduce the harmful effects on human health, which must be reached in a given period;

Nitrogen oxides- the sum of volume concentrations (ppbv) of nitrogen monoxide (nitric oxide) and nitrogen dioxide, expressed in units of mass concentration of nitrogen dioxide (micrograms/m^{y-});

Long term goal- the level that must be reached, in the long term, except in cases where this cannot be achieved through proportionate measures, with the aim of ensuring an effective protection of human health and the environment;

D.O= dissolved oxygen;

Natural park- land area where the existing natural landscape and current land uses are to be maintained, with the possibility of restricting these uses in the future;

National park– large area of land, guarded and cared for, where forestry, mining, hunting, etc. are stopped in order to preserve the unchanged nature;

National emission cap- the maximum amount of a substance that can be emitted at national level, during a calendar year;

p= bad ecological status;

ON B= good ecological potential;

PEM / PEMax= maximum ecological potential;

PEM / PEMo= moderate ecological potential;

P.S= specific pollutants;

PM10- particles in suspention that pass through a size selection orifice, as defined by the reference method for sampling and measuring PM10, SR EN 12341, with a separation efficiency of 50% for an aerodynamic diameter of 10 micrometers;

PM2.5- particles in suspention passing through a size selection orifice, as defined by the reference method for sampling and measuring PM2.5; SR EN 14907, with a separation efficiency of 50% for an aerodynamic diameter of 2.5 micrometers;

Lower evaluation threshold- the level below which, in order to evaluate the quality of the surrounding air, the use of modeling or objective estimation techniques is sufficient;

Plans and programs -plans and programs, including those co-financed by the European Community, as well as any modifications thereof, which are elaborated and/or adopted by an authority at national, regional or local level or which are prepared by an authority for adoption, through a legislative procedure, by the Parliament or the Government and are required by legislative, regulatory or administrative provisions;

Action plan- action plan comprising the steps to be taken at specified intervals of time, as provided in the integrated environmental permit by the activity holder under the supervision of the competent environmental protection authority, in order to comply with legal provisions related to prevention and integrated pollution control; the action plan is an integral part of the integrated environmental permit;

Natural heritage -the set of physico-geographical, floristic, faunal and biocenotic components and structures of the natural environment, whose ecological, economic, scientific, biogenic, sanogenic, landscape and recreational importance and value have a relevant significance in terms of the preservation of the biological diversity of flora and fauna, of the functional integrity of ecosystems, the conservation of genetic, plant and animal heritage, as well as to satisfy the requirements of life, well-being, culture and civilization of the present and future generations;

Pollutant- any substance, prepared in solid, liquid, gaseous form or in the form of vapors or electromagnetic, ionizing, thermal, phonic radiation or vibration energy which, introduced into the environment, changes the balance of its constituents and living organisms and causes damage to material assets;

Pollution- the direct or indirect introduction of a pollutant that can cause damage to human health and/or the quality of the environment, damage to material goods or cause damage or an impediment to the use of the environment for recreational purposes or for other legitimate purposes;

Damage- a quantifiable adverse change of a natural resource or a quantifiable deterioration of the functions performed by a natural resource for the benefit of another natural resource or the public, which may occur directly or indirectly;

Project- documentation regarding the execution of construction works or other installations or improvements, other interventions on the natural environment and landscape, including those involving the extraction of mineral resources;

Compliance Program -Action plan comprising the steps to be taken at specified intervals of time, as provided in the environmental permit or environmental compliance approval by the activity holder under the supervision of the competent environmental protection authority, in order to comply with legal provisions regarding environmental protection; the compliance program is an integral part of the environmental permit or environmental compliance approval;

Sectoral Operational Programme- document approved by the European Commission for the implementation of those sectoral priorities from the National Development Plan that are approved for financing through the community support framework;

Public- one or more natural or legal persons and, in accordance with national legislation or practice, their associations, organizations or groups;

Average exposure indicator- the average level determined on the basis of measurements carried out in urban areas throughout the country and which provide indications regarding the exposure of the population. It is used to calculate the national exposure reduction target and the obligation related to the exposure concentration;

Environmental Report -part of the documentation of the plans or programs, which identifies, describes and evaluates the possible significant effects on the environment, of their application and its rational alternatives, taking into account the objectives and the related geographical area, according to the legislation in force;

Security report- documentation drawn up by natural or legal persons certified according to the law, necessary for objectives in which dangerous substances are present according to the provisions of the legislation regarding the control of activities that present dangers of major accidents in which dangerous substances are involved;

River: body of inland water that flows mostly on the surface of the land, but which can also flow underground in a certain part of its course

Ecological reconstruction- all the works carried out in order to bring a site, after its remediation, as close as possible to the natural state

Water resources: surface waters made up of watercourses with their deltas, lakes, ponds, inland maritime waters and the territorial sea, as well as underground waters on the territory of the country, in their entirety.

Natural resources- all the natural elements of the environment that can be used in human activity: Non-renewable resources - minerals and fossil fuels, renewable - water, air, soil, flora, wild fauna, including the inexhaustible ones - solar, wind, geothermal and wave energy;

Non-renewable resources– resources of the natural heritage whose use is limited in time due to the impossibility of reproduction (e.g. mineral resources);

Renewable resources– natural heritage resources that have the ability to reproduce or renew (water, air, soil, flora, wild fauna, including the inexhaustible ones – solar, wind, geothermal and wave energy);

National register of greenhouse gases -unique, standardized and secure electronic database, which registers and tracks all operations with greenhouse gas emission certificates, in application of GD no. 780/2006, and with greenhouse gas emission units provided by the Kyoto Protocol;

Natural reserve- an area in which the entire natural setting or certain floristic, faunal or geological specimens are protected by law;

Ecological network "Natura 2000" -the European ecological network of protected natural areas and which includes areas of special avifaunistic protection, established in accordance with the provisions of Directive 79/409/EEC on the conservation of wild birds and special conservation areas designated by the European Commission and Directive 92/43/EEC on the conservation natural habitats, wild fauna and flora;

P =(ecological status) poor;

Hydrographic basin planning and management guidelines (SDABH): the planning tool in the field of waters per hydrographic basin, consisting of two parts: the Hydrographic Basin Development Plan (HBDP) and the Hydrographic Basin Management Plan (HBMP).

Climatic changes– complex process of long-term modification of climatic elements (temperature, precipitation, increase in the frequency and intensity of extreme weather phenomena, etc.), due primarily to greenhouse gas emissions resulting from human activities, which have determined imbalances in the atmosphere and they favored the triggering of the greenhouse effect;

ES= ecological status;

Contaminated site -geographically defined area, delimited in surface and depth, polluted with biological or chemical substances;

Site of community interest- Site/area that, in the biogeographical region(s) where it occurs, contributes significantly to maintaining or restoring the favorable conservation status of natural habitats or species of community interest and, as such, can make a significant contribution to the coherence of the NATURA 2000 network and/or to maintaining biological diversity in the respective region(s). For animal species with extensive distribution, the areas of community interest correspond to the territories where these species are naturally present and where essential abiotic and biological factors for their existence and reproduction are present;

Species of community interest- species which on the territory of the European Union are:

- endangered, except for those whose natural range is located at the distribution limit in the area and which are neither endangered nor vulnerable in the western Palearctic region; or
- vulnerable, the species whose inclusion in the endangered category is likely in the near future if the action of disturbing factors persists; or
- rare, species whose populations are reduced in terms of distribution and/or numerically and which, even if they are not currently endangered or vulnerable, are at risk of becoming. These species are located on restricted geographical areas or are rarely dispersed over large areas; or
- endemic and that require special attention due to the specific characteristics of their habitat and/or the potential impact that their exploitation has on the state of conservation;

SPA(special avifaunistic protection areas) - the protected natural area whose purposes are the preservation, maintenance and, where appropriate, the return to a state of favorable conservation of bird species and specific habitats, designated for the protection of wild migratory bird species ;

SCI(Site of Community Importance) - the site/area which, in the biogeographical region(s) where it occurs, contributes significantly to the maintenance or restoration to a favorable conservation status of the natural habitats specified in Annex II or the species of community interest specified in Annex III of Government Emergency Ordinance No. 57/2007 and which contributes significantly to the coherence of the "Natura 2000" network and/or to maintaining biological diversity in the respective biogeographical region(s). For animal species with a wide distribution range, Sites of Community Importance must correspond to the areas within their range where essential abiotic and biotic factors for their existence and reproduction are present;

Priority species -the species for whose conservation the European Community has a special responsibility due to the small proportion of their range on the territory of the European Union;

Protected species -endangered, vulnerable, rare or endemic species, which benefit from a legal status of protection;

Surface water status: is the general expression of the state of a surface water body, determined by the minimum indicators characterizing its ecological state and its chemical state.

Groundwater status: is the general expression of the state of an underground water body, determined by the minimum indicators that characterize its quantitative state and its chemical state.

Conservation status of a natural habitat- all the factors that act on a natural habitat and its characteristic species and that can influence in the long term both its natural distribution, its structure and functions, as well as the survival of its characteristic species;

Conservation status of a species- all the factors that act on a species and that can influence in the long term the distribution and abundance of the populations of the respective species;

Substance- chemical element and its compounds, within the meaning of the legal regulations in force, with the exception of radioactive substances and genetically modified organisms;

Dangerous substance- any substance classified as dangerous by the specific legislation in force in the field of chemicals;

Priority substances- substances that represent a significant risk of pollution to the aquatic environment and through it to humans and water uses, according to the specific legislation in the field of water;

Priority dangerous substances- substances or groups of substances that are toxic, persistent and that tend to bioaccumulate and other substances or groups of substances that create a similar level of risk, according to the specific legislation in the field of water;

Source of ionizing radiation- physical, natural entity, made or used as an element of an activity that can generate exposure to radiation, by emitting ionizing radiation or releasing radioactive substances;

Precursor substances of ozone- substances that contribute to the formation of ground-level ozone;

Ton of carbon dioxide equivalent -one metric ton of carbon dioxide or an amount of any other greenhouse gas with a global warming potential equivalent to one metric ton of carbon dioxide;

National exposure reduction target- the percentage reduction of the average exposure of the population, established for the reference year with the aim of reducing the harmful effects on human health, which must be achieved, where possible, in a given period;

Activity holder- any natural or legal person who exploits, controls or is delegated with decisive economic power regarding an activity with a potential impact on the quality of the surrounding air;

EQR= ecological quality report

Limit value -level fixed on the basis of scientific knowledge, in order to avoid, prevent or reduce harmful effects on human health or the environment, which is reached in a given period and which must not be exceeded after it has been reached;

Target value- the level established, in order to avoid and prevent the occurrence of harmful events and reduce their effects on human health and the environment as a whole, which must be reached as much as possible in a certain period

ELV -end-of-life vehicle, a vehicle that has become waste;

Area- part of the country's territory delimited for the purpose of evaluating and managing the quality of the surrounding air;

Floodable area: the land area within the main bed of a watercourse, delimited by a water level corresponding to certain

flow rates during high-water situations.
Protection zone- the land area around the point where fixed measurements are taken, delimited in such a way that any activity conducted within it, after the installation of measuring equipment, does not affect the representativeness of the air quality data for the surrounding environment for which it was positioned;
Wet area- stretch of ponds, swamps, peatlands, natural or artificial waters, permanent or temporary, where the water is standing or flowing, fresh, brackish or salty, including the stretch of sea water whose depth at low tide does not exceed 6 m.

PHOTOS: COVER 1 - *Original photo from România.* COVER 2 – *Headquarters of N.E.P.A., original photo*

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