Environmental Protection Agency of Montenegro

Indicator-based State of the Environment Report of Montenegro

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For the Publisher:
Ervin Spahić, BSc in Electrical Engineering
Environmental Protection Agency of Montenegro

Designers:
Lidija Šćepanović, Engineer of Organic Technology
Bosiljka Milošević, Mechanical Engineer
MSc Gordana Đukanović, Engineer of Inorganic Technology
Irena Tadić, Engineer of Inorganic Technology
Spec. Tatjana Đoković, Chemical Engineer
MSc Aleksandar Božović, Marine Engineer
MSc Milena Bataković, Graduated Biology
Vesna Novaković, Graduated Biology
Ivana Bulatović, Graduated Biology
Milica Vukčević, Graduated Biology
MSc Snežana Žarković, Engineer of Metallurgy

Cover design:
Environmental Protection Agency of Montenegro

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CONTENT

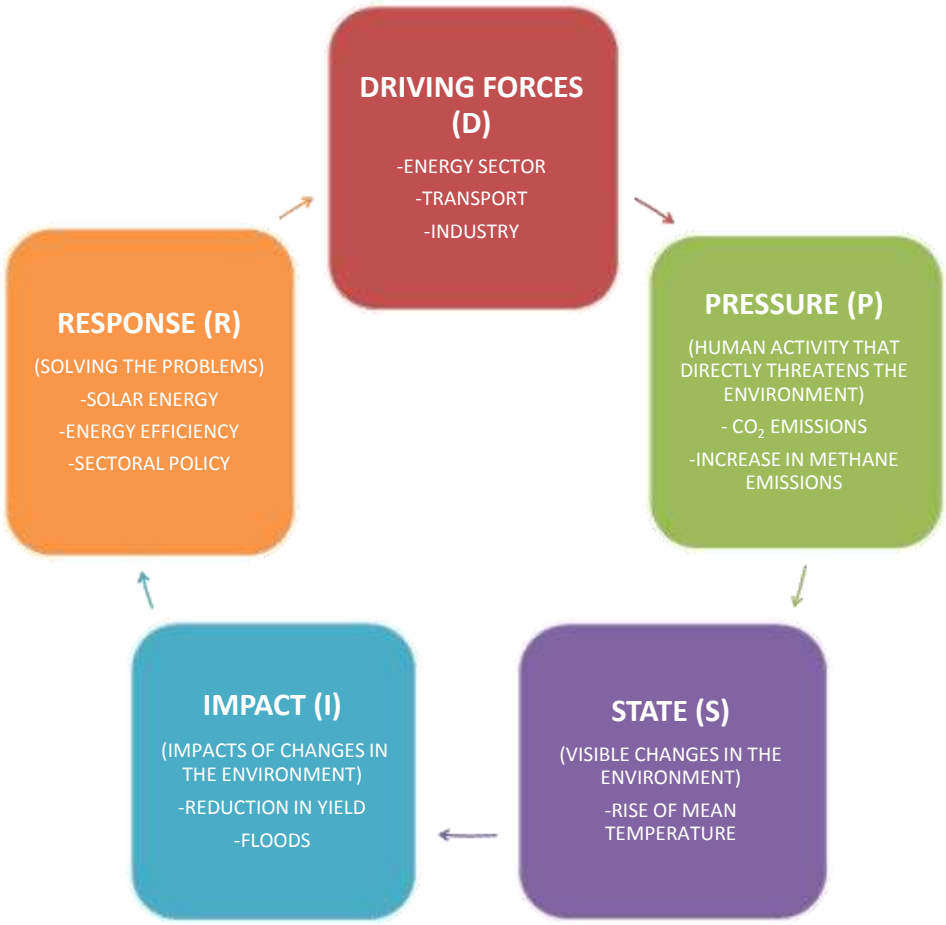
Introduction

The process of reporting on state of the environment began with the adoption of Agenda 21 at the UNCSD conference in Rio in 1992. Chapter 40 of Agenda 21 specifically requires improved information on the environment for the purpose of making decisions. During two decades, reporting on state of the environment became common practice in many countries around the world. State of the environment reports (SoE) are based on the indicator approach to the issue of environmental protection in a concise, simple, understandable and comparable way that shows the current status and trends of changes in the environment.

Therefore, environmental indicator is an instrument for monitoring the state of the environment and changes in it. Indicators can show the main development trends, help to describe the causes and effects of environmental conditions, and to monitor and evaluate the implementation of the environment policy and also transform complex data into information used in political decision making as well as for research purposes and notification of general public. Characteristics of a "good" indicator include the following: it is relevant to a particular problem; it can be expressed as “below” or “above” target value; it is comparable at the international level; it is based on available or feasible data; it is easy to communicate or understand. Therefore, the most important criteria for the selection of indicators include: data availability for development of indicator, significance of the observed indicator for the assessment of the status of the environment in the country and its complexity.

National state of the environment reports summarize data and information on social development and pressures on the environment as a result of this development, environmental issues in general and efforts to reduce pressures on the environment through national legislation and strategies.

The indicator-based State of the Environment Report of Montenegro follows the standard typology of indicators developed by the European Environment Agency (EEA), which is generally used by other international institutions as a standard in the design of state of the environment reports. The methodology is based on DPSIR model:



An indicator-based overview of the state of the environment in Montenegro is based on information and analysis resulting from many years of implementation of monitoring programs for all segments of the environment (which are implemented by the institutions selected in the tender procedure), in addition to data obtained from individual institutions whose data are relevant to environmental protection. The report is structured to address the following chapters:

- Introduction
- Air
- Water
- Climate change
- Agriculture
- Energy
- Tourism
- Transport
- Fisheries
- Waste
- Biodiversity
- Marine ecosystem

The Law on Environment ("Official Gazette of Montenegro", 48/08, 40/10, 40/11 article 19) stipulates mandatory drafting of a State of the Environment Report of Montenegro for a period of four years, based on the National List of Environmental Indicators, which was adopted by the Government of Montenegro at the meeting of 14 March 2013. Consequently, the Environmental Protection Agency publishes the first indicator-based State of the Environment Report in order to present the conditions and information, in accordance with international practices and standards, to decision makers and the general public in Montenegro.

Protection of the environment and human health from the adverse effects of air pollution is not a simple and easy task. It requires constant monitoring of air quality in accordance with accepted international standards, analysis of emissions of air pollutants, connecting them with the sources of emissions and investigating the impact of pollution on the receptors.

Protecting air quality in Montenegro has been current since the early 80s of the twentieth century. Since then, the legal framework and concerns about air quality have constantly improved, which allowed the use of identified solutions in practice. The Environmental Protection Agency, which was established in 2009, in accordance with their competences, assumed the responsibility for the implementation of the legislation in this area, which is almost completely harmonized with the Community acquis, so that in the previous period a network for monitoring air quality was established in Montenegro, data quality was improved, and reporting of air quality in compliance with EU requirements was enabled.

The result of all of these activities is the air quality control and monitoring for the purpose of assessment, planning and management of air quality. Analysis of the results serves as a basis to propose measures for enhancing and improving air quality.

VA01 Air Quality in Urban Areas

Key Question:

Is the air quality satisfactory with respect to human health?

Key Message:

Air quality is affected the most by industrial activity and emissions resulting from the combustion of fuels in large and small furnaces, and internal combustion engines. In addition to emissions, concentrations of air pollutants depend on the geographic and climatic characteristics. This is mostly reflected on the concentration of PM particles, which is the biggest problem for the air quality in Montenegro. High concentrations and a large number of exceeded permitted daily mean concentrations were most pronounced during the heating season, mainly due to the use of solid fuels (coal and wood). The air quality assessed in terms of the concentration of SO_2, NO_2 and O_3 is within the prescribed threshold limit value, with no major concentration variations on an annual basis

Rating of SO_2 trends:

- Compared to 2009 

Rating of NO_2 trends:

- Compared to 2009 

Rating of O_3 trends:

- Compared to 2009 

Rating of PM_{10} trends:

- Compared to 2009 

Impact on Human Health and Ecosystems:

Sulphur (IV) oxide (SO_2) - causes irritation upon inhalation, and very high concentrations can cause breathing problems. Asthma and chronic lung diseases can be extremely sensitive to the negative effects of very high concentrations, which in extreme cases can cause asthma attacks.

Nitrogen (IV) oxide (NO_2) - Short-term exposure to high concentrations of nitrogen (IV) oxide can cause lung damage. Exposure of people with chronic lung diseases such as asthma and chronic obstructive pulmonary disease, can cause changes in the function of the lungs and airways. Based on the results of research conducted on animals, it is reasonably considered that nitrogen (IV) oxide and ozone in combination exacerbate allergic reaction to inhaled allergens.

Suspended particles smaller than 10μm (PM_{10}) - Suspended particles with a diameter smaller than 10 μm are among the most dangerous polluters in the air. When inhaled, they affect the respiratory system resistance and are deposited in the deepest parts of the lungs. Health problems commence when the body starts to defend itself against these foreign bodies (particles). Particles of larger diameter PM_{10} can cause or aggravate asthma, bronchitis and other lung diseases, and thereby reduce the overall resistance of the organism. Although suspended particles PM_{10} negatively affect the entire population, especially vulnerable groups are children, pregnant women, the elderly and the sick. Studies supported by the World Health Organization, although those can not prove a cause and effect relationship between certain health problems and increased concentrations of suspended

particulate matter (primarily due to the different chemical composition and particle diameter), agree that there is no concentration that could be declared safe for the human health.

Ground-level ozone (O_3) - Ground-level ozone has a harmful effect on human health. Inhalation of higher concentrations of ground-level ozone can cause irritation of the airways and difficulty breathing, and people who suffer from asthma and bronchitis are particularly vulnerable. Certainly, a greater sensitivity to the effects of ground-level ozone is demonstrated by the elderly, children and pregnant women. Ground-level ozone affects the deterioration of cardiovascular diseases and arteriosclerosis. Inhalation of ozone comes into contact with all parts of the respiratory system and is well absorbed. Its action is local and systemic. Acting on the lining of the airways, ozone causes damage to the epithelium, which will also result in inflammation and increased sensitivity to allergens.

Reference Legislation:

Law on Air Protection ("Official Gazette of Montenegro", 25/10), Regulation on determining the types of pollutants, threshold limit values and other air quality standards ("Official Gazette of Montenegro", 45/08, 25/12), Rulebook on the conditions and monitoring air quality ("Official Gazette of Montenegro" , 21/2011), Rulebook on the content and the method of preparing the annual report on air quality ("Official Gazette of Montenegro", 27/12 of 31 May 2012), Regulation on the establishment of a network of measurement points for monitoring air quality ("Official Gazette of Montenegro", 44/10 and 13/11).
In accordance with the Regulation on the establishment of a network of measuring points for monitoring air quality ("Official Gazette of Montenegro", 44/10 and 13/11), the territory of Montenegro is divided into three zones (Table 1), which are determined by a preliminary assessment of the air quality in relation to the boundaries of assessment of pollutants on the basis of available data on concentrations of pollutants and modeling of existing data. Air quality border zones coincide with external administrative boundaries of municipalities that are part of these zones.

Table 1. Air Quality Zones

Air quality zone	**Municipalities in the Zone**
Air quality maintenance zone	Andrijevica, Budva, Danilovgrad, Herceg Novi, Kolašin, Kotor, Mojkovac, Plav, Plužine, Rožaje, Šavnik, Tivat, Ulcinj and Žabljak
Northern Zone where it is necessary to improve air quality	Berane, Bijelo Polje and Pljevlja
Southern Zone where it is necessary to improve air quality	Bar, Cetinje, Nikšić and Podgorica

The Regulation defines the pollutants whose concentrations need to be measured continuously in accordance with the established zones of air quality (Table 2).

Table 2. Measurement Points and Parameters

Measuring Point	**Zone**	**Type of Measuring Point**	**Pollutants measured in order to protect human health**	**Pollutants measured in order to protect vegetation**
Tivat	Maintenance Zone	UB	NO_2, PM_{10}, $PM_{2.5}$	
Bar	Southern Zone	UB	NO_2, SO_2, PM_{10}, $PM_{2,5}$, cadmium, arsenic, nickel, benzo (a) pyrene, O_3, CO, benzene	
Pljevlja	Northern Zone	UB	SO_2, NO_2, PM_{10}, $PM_{2.5,}$ cadmium, arsenic, nickel, benzo (a) pyrene	
Gradina	Northern Zone	SB	O_3	NO_x, SO_2, volatile organic compounds

Golubovci	Southern Zone	SB	O_3	NO_x, SO_2, volatile organic compounds
Nikšić	Southern Zone	U	NO_2, SO_2,PM_{10},$PM_{2,5}$, cadmium, arsenic, nickel, benzo (a) pyrene, O_3, CO, benzene	
Podgorica	Southern Zone	UT	NO_2, PM_{10}, CO, benzene, benzo (a) pyrene, lead	

In 2012, the equipment to monitor air quality was installed in Tivat, Golubovci and Gradina. The report analyzed data from the measuring stations in Podgorica, Nikšić, Bar and Pljevlja, where the measurements were done in the period from 2009 to 2012.

Figure 1 shows the location of automatic stationary air quality monitoring stations within the zone (network of measurement sites).

Figure 1. Network of measurement sites – air quality zones

Description of indicators

The indicator represents the number of days during the year when threshold concentration of sulfur (IV) oxide (SO_2), nitrogen (IV) oxide (NO_2), suspended particulate matter smaller than 10μm (PM_{10}) and ground-level ozone (O_3) were exceeded in the urban areas, percentage of the population exposed to exceeded threshold concentration of pollutants by zones of air quality and how many times the threshold limit values of concentrations of pollutants were exceeded at the observed measuring points.

Indicators are rated with respect to:

- Concentration of pollutants is expressed in micrograms per cubic meter (μg/m^3).
- The share of the urban population exposed to pollutants, which is expressed as a percentage (%)

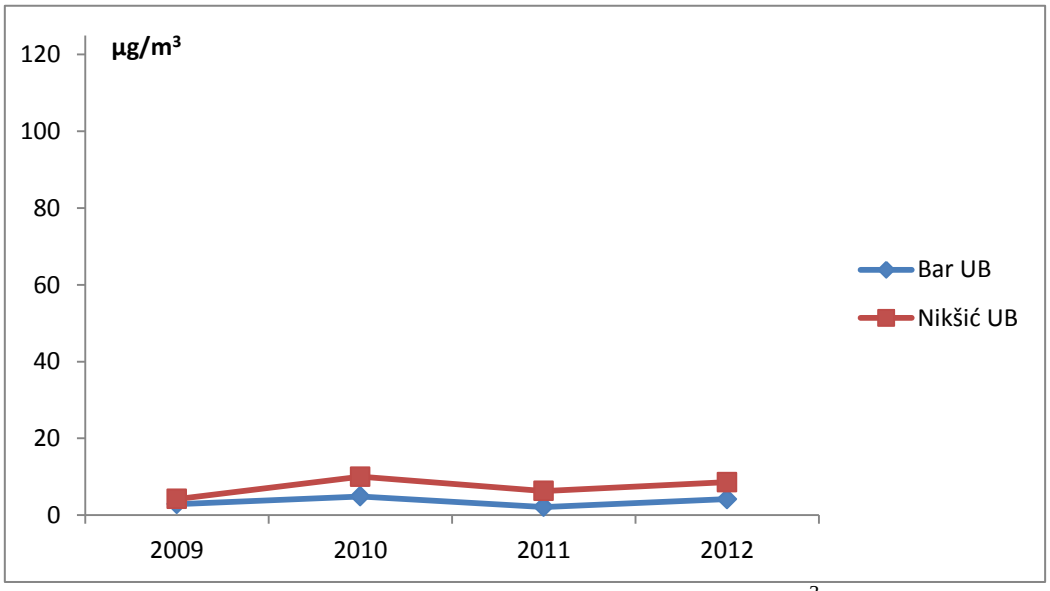
As compared to other parameters that define this indicator only the concentration of PM_{10} dust particles in the air was above the allowable concentration, the description of this sub-indicator was made in relation to both aspects of assessment of the status.

Indicator Evaluation

Air quality in urban areas in relation to the immission concentration of sulfur (IV) oxide

(SO_2)

At the measuring stations in Nikšić and Bar for measuring background pollution in the urban area (UB), the concentration of sulfur (IV) oxide (SO_2) is continuously monitored. The graph 1 shows the annual mean concentration of the pollutant in the period 2009-2012.

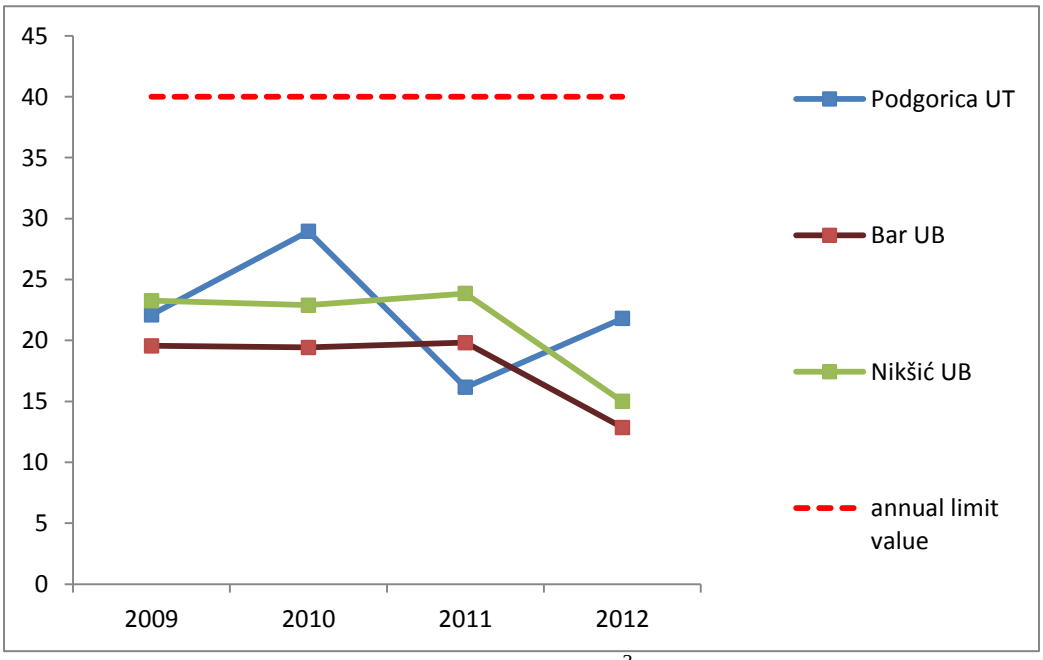


Graph 1. Mean annual concentration of sulfur(IV)oxide (SO_2) (g/m^3) at urban background locations.

During the reporting period average annual concentration of SO_2 in the air was several times less than the prescribed value. Measured maximum concentrations (hourly and daily mean) did not exceed the threshold limit value, so that as regards this pollutant the air was of very good quality.

Air quality in urban areas compared to the immission concentration of nitrogen (IV) oxide (NO_2)

At the measuring stations in Podgorica - a point to measure pollution from traffic in the urban area (UT), Nikšić and Bar - points to measure background pollution in the urban area (UB), the concentration of nitrogen (IV) oxide (NO_2) is continuously monitored. The graph 2 shows the annual mean concentrations of nitrogen (IV) oxide (NO_2) ($\mu g/m^3$) for the period 2009-2012.

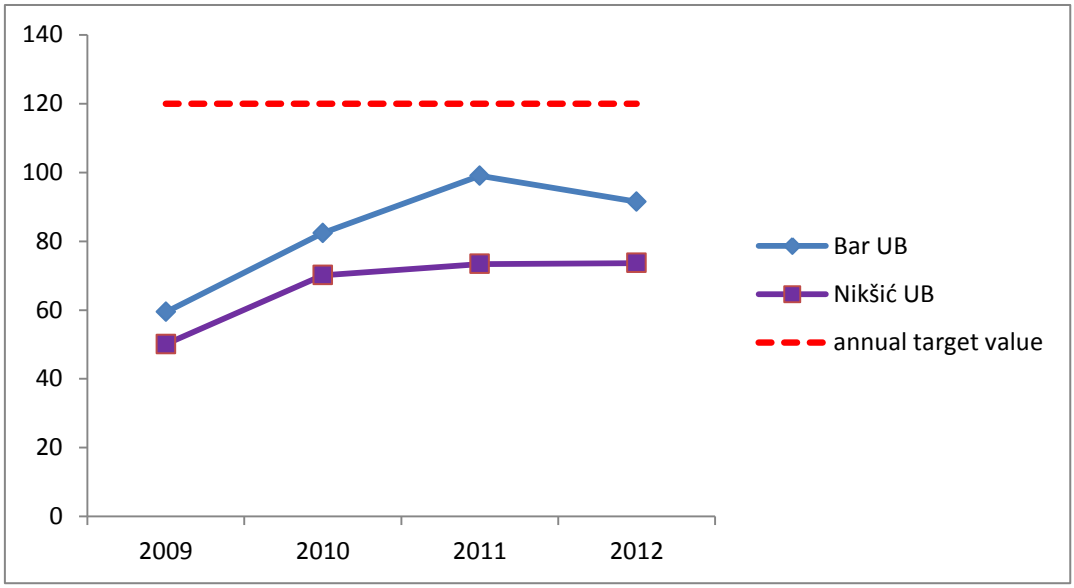


Graph 2. Mean annual concentrations of NO_2 ($\mu g/m^3$) at the traffic and urban background locations

Mean annual concentrations of NO_2 were below the prescribed limit. Due to the impact of fossil fuel (in combination with other factors, climatic and geographic-morphological), elevated concentrations of hourly values were occasionally measured, but there is no recorded growth trend.

Air quality in urban areas compared to the immission concentrations of ground-level ozone (O3)

At the measuring stations in Nikšić and Bar for measuring background pollution in the urban area (UB) concentrations of ground-level ozone (O_3) are continuously monitored. Graph 3 shows the annual mean concentrations of ground-level ozone (O_3) (µg/m^3) at these locations for the period 2009-2012.



Graph 3. Mean annual concentrations of ground-level ozone (O_3) (µg/m^3) at urban background locations

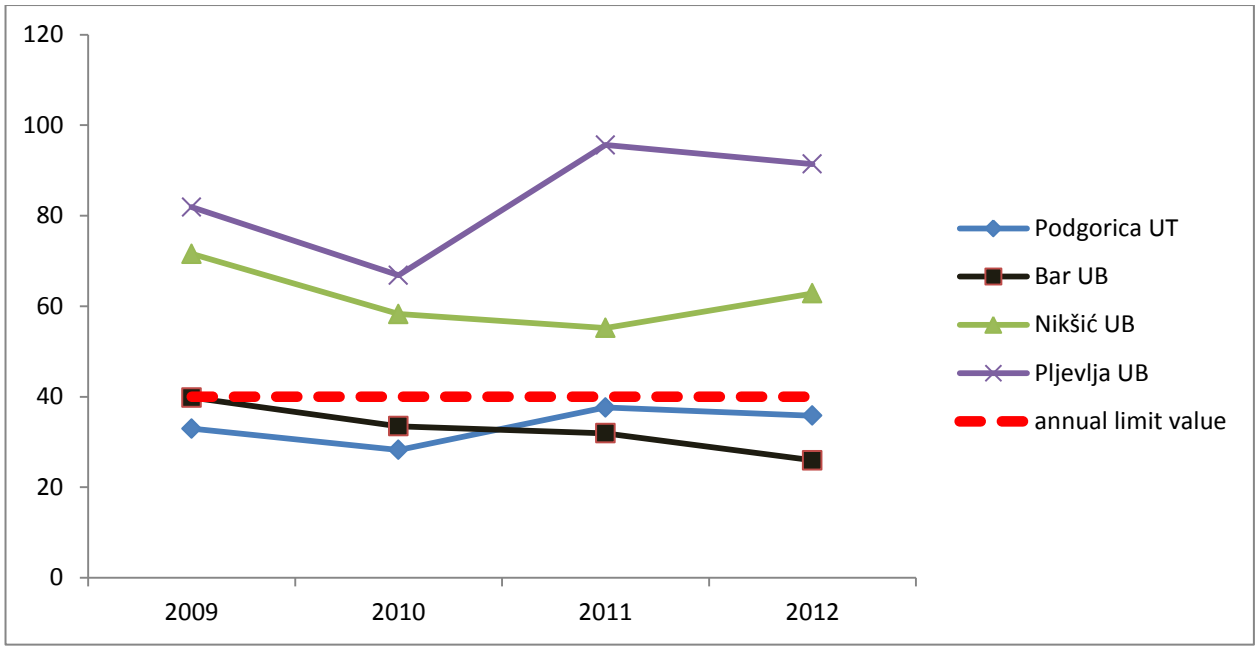
Ground-level ozone belongs to the group of greenhouse gases. The key ingredient is the so-called summer photochemical smog, a major pollution problem of many world cities. Measurements during the previous years show that most cases of exceeded maximum daily eight-hour mean value occur during the summer months in the coastal area. However the maximum hourly concentrations did not exceed 180 µg/m^3 (notification threshold).

Mean annual concentrations of ground-level ozone (O_3) showed a growing trend in the period 2009--2011. Mean annual concentrations in 2012 stopped this trend, and were either at the level or slightly lower compared to 2011.

However, all high yearly values are below the prescribed target value of 120µg/m^3.

Air quality in urban areas compared to the immission concentration of dust particles PM_{10}

At the measuring stations in Podgorica - the place to measure pollution from traffic in the urban area (UT), Nikšić, Bar and Pljevlja - places to measure background pollution in the urban area (UB), the concentration of dust particles PM_{10} is continuously monitored. Graph 4 shows the annual mean concentration of dust particles PM_{10} (µg/m^3) for the period 2009-2012.

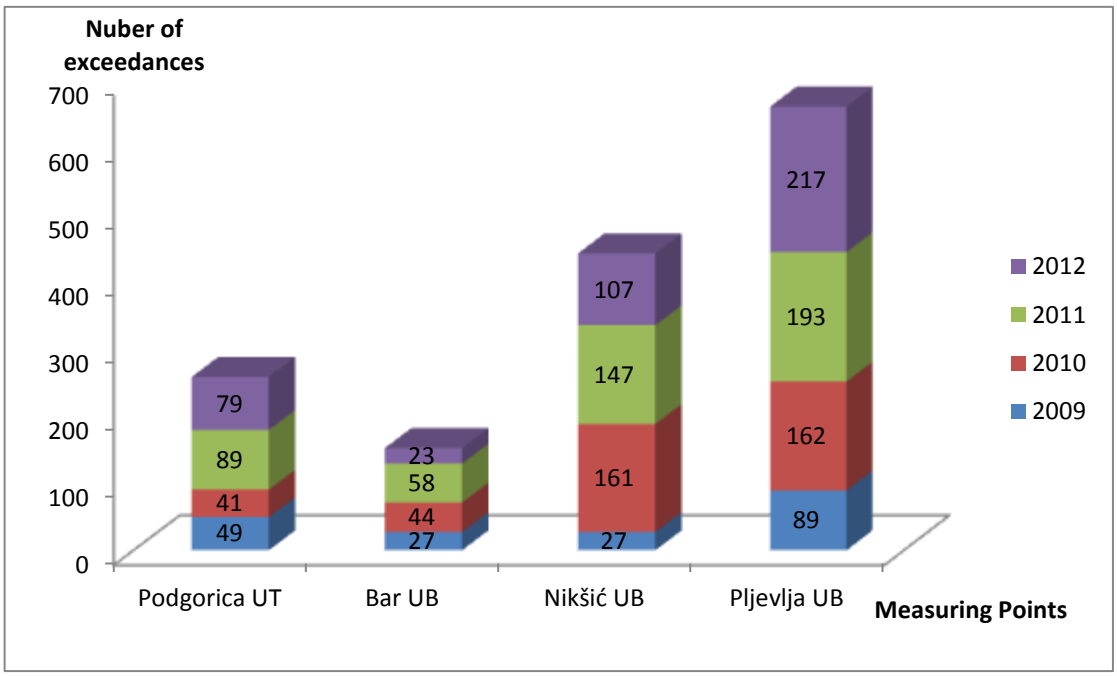


Graph 4. Mean annual concentrations of dust particles PM_{10} ($\mu g/m^3$) at traffic and urban background locations

The trend of high concentrations of PM_{10} particles in the air in urban and industrial and urban areas for the considered period.

Mean annual concentrations of PM_{10} particles (40 $\mu g/m^3$) were higher than permissible in Nikšić and Pljevlja during the period 2009-2012. Increased concentrations of PM_{10} particles, fraction of TSP, which according to the recommendations of the WHO (World Health Organization) is of particular harmful effects on human health, were reported at all measurement locations and have a significant impact on worse air quality.

The allowed number of exceedances during the calendar year is 35. The largest number of exceedances and maximum concentrations were measured in Pljevlja (North Zone). Graph 5 shows the number of exceedances of the permitted daily mean concentrations of PM_{10} dust particles (50 $\mu g/m^3$) per annum.

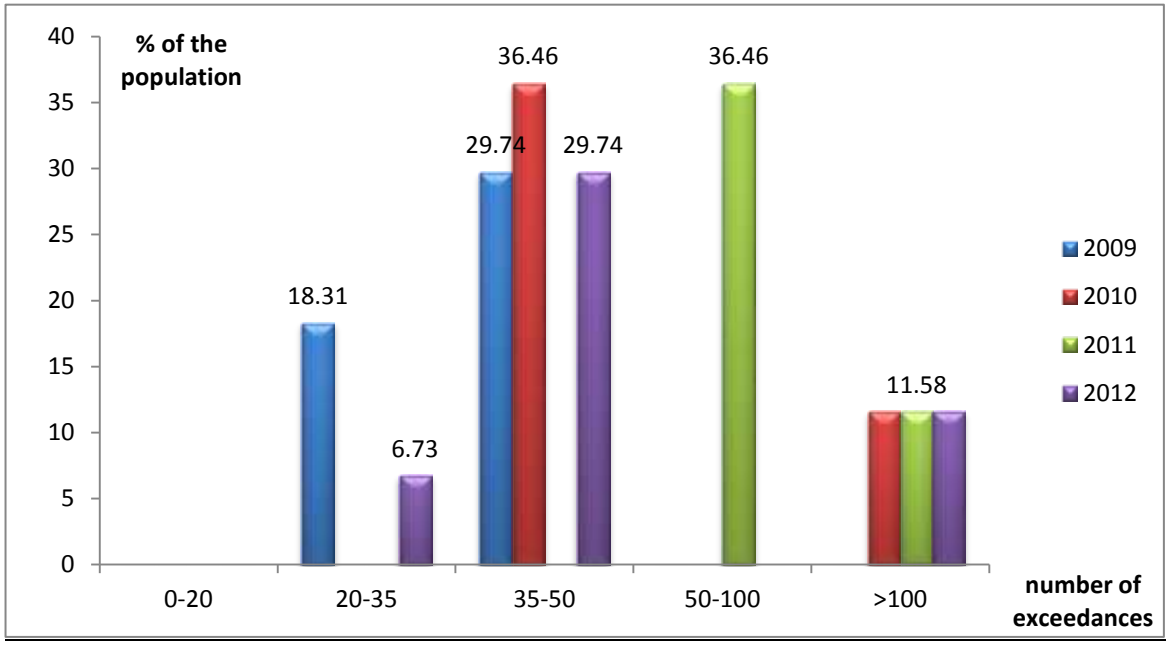


Graph 5. Number of exceedances of the permitted average daily concentrations of dust particles PM_{10}

Note:
In Bar, Pljevlja and Nikšić, automatic monitoring was established on 1 June 2009, so that the number of exceedances during 2009 refers only to the second part of the year.

The graph shows that at all measuring points, except in the Bar (2012), the number of exceedances per year was above the permitted.

In the period 2009-2012, in the Southern zone where it is necessary to improve air quality, the largest percentage of the population was exposed to exceedances of the permitted mean daily concentration limits - 36.46% 35-50 days during 2010, while in 2012 the same percentage of the population was exposed to a number of exceedances of 50 to 100 days. In the period 2010-2012, 11.58% of the population were exposed to exceedances of the permitted daily concentrations of more than 100 days during the calendar year. Graph 16 shows the percentages of the population from the Southern zone in relation to the total population in Montenegro who were exposed to exceedances of the permitted daily concentration of PM_{10} particles in the air.

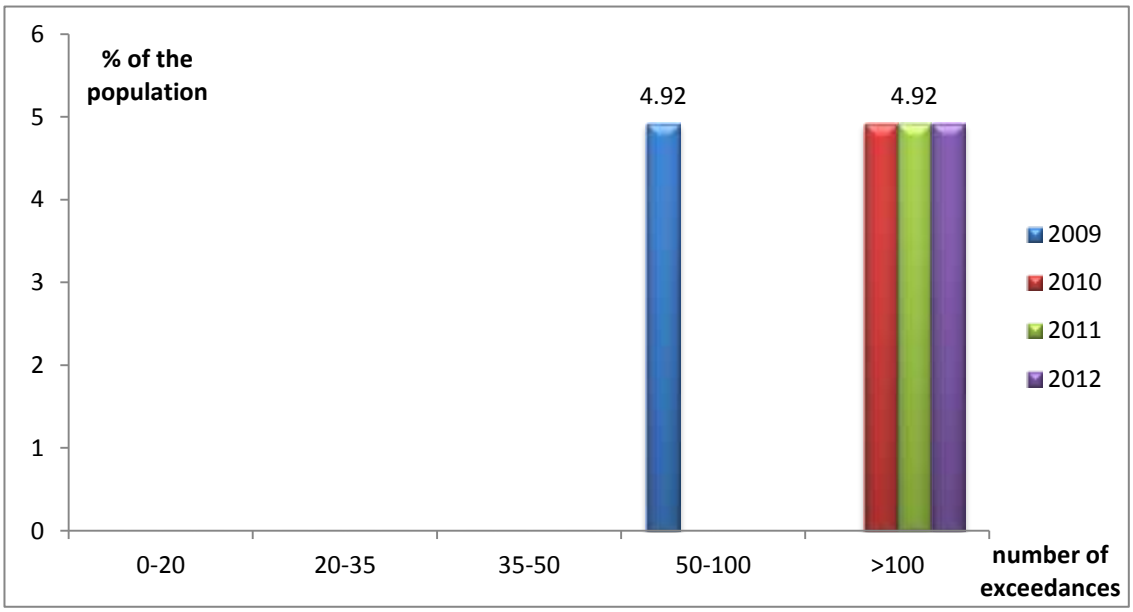


Graph 6. The percentage of the population that is exposed to exceedances of daily limit values of PM_{10} particles - Southern Zone

This air quality zone covers: Bar, Cetinje, Nikšić and Podgorica.

In the period 2009-2012, in the Northern zone where it is necessary to improve air quality, the largest deviations from the prescribed limits were recorded. 4.92% of the total population (of the Municipality of Pljevlja)[1] were exposed to exceeded allowable daily mean concentrations of PM_{10} particles. Graph 7 shows the percentages of the population in the Northern zone in relation to the total population of Montenegro who were exposed to exceeded permitted daily concentration of PM_{10} particles in the air.

[1] The Northern zone, where it is necessary to improve air quality, covers: Berane, Bijelo Polje and Pljevlja. Bearing in mind that the measurement station to monitor the air quality is located in the urban area of Pljevlja, and that the configuration of the land is specific, the proportion of the exposed population refers to the citizens of the Municipality of Pljevlja in relation to the total population in Montenegro, not the total population of the Northern Zone.



Graph 7. Percentage of the population exposed to exceeded daily limit values of PM_{10} particles – Northern Zone

During the period 2010-2012, the number of exceedances was more than 100 days during the calendar year. It should be borne in mind that automatic monitoring was established in Pljevlja on 1 June 2009, so that the number of exceedances in 2009 refers only to the second part of the year. Increased concentrations of PM_{10} dust matter in the air had the biggest impact on poorer air quality, not only in the Northern Zone, but also in other parts of Montenegro. This problem is most pronounced in Pljevlja (Northern Zone) and Nikšić (Southern Zone), where high concentrations were recorded and on a daily basis, in addition to a large number of exceedances, as well as exceedances of the permitted annual mean concentration.

Source of data: Environmental Protection Agency (www.epa.org.me)
Detailed description of indicators: www.epa.org.me/nli/va01
Reference to international indicators: /

VA02 Emissions of Acidifying Gases

Key Question:

Is there any progress in reducing air pollution by acidifying gases that adversely affect human health and ecosystems?

Key Message:

Key sources of emissions of acidifying gases are the sectors of energy, transport and agriculture. In 2010, about 90% of sulfur oxides (SO_x), and 45% of nitrogen oxides (NO_x) were emitted by the energy sector while the road traffic and other traffic, including construction equipment, was the source of about 50% of NO_x emissions. Most (97%) of the total emissions of ammonia (NH_3) comes from the agricultural sector. In 2010, the Thermal Power Plant Pljevlja was operating at full capacity throughout the year, which was not the case in 2009, when the plant was undergoing maintenance for almost half a year, and was out of operation. Over the previous 10 years, SO_x emissions have been unstable with a tendency to increase, while NO_x emissions showed a slight increase in contrast to the clear downward trend of NH_3.

Rating of NO_x and SO_x emission trends:

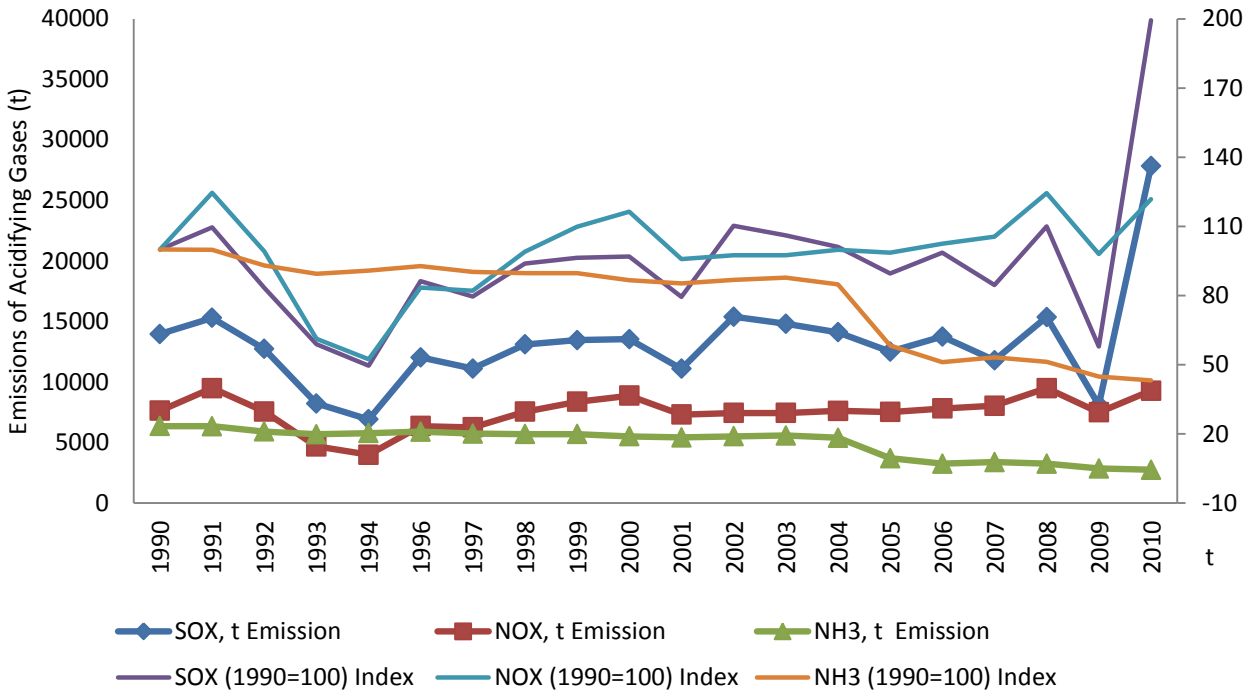
- Compared to 2009
- Compared to 2005
- Compared to 2000
- Compared to 1990

Impact on Human Health and Ecosystems:

Acidifying gases reduce the pH and increase the acidity of land and water and have a negative effect on aquatic and terrestrial ecosystems (loss of biodiversity). The acid precipitation phenomenon seriously endangers forests (disrupts the flow of nutrients and damages the root system), which can lead to increased erosion. These substances affect the health of people, irritate the respiratory system and may aggravate the problems of people with asthma and allergies. In terms of health impact, NO_2 poses the greatest danger, because long-term exposure may increase mortality due to respiratory diseases.

Reference Legislation:

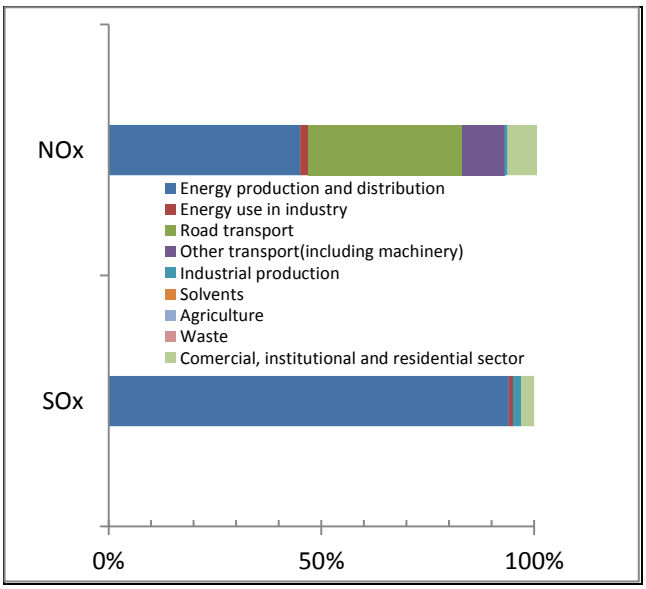
Law on Ratification of the Convention on Long-Range Transboundary Air Pollution, Law on Ratification of the Kyoto Protocol, Law on Ratification of the Protocol to the Convention on Long-Range Transboundary Air Pollution, Law on Environment, Law on Air Protection, Law on Official Statistics and the System of Official Statistics, Regulation on limit values of pollutants in liquid fuels of petroleum origin, Regulation on substances that deplete the ozone layer and alternative substances, Regulation on establishing a network of measurement points for monitoring air quality, Regulation on determining the types of pollutants, limit values and other standards for air quality, Rulebook on emissions of pollutants into the air, Regulation on the limit values of emissions of air pollutants from stationary sources, Regulation on maximum national emissions of certain pollutants.



Graph 8. Emissions and indices of emissions of acidifying gases, 1990-2010.

Indicator Evaluation

During the period of sanctions, from 1990 to 1995, there was a significant drop in emissions of acidifying gases, primarily of SO_x and NO_x, due to the overall reduction in economic activity, and primarily a drop in energy production and intensity of transport. After 1995, SO_x and NO_x emissions showed a steady upward trend which was stabilized for NO_x in 2009, around the base value of 1990, while the SO_x emissions trend was unstable, probably as a result of changes in the energy sector, which was particularly pronounced in 2009 where a decline was observed in SO_x emissions by almost 50% compared to 2008. With intensifying energy production in 2010, the emission levels suddenly increased. In the same reporting period, due to a drop in agricultural production, emissions of NH_3 showed a stable trend of constant slight decline, and in 2010 those amounted to only about 50% of the emissions in 1990.



Graph 9. Contribution to emissions of acidifying gases by sector, 2010

During the period for which data are available on the participation of individual sectors in the emissions of SO_x and NO_x (2006-2010), in both cases there is an evident trend of increasing participation of the energy sector in total emissions (by 18% and 7%), a significant reduction in emissions from energy use in industry (28% and 24%) and the share of transport (about 30% and about 15%). There was an increase of NO_x emissions (about 15%) by public sector services, institutions and households. Changes in the amount of emissions from other sectors show very small changes and have no significant effect on the change in total emissions of acidifying gases. Although an increase in emissions of SO_x and NO_x was observed in 2010, it was nevertheless significantly lower below the level of developed countries, so that the emission of these pollutants has no effect on the intermittent acid precipitation in some locations in Montenegro.

Table 3. Emissions of Acidifying Gases

Emission of pollutants/ year	1990	2000	2006	2007	2008	2009	2010
Emissions of SO_X, t	13959	13531	13754	11794	15357	8087	27824
Emissions of NO_X,	7622	8874	7809	8040	9486	7469	9280
Emissions of NH_3, t	6351	5504	3242	3380	3254	2852	2744
SO_X index (1990=100)	100	97	99	84	110	58	199
NO_X index (1990=100)	100	116	102	105	124	98	122
NH_3 Index (1990=100)	100	87	51	53	51	45	43

Source of Data: Environmental Protection Agency (www.epa.org.me)
Detailed description of indicators: www.epa.org.me/nli/va02
Reference to international indicators: EEA (http://www.eea.europa.eu/data-and-maps/indicators/emissions-of-acidifying-substances-1)

VA03 Ozone Precursor Emissions

Key Question:

Is there any progress in reducing air pollution by ozone precursors that adversely affect human health and ecosystems?

Key Message:

The key sources of ozone precursor emissions are the sectors of energy, transport, public services, institutions and households, as well as forest fires. In 2010, the energy sector was the source of 45% of the total emissions of nitrogen oxides (NO_x) and 10% of the total emissions of methane (CH_4). The transport sector emitted around 50% of total NO_x emissions and 20% of total emissions of carbon monoxide (CO). Industrial processes were the source of CO, with a share of about 10%, while the agricultural production emitted about 50% of CH_4 emission, while the waste sector emitted about 20% of methane.

Rating of Trends:

- Compared to 2009
- Compared to 2005
- Compared to 2000
- Compared to 1990

The sector of public services, institutions and households emitted about 50% of the total emissions of CO, 13% of CH_4 and 10% of NMVOC. In 2010, approximately 70% of the total NMVOC emissions resulted from forest fires, as well as 11% of CO emissions.

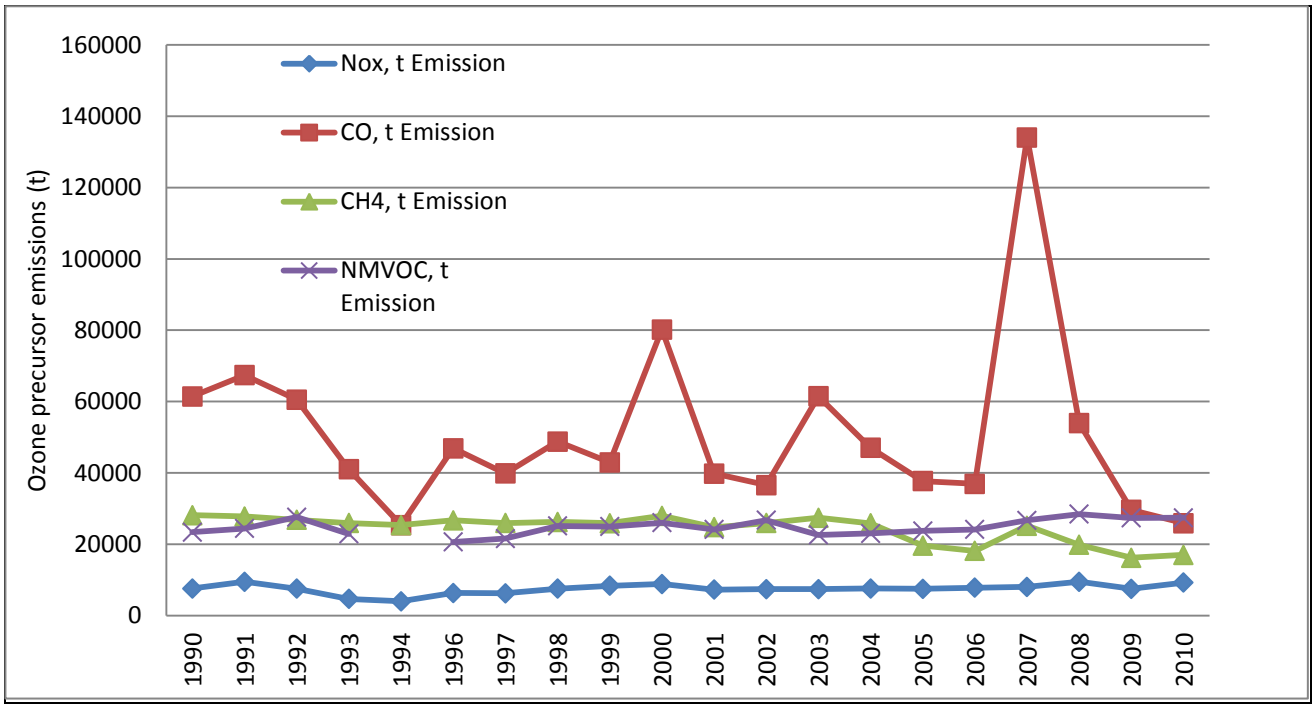
Impact on Human Health and Ecosystems:

Ozone precursors are pollutants which are the precursor of the phenomenon of tropospheric ozone. The emergence of this special form of oxygen, made up of three oxygen atoms (while oxygen in the atmosphere is composed of two atoms), is closely linked to the effect of the sun's ultraviolet rays on the emitted ozone precursors, particularly nitrogen oxides (NO_x). The production of tropospheric ozone is most intense during the hours when the sun is strongest, during the day when it is very hot, when the sky is blue and the wind is weak. There is still no clear evidence that the occurrence of this type of ozone causes a certain disease of people, but the fact is that it has a negative impact on people with already poor health especially when it comes to lung patients. The occurrence of elevated concentrations of ozone precursors as well as the tropospheric ozone by all means negatively affects the atmospheric balance and destruction of the ozone layer that protects people and ecosystems from the harmful effect of UV and cosmic radiation.

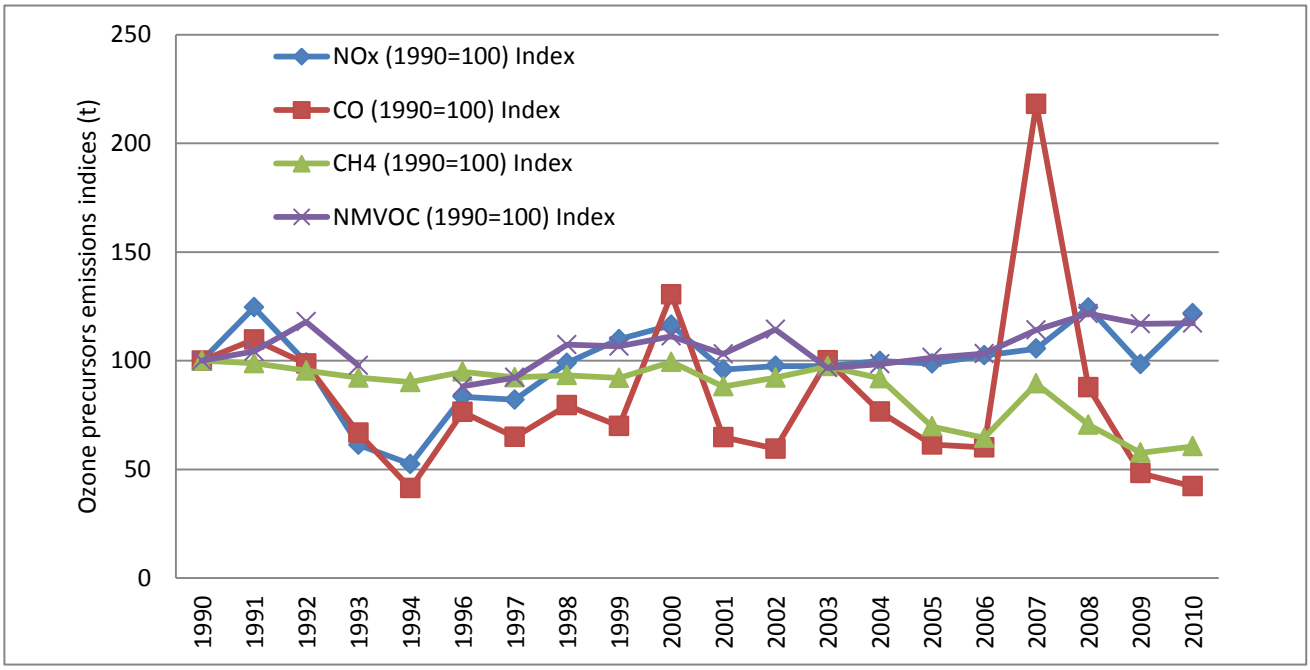
Reference Legislation:

Law on Ratification of the Convention on Long-Range Transboundary Air Pollution, Law on Ratification of the Kyoto Protocol, the Law on Ratification of the Protocol to the Convention on Long-Range Transboundary Air Pollution, Law on Environment, Law on Air Protection, Law on Official Statistics and the System of Official Statistics, Regulation on limit values of pollutants in liquid fuels of petroleum origin, Regulation on substances that deplete the ozone layer and alternative substances, Regulation on establishing a network of measurement points for monitoring air quality, Regulation on determining the types of pollutants, limit values and other standards for air quality, Rulebook on emissions of pollutants into the air, Regulation on the limit values of emissions of air

pollutants from stationary sources, Regulation on maximum national emissions of certain pollutants.



Graph 10. Ozone precursor emissions, 1990-2010



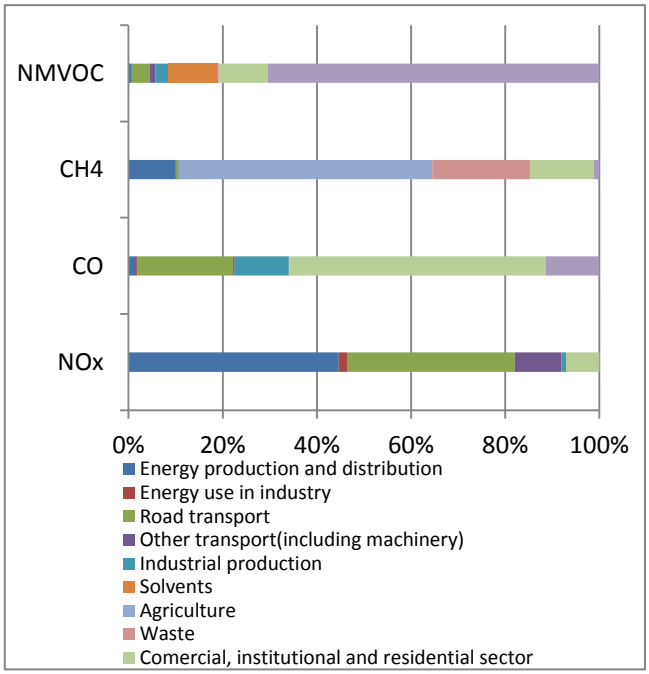
Graph 11. Ozone precursors emissions indices, 1990-2010

Indicator Evaluation

During the period 1990-2010, the trend of precursor emissions of NOx, NMVOC and CH_4 recorded sporadic fluctuations while CO emissions varied greatly during the reporting period. Marked changes in CO emissions are related to the level of industrial production, energy production, the intensity of road traffic, and especially the number of fires which were the most numerous during the summer months of 2007.

In comparison to 2009, in 2010 a discrete increase of CH_4 and NMVOC was recorded, and a noticeable increase in the level of NOx emissions due to the intensified energy production and reduced level of CO emissions due to a drop in industrial production.

During the period for which data are available on the participation of individual sectors in the emissions of NOx (2006-2010), there was an apparent trend of increasing the share of the energy sector in total emissions (7%), and a significant reduction in emissions from energy use in industry (24%) and the share of traffic (approximately 15%). There was an increase of NOx emissions (about 15%) in the sector of public services, institutions and households.



Graph 12. Contribution to ozone precursors emissions by sector, 2010

Changes in the amount of emissions from other sectors show very small changes and have no significant effect on the change in total NOx emissions. In the said five-year period in the sectors of energy production and use in the industry, the trend of CO and NMVOC emissions was reduced by 26% and 20% respectively, while in the road traffic it went down in both cases by 5%. While in the sector of other traffic, the trend of CO emissions decreased by 7%, the trend in NMVOC emissions increased by 24%. The trend CO emission from production processes went down by 28%, and the trend in NMVOC emissions recorded a slight increase of only 6%. During the five-year period, there was an increased number of forest fires, which led to an increase in the trend of CO emissions by 22%. The most significant changes in the trend of CH_4 were observed in the use of energy in industry (-39%), transport sector, not including road transport (+21%), industrial processes (25%), and the forestry sector (22%).

Table 4. Ozone precursor emissions

	1990	2000	2006	2007	2008	2009	2010
NOx emissions t	7622	8873	7808	8040	9486	7496	9280
CO emissions, t	61448	80191	36926	134031	53941	29628	25919
CH4 emissions, t	28144	27979	18153	25176	19846	16231	17046
NMVOC emissions, t	23415	26042	24168	26728	28477	27381	27443
NOx index (1990=100)	100	116	102	105	124	98	122
CO index (1990=100)	100	131	60	218	88	48	42
CH4 index (1990=100)	100	99	65	89	71	58	61
NMVOC index (1990=100)	100	111	103	114	122	117	117

Source of Data: Environmental Protection Agency (www.epa.org.me)
Detailed description of indicators: www.epa.org.me/nli/va03
Reference to international indicators: http://www.eea.europa.eu/data-and-maps/indicators/emissions-of-ozone-precursors-version-2/assessment-2

VA04 Emissions of Primary Suspended Particles and Secondary Particulate Matter Precursors

Key Question:

Is there any progress in reducing air pollution by primary suspended particles and precursors of secondary suspended particles?

Key Message:

The key sources of emissions of primary suspended particles of dust particles smaller than10 μm (PM_{10}) and powdery substances smaller than 2.5 μm ($PM_{2,5}$) are production processes, public services, institutions and households, energy production and agriculture.

In 2010, 42% of the total emissions of PM_{10} came from the production process, 27% from the sector of public services, institutions and households, 15% from agriculture and 12% from the sector of energy production. The sector of public services, institutions and households had the largest share in the emission of $PM_{2,5}$ amounting to 50%, while the production processes emitted about 30% of $PM_{2,5}$.

The key sources of emissions of precursors of secondary suspended particulate matter (NOx, SOx, and NH_3) are the sectors of energy, transport and agriculture. In 2010, about 90% of sulfur oxides (SOx), and 45% of nitrogen oxides (NOx) were emitted from the energy sector while the road transport and other transport, including construction equipment, was the source of about 50% of NOx emissions. Most (97%) of the total emissions of ammonia (NH_3) comes from the agricultural sector.

Rating of Trends of primary suspended particles:

- Compared to the previous year
- Compared to 2005
- Compared to 2000
- Compared to 1990

Rating of trends of precursors of secondary suspended particles:

- Compared to the previous year
- Compared to 2005
- Compared to 2000
- Compared to 1990

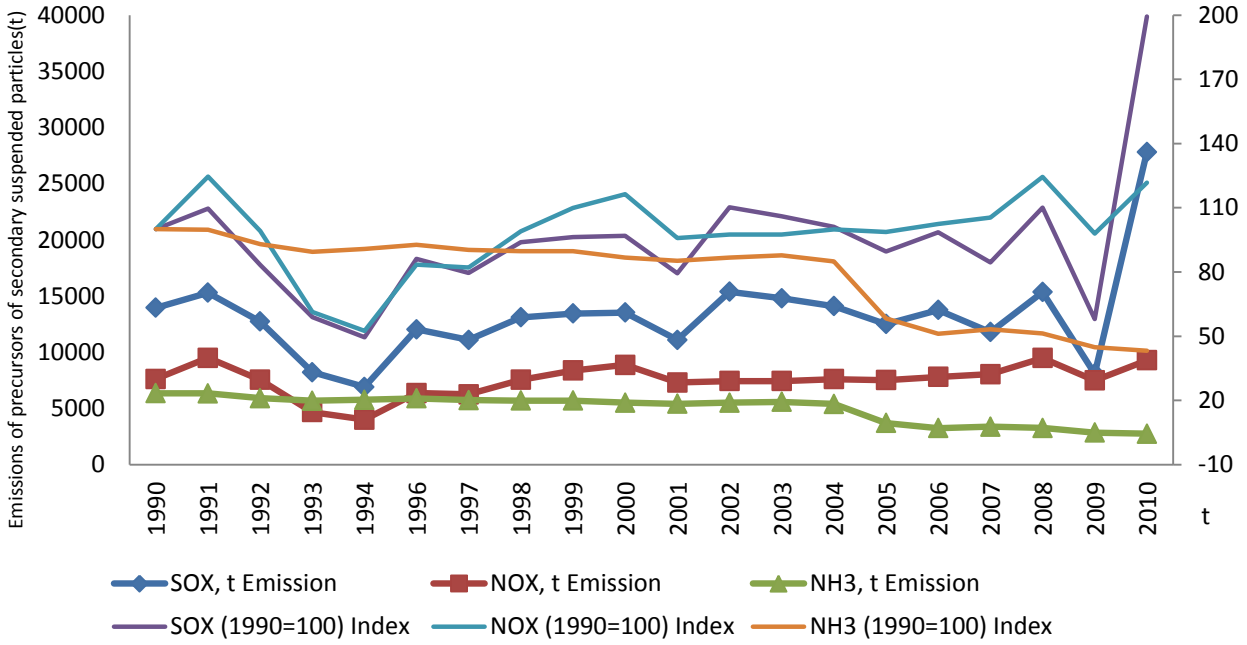
Impact on Human Health and Ecosystems:

Powdery substance may have an irritating, toxic and carcinogenic effect on the body, may cause allergies, fibriose changes in the lungs or infection if the dust contains either infectious or toxic agents. Precipitation has an impact on washing powder substances down, which generally improves air quality but jeopardizes the quality of land and water, and thus has a negative effect on the ecosystems.

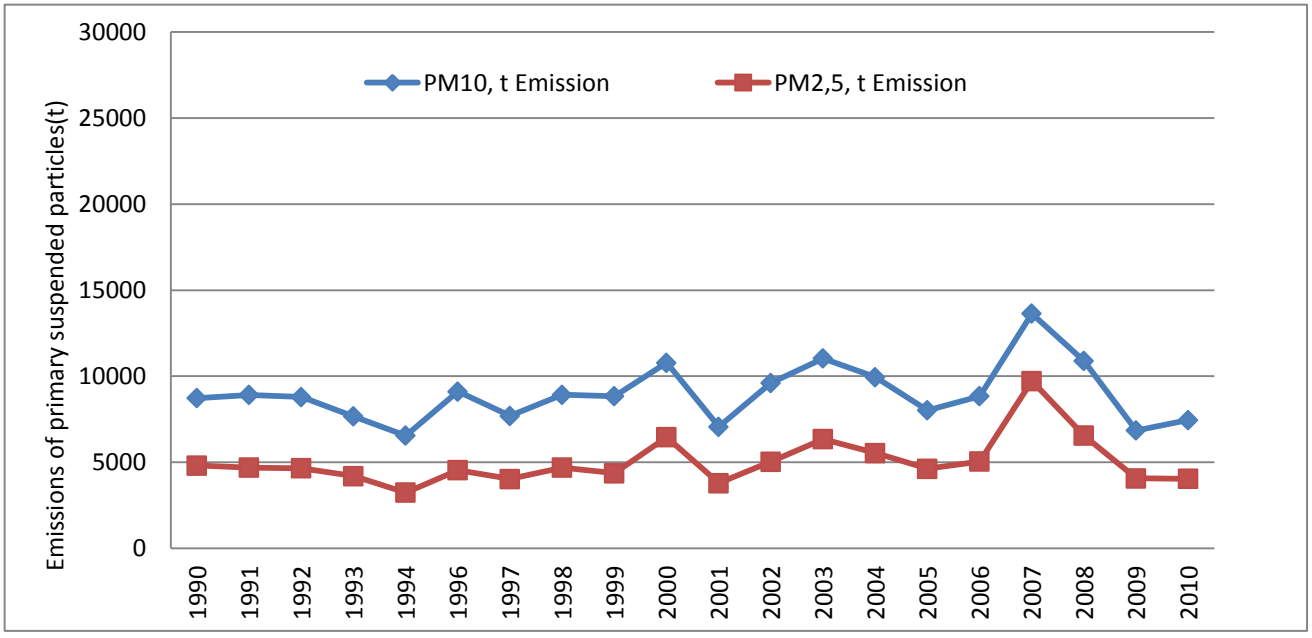
The effects on health and ecosystems depend on the particle size, species composition, concentration and length of exposure.

Reference Legislation:

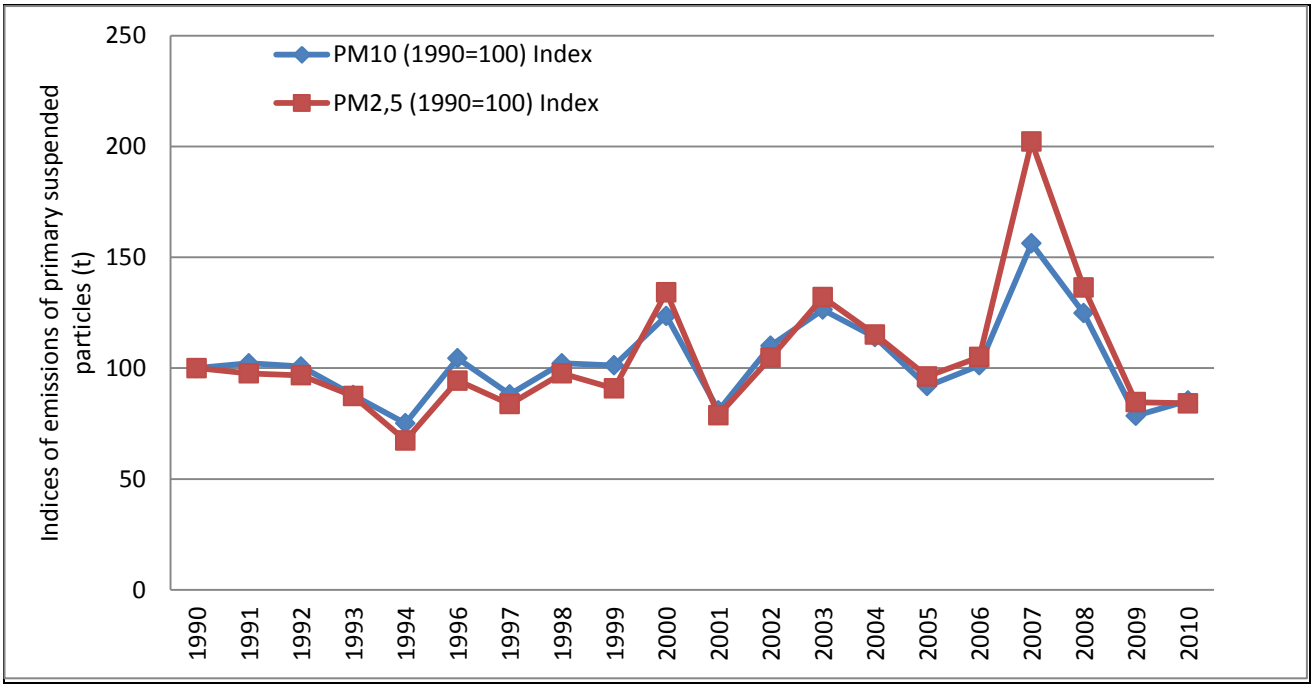
Law on Ratification of the Convention on Long-Range Transboundary Air Pollution, Law on Ratification of the Kyoto Protocol, the Law on Ratification of the Protocol to the Convention on Long-Range Transboundary Air Pollution, Law on Environment, Law on Air Protection, Law on Official Statistics and the System of Official Statistics, Regulation on limit values of pollutants in liquid fuels of petroleum origin, Regulation on substances that deplete the ozone layer and alternative substances, Regulation on establishing a network of measurement points for monitoring air quality, Regulation on determining the types of pollutants, limit values and other standards for air quality, Rulebook on emissions of pollutants into the air, Regulation on the limit values of emissions of air pollutants from stationary sources, Regulation on maximum national emissions of certain pollutants.



Graph 13. Emissions of precursors of secondary suspended particles, 1990-2010



Graph 14. Emissions of primary suspended particles, 1990-2010

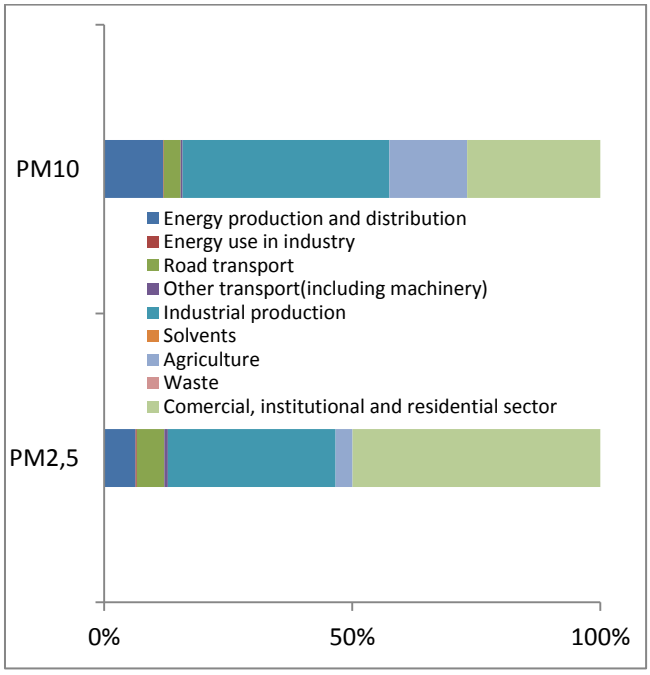


Graph 15. Indices of emissions of primary suspended particles, 1990-2010

Indicator Evaluation

Between 1990 and 1994, there was a decrease in emissions of PM_{10} and $PM_{2,5}$ due to reduced industrial and energy production. After this period, there was mostly an upward trend in emissions of these pollutants with sporadic drops. A significant increase in emissions of powder materials due to large-scale forest fires was recorded during summer in 2007.

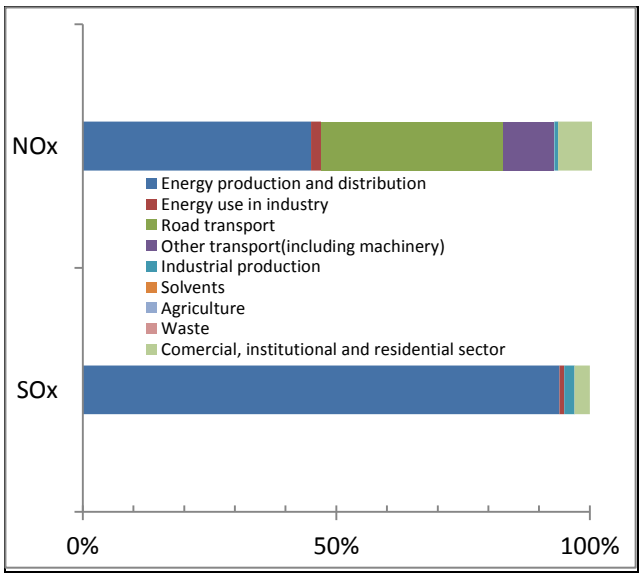
During the period for which data are available on the share of individual sectors in emissions of PM_{10} and $PM_{2,5}$ (2006-2010), in both cases there was a visible trend of decreasing the share of the energy sector in total emissions (by 29% and 37%), and a significant reduction in emissions from energy use in industry (46% and 41%). There was an increase in emissions of powder substances (45% and 49% respectively) from the production processes. Changes in the amount of emissions from other sectors are very small and have no significant effect on the change in the total emissions of PM_{10} and $PM_{2,5}$.



Graph 16. Contribution to emissions of primary suspended particles by sector, 2010

During the period of sanctions, from 1990 to 1995, there was a significant drop in emissions of precursors of secondary suspended particles, primarily SOx and NOx, due to the overall reduction in economic activity, and primarily a drop in energy production and intensity of transport. After 1995, SOx and NOx emissions showed a steady upward trend which was stabilized around the base value of 1990 for NOx in 2009, while the trend of emissions of SOx was unstable, probably as a result of changes in the energy sector, which was particularly pronounced in 2009 where a drop in SOx emissions by almost 50% was observed compared to 2008. With intensifying energy production in 2010, the emission levels recorded a steep increase. In the same reporting period, due to a drop in agricultural production, emissions of NH_3 showed a stable trend of constant slight decline, and in

2010 amounted to only about 50% of the emissions in 1990.



Graph 17. Contribution to emissions of precursors of secondary suspended particles in 2010

During the period for which data are available on the participation of individual sectors in the emissions of SOx and NOx (2006-2010), in both cases there is a visible trend of increasing the share of the energy sector in total emissions (by 18% and 7%), a significant reduction in emissions from energy use in industry (28% and 24%) and the share of transport (about 30% and about 15%). There was an increase of NOx emissions (about 15%) from the sector of public services, institutions and households.

Table 5. Emissions of precursors of secondary suspended particles

	1990	2000	2006	2007	2008	2009	2010
Emissions of SO_X, t	13959	13530	13753	11794	15357	8086	27824
Emissions of NO_X, t	7622	8873	7808	8040	9486	7496	9280
Emissions of NH3, t	6351	5504	3242	3380	3254	2852	2744
Index SO_X (1990=100)	100	97	99	84	110	58	199
Index NO_X (1990=100)	100	116	102	105	124	98	122
Index NH3 (1990=100)	100	87	51	53	51	45	43

Table 6. Emissions of primary suspended particles

	1990	2000	2006	2007	2008	2009	2010
Emissions of PM_{10}, t	8730	10787	8838	13642	10891	6851	7451
Emissions of $PM_{2,5}$, t	4810	6458	5051	9723	6557	4071	4046
Index PM_{10} (1990=100)	100	124	101	156	125	78	85
Index $PM_{2,5}$ (1990=100)	100	134	105	202	136	85	84

Source of Data: Environmental Protection Agency (www.epa.org.me)
Detailed description of indicators: www.epa.org.me/nli/va04
Reference to international indicators: http://www.eea.europa.eu/data-and-maps/indicators/emissions-of-primary-particles-and-5/assessment-2

Considering the importance of water as a natural resource and a resource in general use , as well as its natural properties that make it an indispensable condition for life and work and a healthy environment, it is essential to monitor its natural state and to take all necessary measures in order to conserve the resource.

One of the main policy objectives of preserving, protecting and improving the environment is to preserve water quality and thus human health, and the protection of natural resources that directly or indirectly affect the water.

By water resources in relation to its surface Montenegro is one of the richest water areas in the world. Due to the increase in the quantity and availability of water data, when developing relevant policies for water protection, it is necessary to make sense of all the parameters that provide information about water quality in order to facilitate the decision making process and making the best possible decisions about the use and protection of water from the concerned river basin. For this reason, the need arose for defining the indicators that give us an answer on the status of water quality. Due to the current unavailability of data, this report includes only indicators that represent the state of water quality such as oxygen regime, the presence of nutrients and water quality index.

The indicator Nutrients in Surface Waters shows concentrations of orthophosphate and nitrate in rivers, total phosphorus and nitrate in lakes and nitrate in groundwater in order to have an idea about the degree of eutrophication, which causes accelerated proliferation of algae and higher plants and creating undesirable balance of aquatic ecosystems as well as the water quality.

The indicator of oxygen consumption in rivers shows the status and trends in the concentration of biodegradable organic matter (pollution) in terms of biological oxygen demand and total ammonia concentration, where the concentration of ammonium ions (NH_4^-) indicates possible bacterial activity of waste which through sewer systems or by erosion reaches surface waters.

The index of water quality is described as an indicator of the environment, clear and easy to understand, so that it enhances the activity of target groups in the preservation of the environment.

V01 Nutrients in Freshwaters

Key Question:

Is the amount of nutrients in freshwaters decreasing?

Key Message:

A key source of nutrients in freshwater is wastewater from urban areas, industry and more significantly from agriculture. In the reporting period (2009-2012), there was a significant increase in the presence of orthophosphate in rivers (36%) and a smaller increase in nitrate (about 5%). At the same time there is a spatial unevenness of these trends, especially for orthophosphates.

Rating of Trends:

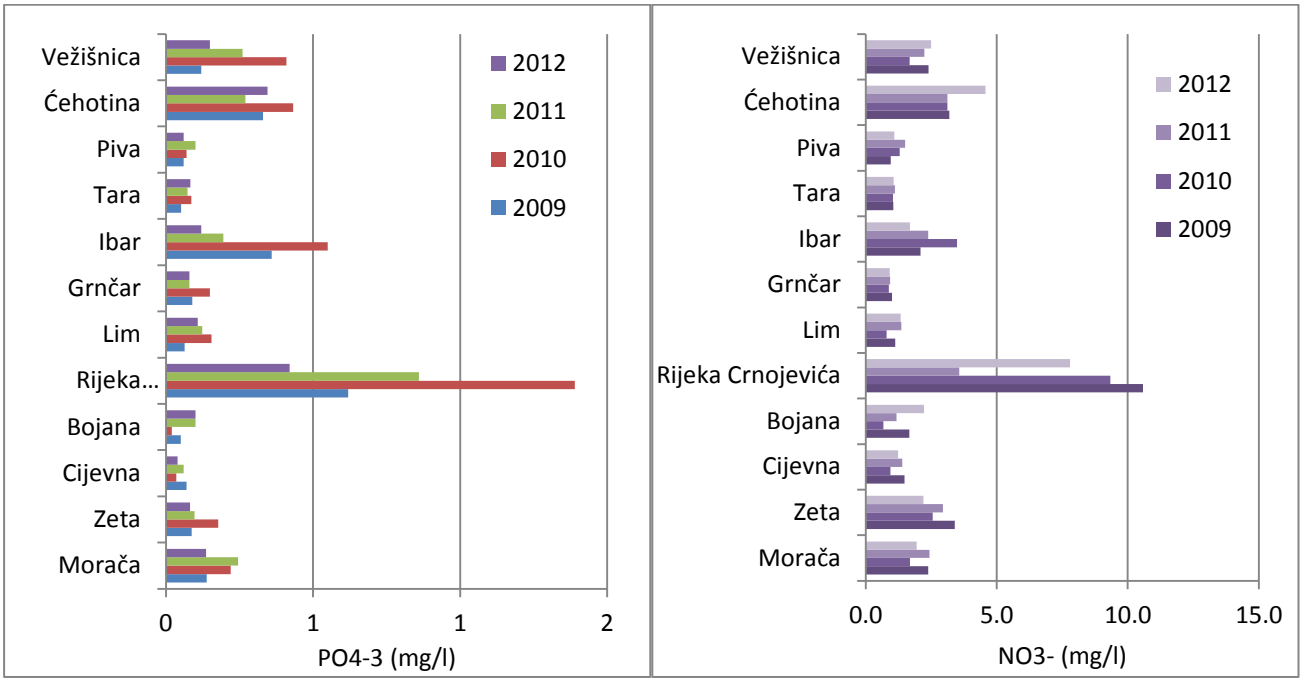
- Compared to the previous year
- Compared to 2009

Impact on Human Health and Ecosystems:

Enrichment of water with nutrients, especially compounds of nitrogen and/or phosphorus leads to eutrophication, which results in rapid proliferation of algae and higher plants and making unwanted changes to the balance of organisms present in the water and the water quality. The most significant source of pollution by nitrogen is erosion of agricultural land, while most of the phosphorus pollution originates from municipal and industrial wastewater. This causes ecological changes that may lead to the loss of plant and animal species (reducing ecological status) and have a negative impact on the use of water for human consumption and other purposes.

Reference Legislation:

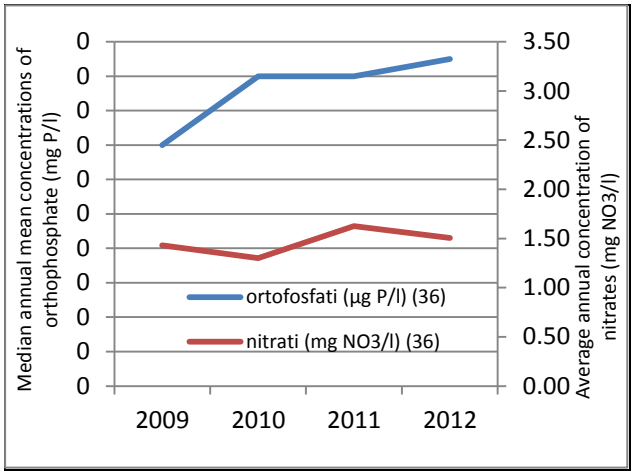
Law on Environment,
Law on Official Statistics and the System of Official Statistics,
Law on Waters,
Regulation on the classification and categorization of surface and groundwater.



Graph 18. Mean annual values of nitrates (left) and orthophosphates (right) by river, for the period 2009-2012

Indicator Evaluation

Compared to the previous year observed, average annual value of nitrate concentration decreases in virtually all streams with lower spatial imbalances. Thus, the decrease in concentration is observed in all streams except the Ibar river and the Piva river, which should be conditionally taken as the two rivers are monitored only at three profiles which may mean that it is a kind of concentrated pollution. In larger rivers, the Morača, Zeta, and Lim, there is a decline in nitrate concentrations by approximately 25%, while the trend is slightly stagnant at the Tara and Ćehotina. Results show a trend of decline in concentrations of NO_3 in 2010, while in 2011 increased concentrations of NO_3 by 25% were noticed, and in 2012 the concentration of NO_3 decreased by 8%.



Graph 19. Concentration of nitrates and orthophosphates in rivers in Montenegro, 2009-2012

In contrast, the concentration of orthophosphate significantly varies spatially, so that in the Cijevna and Bojana concentrations decreased by approximately 50%, and in the larger rivers of Morača and Tara those increased by approximately 60%. Particularly worrying is the increase in concentration of orthophosphate in the Zeta, Rijeka Crnojevića and Lim, where the annual mean concentration were more than two times higher in 2010 than in 2009. The most alarming situation is in the Vežišnica, where the concentration is even 3.9 times higher than in the previous year.

If the annual mean concentrations in streams are aggregated by drainage basin, it is concluded that the concentration of nitrate in the Black Sea basin is practically unchanged while in the Adriatic basin the concentration decreases by 33%. For orthophosphate, an increase in both catchment areas is recorded, by 85% in the Black Sea and by 35% in the Adriatic Sea.

Source of Data: Hydrometeorological and Seismological Office of Montenegro (www.meteo.co.me)
Detailed description of indicators: www.epa.org.me/nli/v01
Reference to international indicators: EEA (http://www.eea.europa.eu/data-and-maps/indicators/nutrients-in-freshwater/nutrients-in-freshwater-assessment-published-3)

V02 Oxygen Consuming Substances in Rivers

Key Question:

What is the Oxygen Consuming Substances in water courses (BOD5)?

Key Message:

BOD5 concentration is the demand of organisms that consume oxygen in organic oxidized matter and is the main parameter for the assessment of surface water pollution by organic substances as well as to assess the efficiency of wastewater treatment.
The presence of ammonium ions is an indicator of possible bacterial activity of decomposition of matter of human and animal origin which through the sewage system or by erosion comes to surface water.

Rating of Trends:

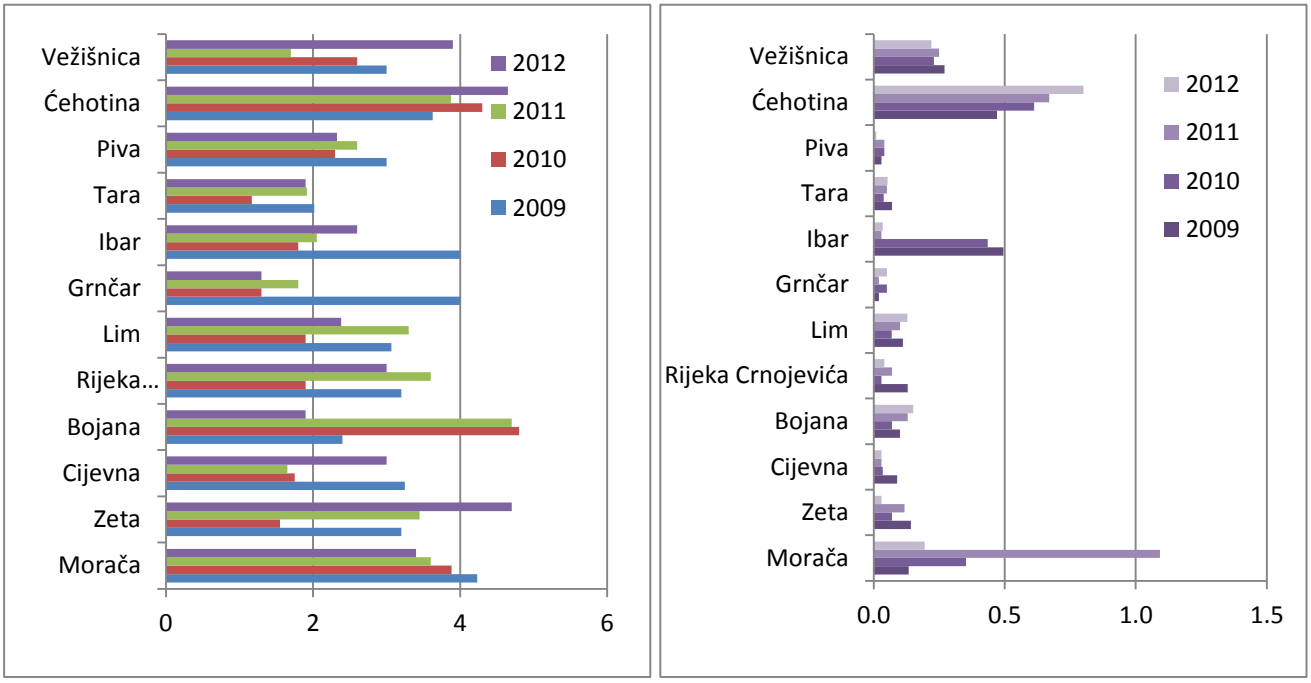
- Compared to the previous year
- Compared to 2009

Impact on Human Health and Ecosystems:

Organic pollution leads to high rates of metabolic processes that require oxygen, which leads to a lack of oxygen and the occurrence of anaerobic conditions in aquatic ecosystems in which nitrogen transformations in reduced form in turn leads to increased concentrations of ammonia, which is toxic to aquatic animals above a certain concentration.

Reference Legislation:

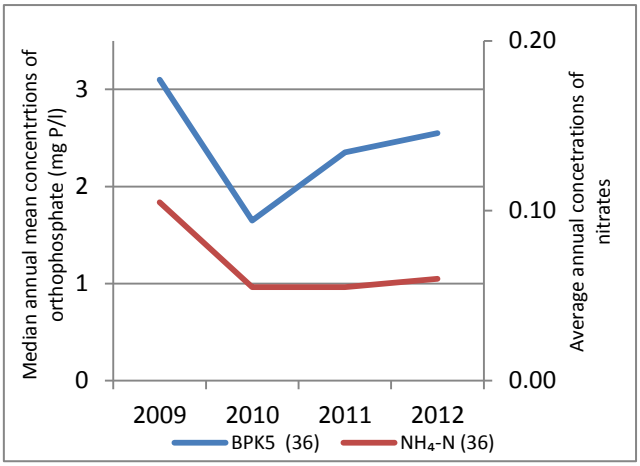
Law on Environment,
Law on Official Statistics and the System of Official Statistics,
Law on Waters,
Regulation on the classification and categorization of surface and groundwater.



Graph 20. Mean annual values of BOD5 and ammonia NH_4 in the rivers during the period 2009-2012

Indicator Evaluation

Rating the quality of freshwater based on substances that consume oxygen (BOD5 and NH_4) based on the data of testing the quality of surface water in Montenegro. The analysis included 13 water courses with 36 measuring profiles in the period 2009-2012. On the basis of average annual values relevant for each measuring point, a median value of arranged series of parameters of BOD5 (Biochemical Oxygen Demand) and NH_4 (ammonium ion) was calculated. In the reporting period of 2009-2012 there was a decrease in the concentration of BOD5 by 18%. When it comes to the concentration of ammonium ions, a decline in concentration of 43% was observed.



Graph 21: Median concentration of oxygen and ammonium ions in the period 2009-2012

Source of Data: Hydrometeorological and Seismological Office of Montenegro (www.meteo.co.me)
Detailed description of indicators: www.epa.org.me/nli/v02
Reference to international indicators: EEA (http://www.eea.europa.eu/data-and-maps/indicators/nutrients-in-freshwater/nutrients-in-freshwater-assessment-published-3)

V03 Water Quality Index

Key Question:

What is the quality of freshwater in Montenegro?

Key Message:

The indicator "Water Quality Index" was calculated by the Environmental Protection Agency. The indicator is based on the method of Water Quality Index, according to which ten parameters of physico-chemical and microbiological quality (oxygen saturation, Biochemical Oxygen Demand, ammonium ion, pH, total oxides of nitrogen, orthophosphate, suspended solids, temperature, conductivity and coliform bacteria) are aggregated into the composite indicator of the quality of surface waters. It is important to note that the Water Quality Index is descriptive, and when developing descriptive indicators certain numerical precision of the original parameters of the environment is always scarified.

Rating of Trends:

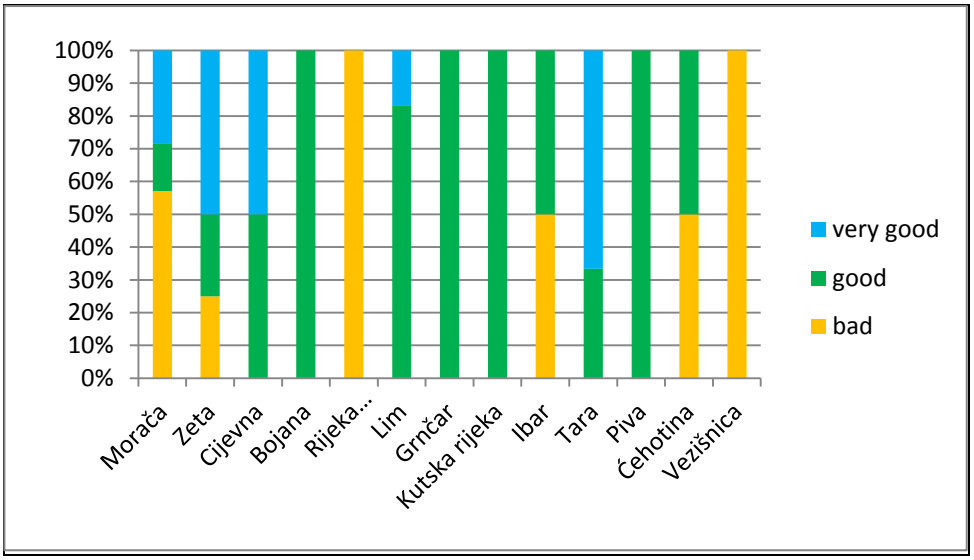
- Compared to the previous year
- Compared to 2009

Impact on Human Health and Ecosystems:

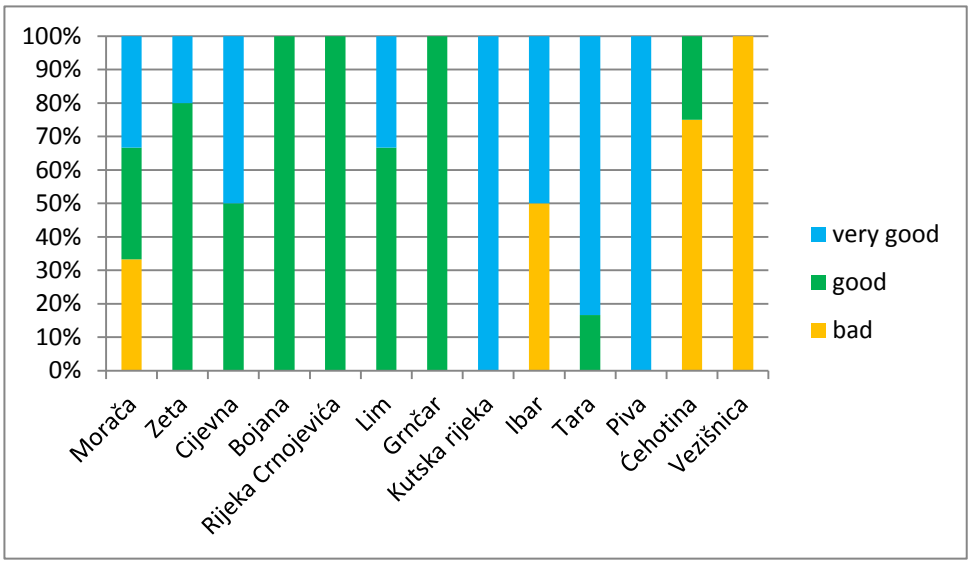
Water Quality Index for freshwaters is classified with compatibility of existing classification according to their use and level of cleanness. Waters whose Water Quality Index is excellent are those that can be used in their natural state, with filtration and disinfection, to supply water to settlements, in the food industry, and as surface water for edible fish rearing. Water whose Water Quality Index is "very good" and "good" are those which can be used in the natural state for bathing and recreation, water sports, for cultivation of other fish species (*Cyprinids*), or which, when modern methods of treatment are applied, can be used for supplying drinking water to settlements and in food industry. Waters whose Water Quality Index is "bad" are those that can be used for irrigation, and after modern methods of treatment also in the industry, other than food industry. Waters whose Water Quality Index is "very bad" are those whose quality has an adverse affect the environment and can be used only after the application of specific methods of treatment.

Reference Legislation:

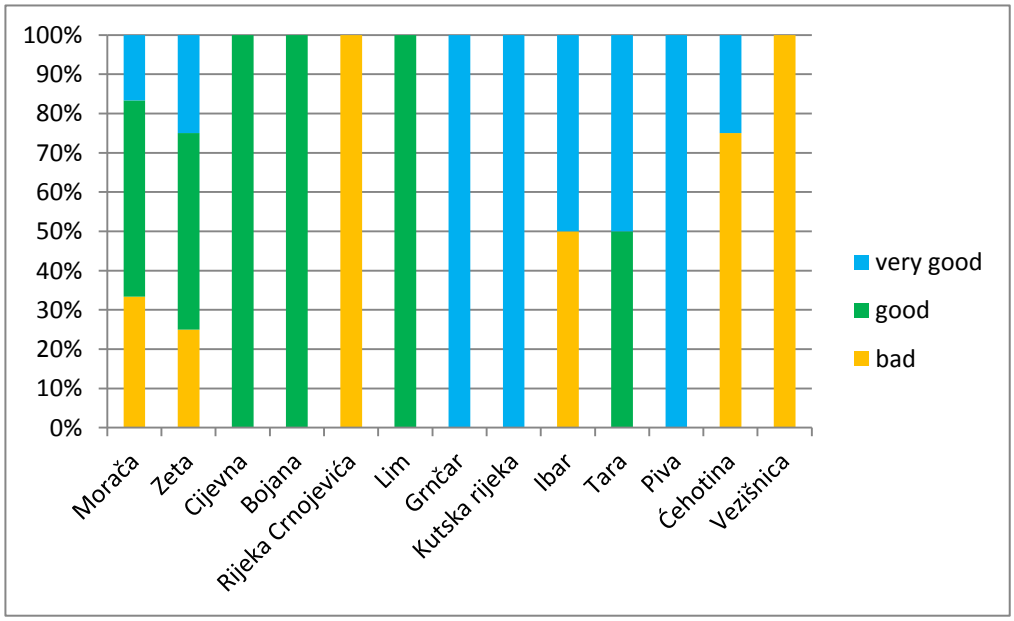
Law on Environment,
Law on Official Statistics and the System of Official Statistics,
Law on Waters,
Regulation on the classification and categorization of surface and groundwater.



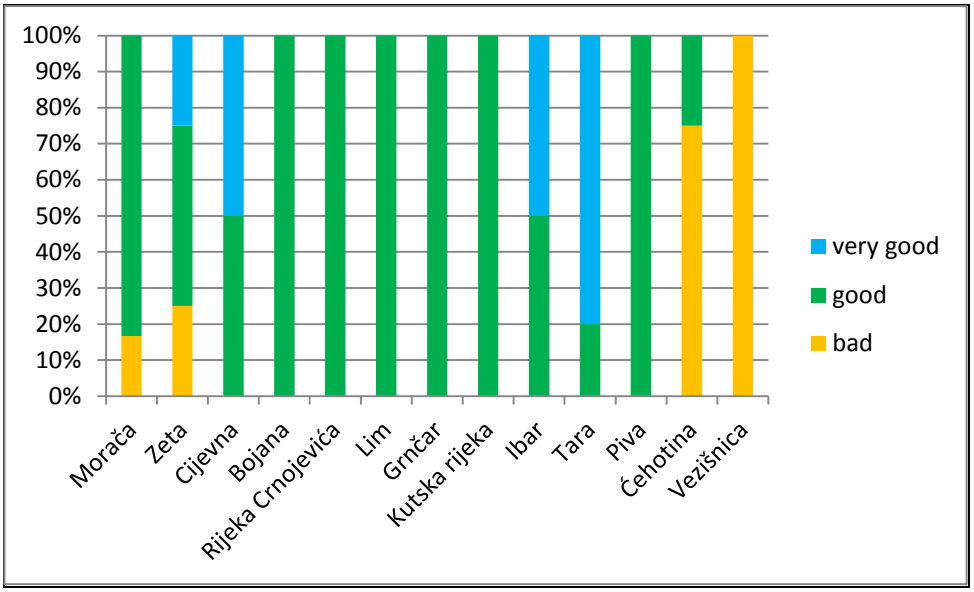
Graph 22. Water Quality Index by river in 2009



Graph 23. Water Quality Index by river in 2010

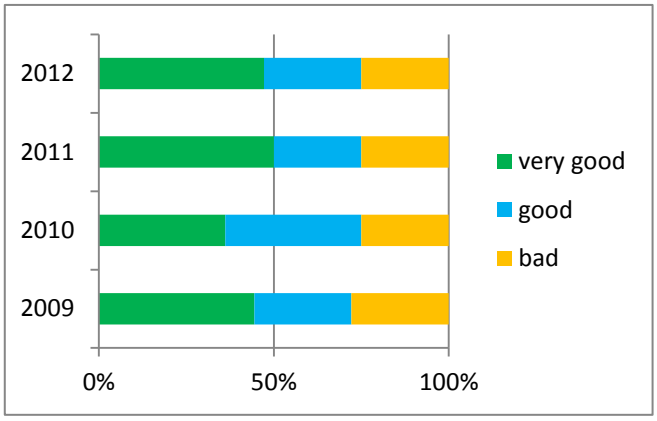


Graph 24. Water Quality Index by river in 2011



Graph 25. Water Quality Index by river in 2012

Indicator Evaluation



Grafik 26. WQI frequency distribution (2009-2012) in rivers

The indicator is based on the method of calculating the Water Quality Index, according to which the ten parameters of physico-chemical and microbiological quality are aggregated into a cumulative indicator of the quality of surface waters. In the reporting period of 2009-2012, on the basis of Water Quality Index, it can be concluded that the poor quality is found in the Vežišnica river, which is also shown by the real state of all water quality parameters that were outside of the prescribed class downstream from the point of discharge from the Thermal Power Plant (TPP) Pljevlja. The main reason for poor water quality in the Vežišnica is the proximity of the TPP of Pljevlja and wastewater discharge from the Municipality of Pljevlja.

Analysis of indicator results shows that in 2009 40% of rivers were of good quality, and the poorest quality was of the Morača, Vežišnica and Rijeka Crnojevića. In 2010 situation on the river Morača significantly improved and in 2012 about 45% of the river was of good quality, 30% very good and 25% bad. Results show that the most polluted waterways include the Vežišnica, Ćehotina in Pljevlja, Morača in the area of Podgorica, Ibar near Bać, and Lim near Bijelo Polje.
According to the analysis of indicator values for the period 2009-2012, for the class of a very good quality, the Ibar river is of the best quality at the measuring point Rožaje WQI (88). In the class of good quality the river Grnčar is of the best quality at the measuring point Gusinje WQI (84), Lim at the measuring point Andrijevica WQI (84), Tara on profiles Djurdjevića Tara and Šćepan polje field WQI (84), Cijevna near Trgaj WQI (84).

Source of Data: Hydrometeorological and Seismological Office of Montenegro (www.meteo.co.me)
Detailed description of indicators: www.epa.org.me/nli/v03

CLIMATE CHANGE

During the period of 26 November to 7 December 2012, in Doha, Qatar, the annual United Nations Conference on Climate Change was held. The high-level segment took place in the period 4-7 December 2012, and during this period a delegation of Montenegro took part in the Conference. The Conference of the Parties to the Convention on Climate Change (hereinafter the COP Conference of the Parties) is the highest constitutional authority of the Convention, which includes empowered state delegations of the Parties. At its regular annual sessions the COP reviews implementation of the Convention and is authorized to take the appropriate decisions relevant to effective implementation and achievement of the objectives of the Convention.

The United Nations Framework Convention on Climate Change (hereinafter referred to as the Convention) was adopted at the UN Conference on Environment and Development in Rio de Janeiro in 1992, when it was signed by 166 countries. In March 1994 the Convention entered into force, and a year later in Berlin, the First Session of the Conference of the Parties to the Convention was held, and since then annual sessions are held regularly. The Convention has been signed by 195 countries.

The main objective of the Convention is to reduce emissions of greenhouse gases due to human activities , in order to prevent further warming of the atmosphere, which has resulted in global climate change and sea levels rising around the world. In accordance with the accepted principle of Common but Differentiated Responsibility, particularly the responsibility of developed countries in the current global warming of atmosphere, provisions of the Convention clearly demarcated the responsibilities of developing countries, countries with transitional economies and industrialized countries . In Annexes 1 and 2, which are an integral part of the Convention , there is a list of all the developed countries and countries in transition, which, when the Convention was adopted, accepted additional responsibilities in terms of providing new and additional financial resources to support developing countries and the obligation of stabilization and reduction of national emissions of greenhouse gases (GHG) to the level of 1990.

All other countries - Parties to the Convention , including Montenegro (the so-called Non-Annex 1 Parties), in terms of rights and obligations, under this Convention belong to the group of countries, which are developing countries , and with no obligation of quantified reduction of emissions of greenhouse gases.

KP01 Annual Air Temperature

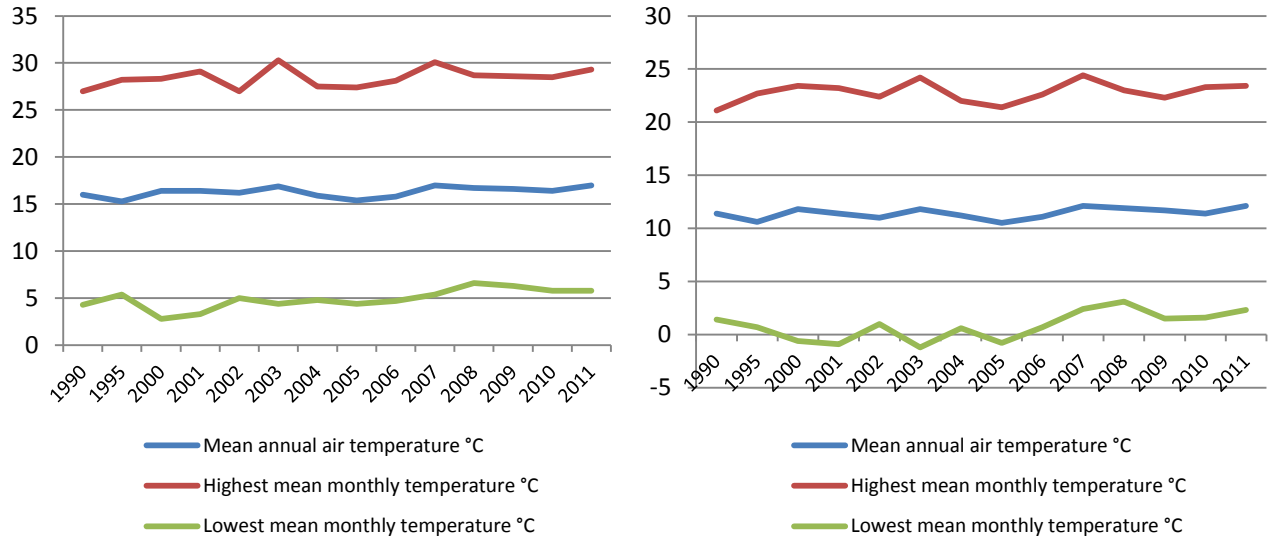
The upward trend in air temperature in the second half of the twentieth century is evident in most of the territory of Montenegro.

According to available data, i.e. a series of measurements in 1949, and at some stations since 1958, it is evident that extreme heat has been recorded more often since 1998, and especially during August.
Period of June, July and August is characterized by high air temperatures, especially in the area of Zeta-Bjelopavlici plain. Mean quarterly temperature in this period was almost 25°C in Podgorica. High summer temperatures are associated with warm tropical waves and a long period of sunny and warm weather with stable weather conditions.
In the three-month period of September, October and November, average temperatures were for about 8°C lower than in the summer quarter. The intensity of reduction is equally distributed both for the northern and southern-coastal warmer climate areas.

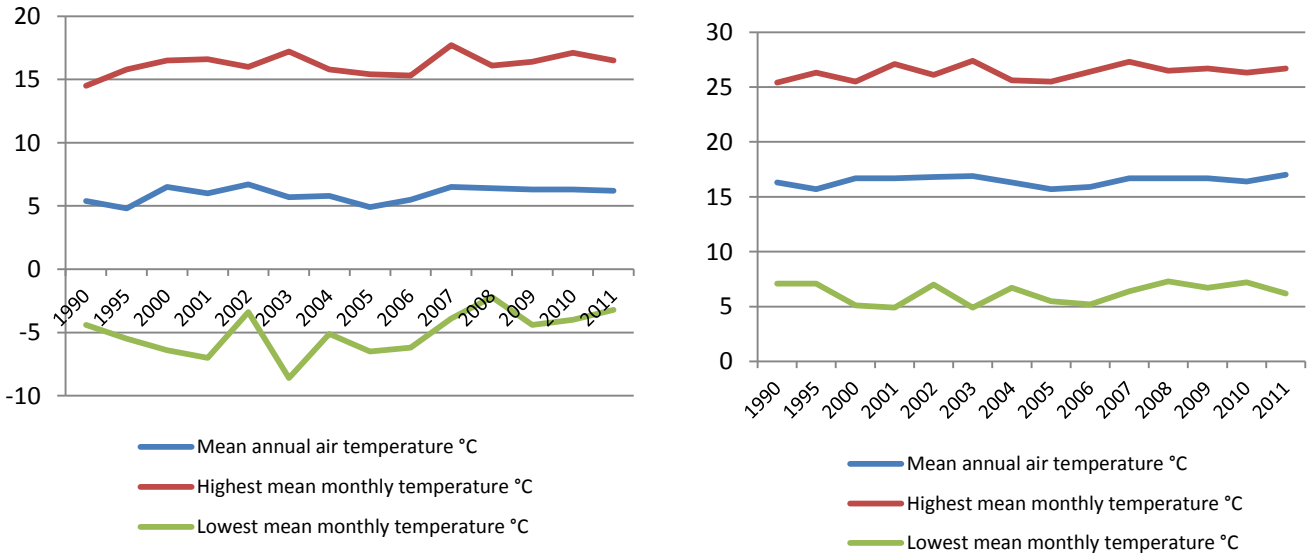
The period of December, January and February is characterized by the fact that mean quarterly temperatures are below zero in the larger area of Montenegro, which has a strong continental climate.
In the mountainous regions the quarterly average temperature during spring months is around 3°C, in the central continental area around 8°C, and in the south around 14°C.

The tables below show mean annual and extreme monthly temperatures during the last 20 years, which were measured at individual measuring stations.

Rating of Trends: /



Graph 27. The trend of mean annual and extreme mean monthly temperatures 1990-2010 (Podgorica – left, Nikšić – right)



Graph 28. The trend of mean annual and extreme mean monthly temperatures 1990-2010 (Žabljak – left, Coastal Region – right)

Indicator Evaluation

The trend of mean annual and extreme mean monthly temperatures at the measuring stations over the past 20 years was mostly stable except for fluctuations during the period 2000-2005 and 2006-2008.

Source of Data: The Initial National Communication on Climate Change of Montenegro, 2010; Climate Atlas of Montenegro, 2012; Hydrometeorological and Seismological Office of Montenegro (www.meteo.co.me).
Detailed description of indicators: www.epa.org.me/nli/kp01

KP02 Annual Precipitation

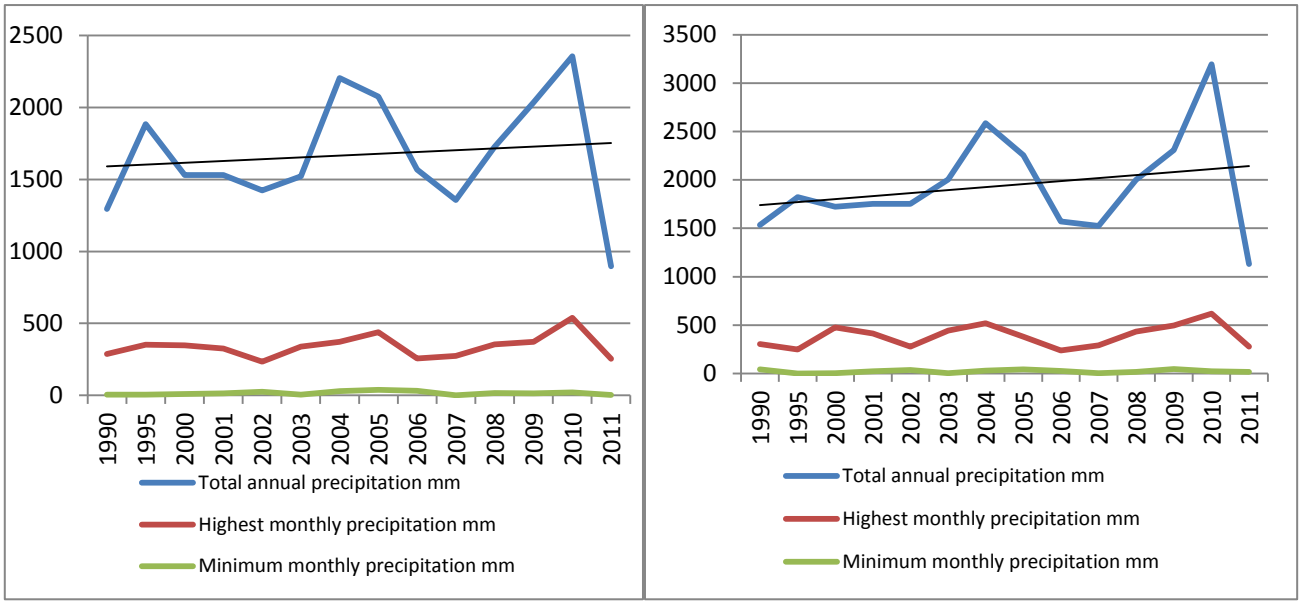
Rainfall is one of the most important climate parameters that determine a region's climate. Rainfall may be of different forms. The most important forms of precipitation are rain, snow, sleet and hail.

Annual average precipitation in the territory of Montenegro is very heterogeneous, with a very pronounced rainy and less rainy region. Rainiest regions have almost 6 times the average annual rainfall compared to the least rainy regions. The highest average annual rainfall is in the southwestern part, the area of Orjen, with 3000-5000 mm. The lowest rainfall is found in the northeastern and far northern parts. There, an average annual precipitation amount is between 700 and 1000 mm.
In the summertime in Montenegro there are different precipitation regimes. The continental area has increased rainfall, while the coastal area has reduced rainfall.

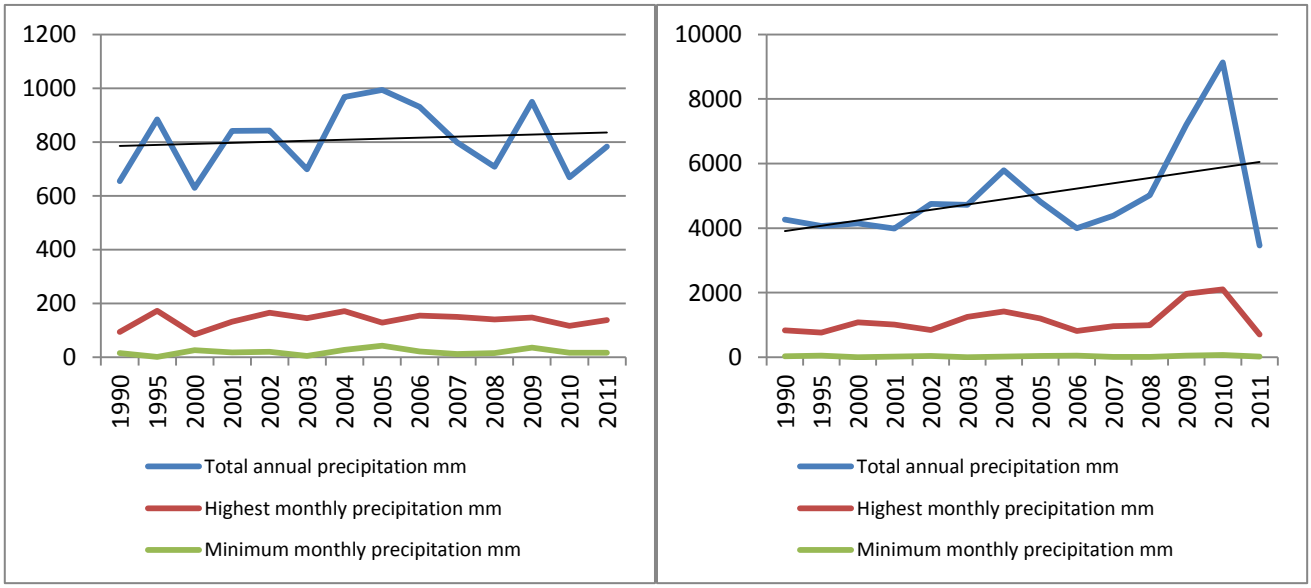
In the fall the so-called rainy series, lasting for several days, often occur. In this period the rainfall is the lowest in the northern regions of Montenegro and the highest in the coastal and central region.
In winter, the so-called rain series lasting for a few days often occur as well, with high rainfall. In this period rainfall is the lowest in the northern regions, and the highest in the coastal and central region.

In spring, average quarterly rainfall is about 6 times higher in the rainiest areas in relation to the amount in the least rainy regions (in the far north of Montenegro).

Rating of Trends: /



Graph 29. Annual precipitation at measurement stations for the period 2009-2011 (Podgorica – left, Nikšić – right)



Graph 30. Annual precipitation at measurement stations for the period 2009-2011 (Pljevlja – left, Crkvice – right)

Indicator Evaluation

Over the previous 20 years, there was an upward trend in annual amounts of rainfall in the central and southern parts of Montenegro, with the exception of 2011 where a sudden drop was recorded. In northern regions, during the period 1990-2011, rainfall varied, although the overall trend is mainly stable.

Source of Data: The Initial National Communication on Climate Change of Montenegro, 2010; Climate Atlas of Montenegro, 2012; Hydrometeorological and Seismological Office of Montenegro (www.meteo.co.me).
Detailed description of indicators: www.epa.org.me/nli/kp02

KP03 Consumption of Ozone Depleting Substances

On 23 October 2006, through succession, Montenegro became Party to the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer, as well as four amendments to the Montreal Protocol. As a new Party to the Montreal Protocol, Montenegro is classified as a country of the Montreal Protocol Article 5 (developing country and a country with a low consumption of substances that deplete the ozone layer).

As concrete steps in implementing the Montreal Protocol, in 2007 the National Program for the Elimination of Substances that deplete the ozone layer and the Plan for the Ultimate Elimination of CFC Substances were adopted and approved. The implementation of these projects in Montenegro met the deadline for the final elimination of CFC substances that deplete the ozone layer, i.e. banned any consumption or import of CFC substances as of 1 January 2010.

The Plan for eliminating HCFC substances that deplete the ozone layer was prepared by the Environmental Protection Agency of Montenegro in cooperation with UNIDO, as the implementing agency.

The primary purpose of the adoption of the Plan is to enable the Government of Montenegro to gradually eliminate the consumption of HCFC substances, especially in the service sector. Without adequate measures to reduce the demand for HCFC substances, Montenegro would not be able to fulfill the requirements of the Montreal Protocol, i.e. the deadlines for the elimination of these substances, as follows:

The baseline period (baseline demand from which the reduction of demand for HCFC substances is accounted for) is the period of 2009-2010.

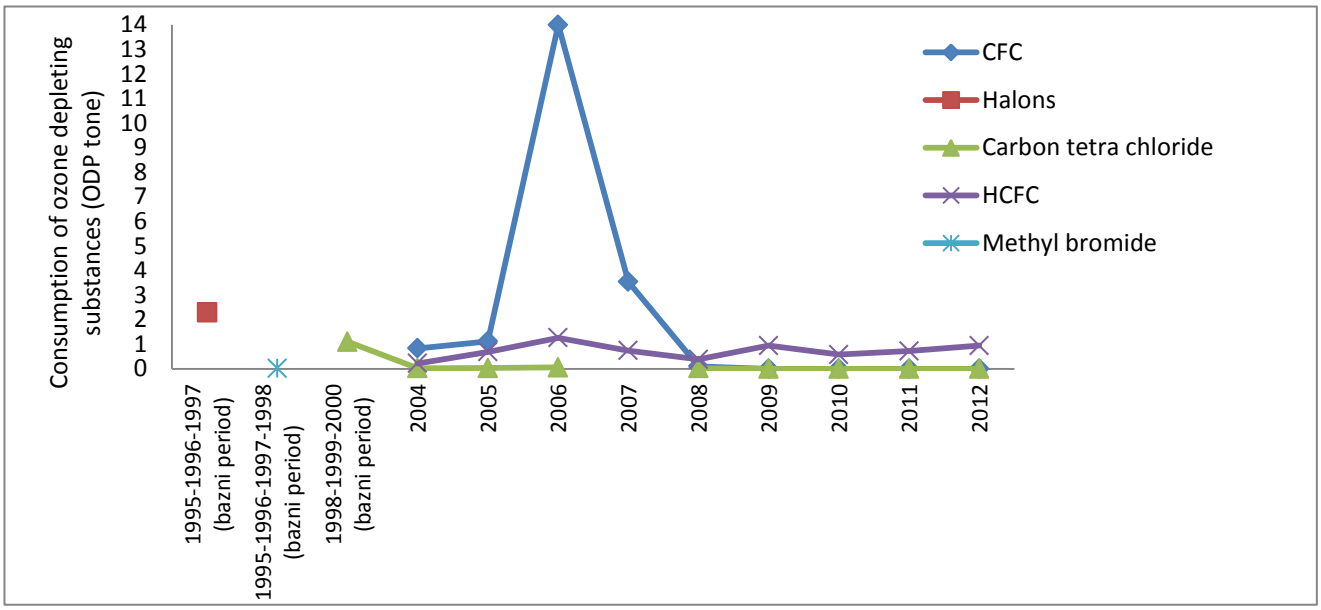
• demand freezing on the level of baseline demand - 2013
• Obligatory 10 % reduction by 2015
• 35% reduction by 2020
• 67.5 % reduction by 2025
• 97.5 % reduction by 2030, and
• 100 % reduction by 2040.

As a candidate country for EU accession, Montenegro will revise the timetable for elimination in accordance with the dynamics of the EU accession process for which these limits are more stringent. In 2012, Montenegro imported a total of 43.27 t of alternative substances F-gases, both pure and in mixed groups.

Rating of Trends: /

Reference Legislation:

Law on Ratification of the Convention on Long-Range Transboundary Air Pollution, Law on Ratification of the Kyoto Protocol, Law on Ratification of the Protocol to the Convention on Long-Range Transboundary Air Pollution, Council for Clean Development Mechanism, Law on Environment, Law on Air Protection, Regulation on limit values of pollutants in liquid fuels of petroleum origin, Regulation on establishing a network of measurement points for monitoring air quality, Regulation on substances that deplete the ozone layer and alternative substances, Regulation on determining the types of pollutants, limit values and other standards for air quality, Rulebook on emissions of pollutants into the air, Law on Official Statistics and the System of Official Statistics.



Graph 31. Consumption of ozone depleting substances in ODP tonnes

Table 7. Consumption of ozone depleting substances in ODP tonnes

Period	CFC	HALONS	CARBON TETRA CHLORIDE	HCFC	METHYL BROMIDE
1995-1996-1997 (baseline period)	104.9	2.3	-	-	-
1995-1996-1997-1998 (baseline period)	-	-	-	-	0.015
1998-1999-2000 (baseline period)	-	-	1.1	-	-
2004	0.83	-	0.022	0.22	-
2005	1.12	-	0.033	0.69	-
2006	14	-	0.055	1.26	-
2007	3.54	-	-	0.74	-
2008	0.08	-	0.022	0.38	-
2009	0	-	0	0.94	-
2010	0	-	0	0.58	-
2011	0	-	0	0.72	-
2012	0	-	0	0.94	-

Source of Data: Environmental Protection Agency (www.epa.org.me)
Detailed description of indicators:www.epa.org.me/nli/kp03
Reference to international indicators: http://www.eea.europa.eu/data-and-maps/indicators/production-and-consumption-of-ozone/production-and-consumption-of-ozone-4

KP04 Trends in Greenhouse Gas Emissions

Key Question:

What is the progress in reducing emissions of greenhouse gases?

Key Message:

Direct greenhouse gas emissions, covered by the Kyoto Protocol (CO_2, N_2O, CH_4, etc.) are gaseous constituents of the atmosphere that absorb and retransmit the infrared radiation and get into the atmosphere naturally or as a result of human activities. In the period 1990-2009, after the downward trend in emissions until 1994, there is an upward trend, with the exception of 2009, when a significant decrease of about 20% was recorded compared to the previous year as a result of reduced energy production in the Thermal Power Plant Pljevlja due to repairs and closing of the power plant at the Aluminium Plant Podgorica (KAP).

Rating of Trends:

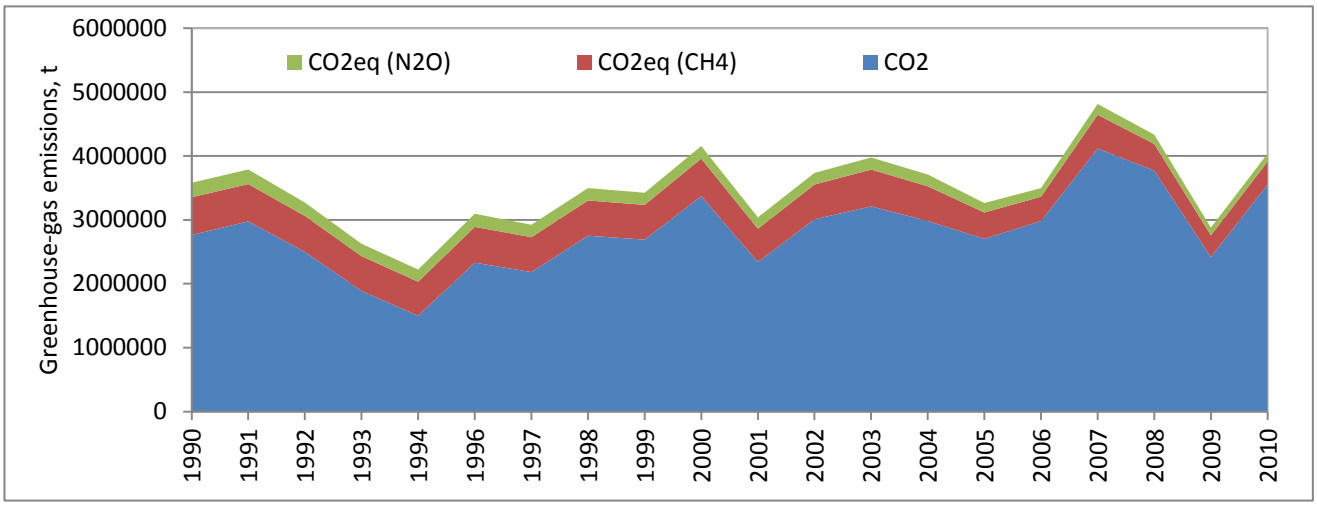
- Compared to the previous year
- Compared to 2005
- Compared to 2000
- Compared to 1990

Impact on Human Health and Ecosystems:

Production of greenhouse gases has minimal direct impact on human health and ecosystems. However, given the connection between greenhouse gas emissions and climate change, the indirect effects of these emissions include all effects that are caused by climate change. In addition, since the greenhouse gases are normally produced together with other pollutants, it can be concluded that increased greenhouse gas emissions also indicate an increased total emission of pollutants, i.e. air pollution and thus an increased risk to human health and ecosystems.

Reference Legislation:

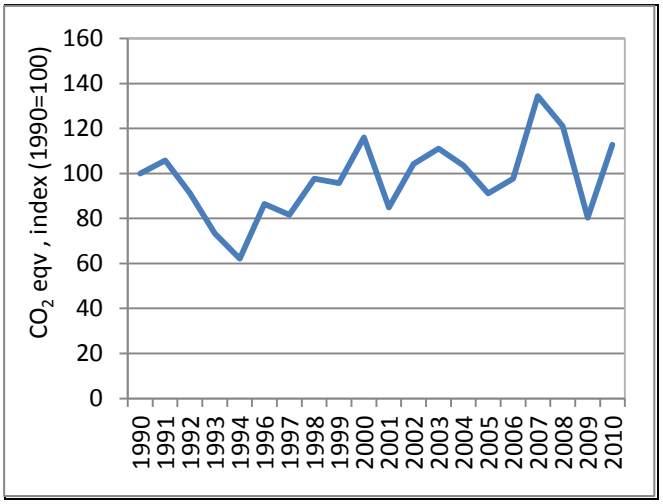
Law on Ratification of the Convention on Long-Range Transboundary Air Pollution, Law on Ratification of the Kyoto Protocol, Law on Ratification of the Protocol to the Convention on Long-Range Transboundary Air Pollution, Council for Clean Development Mechanism, Law on Environment, Law on Air Protection, Regulation on limit values of pollutants in liquid fuels of petroleum origin, Regulation on establishing a network of measurement points for monitoring air quality, Regulation on substances that deplete the ozone layer and alternative substances, Regulation on determining the types of pollutants, limit values and other standards for air quality, Rulebook on emissions of pollutants into the air, Law on Official Statistics and the System of Official Statistics.



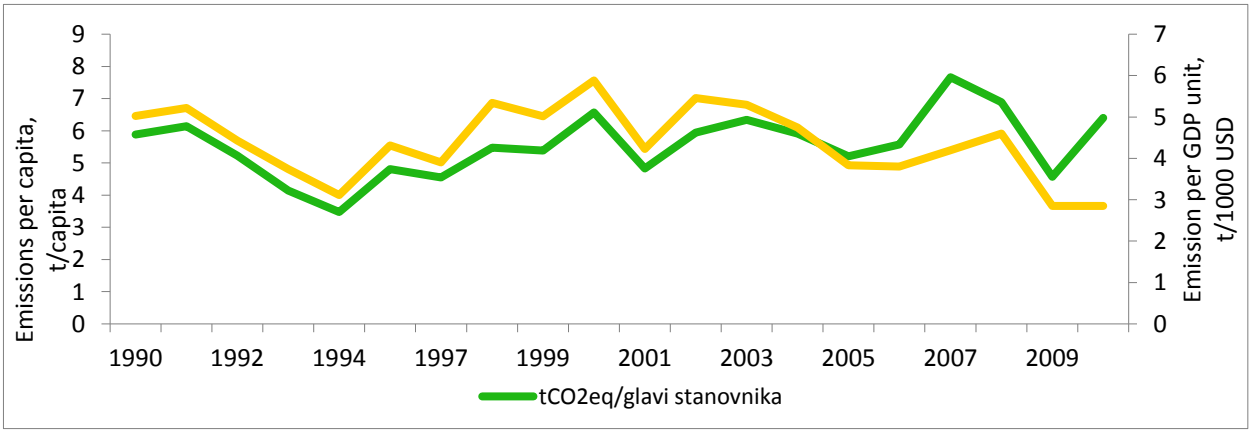
Graph 32. Greenhouse-Gas Emissions 1990-2010

Indicator Evaluation

GHG emissions are monitored based on emissions of certain pollutants and especially those that cause climate change at the global level. This monitoring is based on emissions data from major sources classified by major emitting sectors (IPCC nomenclature) with 1990 as the baseline year, namely: energy (supply and use of energy), transport, industrial (process not including emissions from the fossil fuels combustion process for energy use), agriculture, waste and other (non-energy sectors). In the reporting period, as a clear consequence of the crisis in early 90s of the last century, emissions were reduced by over 50% over a 5-year period.



Graph 33. Greenhouse-Gas Emissions Index, 1990-2010 (1990=100)



Graph 34. The intensity of greenhouse gases, 1990-2010

However, already in 1998 the GHG emissions reached those from the baseline year of 1990. In the period 1998-2008, there was an evident growing trend, as a result of energy consumption in virtually all sectors other than the industry. The last year observed recorded, as a result of the global economic crisis, a new decline in industrial production and consumption of energy which caused the decrease of greenhouse gas emissions to a level lower by 22% than that for the baseline year. Another indicator, the so-called intensity of greenhouse gas emissions, calculates the load of these emissions in relation to the Gross National Income (GDI), i.e. in relation to population. Given the slow growth or stagnation of GDI as well as a relatively stable population, this sub-indicator also showed an upward trend until 2008, and then a significant drop in 2009.

Table 8. The intensity of greenhouse gases, 1990-2010

	1990	2000	2005	2006	2007	2008	2009	2010
Total Emissions (tCO2eq)	3581016	4155624	3263013	3497529	4813706	4333691	2878768	4036743
Population	608816	632606	626739	627074	627962	629185	630435	630435
GDI (constant prices 2000) (million USD)	1005	1 065	1 739	1 970	2 378	2 866	2 911	3 054
tCO2eq/capita	6	7	5	6	8	7	5	6
tCO2eq/ USD 1000	5	6	4	4	4	5	3	3

Source of Data: Environmental Protection Agency (www.epa.org.me)
Detailed description of indicators: www.epa.org.me/nli/kp04
Reference to international indicators: EEA (http://www.eea.europa.eu/data-and-maps/indicators/greenhouse-gas-emission-trends/greenhouse-gas-emission-trends-assessment-4)

AGRICULTURE

Agriculture is one of the strategic sectors, which along with tourism is a top priority of the economic development of Montenegro and has a very high share of 8.3% in the GDP of Montenegro, with about 650,000 inhabitants and good basic characteristics for the development of agriculture, which is reflected in the following: a total of 309,240.7 hectares of land available, and 221,297.6 hectares of cultivated land, well above the available surface area of most European countries, the existence of a tradition of agriculture, as well as the existence of workforce for this activity.

The main objectives of the development of Montenegrin agriculture include: ensuring food security, including the satisfaction of needs of the local population, tourism demand in Montenegro, exports of specific Montenegrin products, increasing the competitiveness of food producers in the domestic and foreign market, balanced regional development of Montenegro, as well as creating better living conditions in rural areas, while respecting the principles of sustainable development, the inclusion of Montenegrin agriculture in regional, European and international integration processes. In addition to the basic prerequisites for the development of agriculture, Montenegro has many advantages that are reflected in the favorable agro-climatic conditions for specific production starting from the cultivation of olive and citrus on the coast, through the cultivation of early vegetables and other intensive crops in the central part (Zeta-Bjelopavlići plain) to animal husbandry in large areas of land in northern mountainous region of the Republic. Preservation of land, water and air from pollution, makes it possible to affirm the organic farming.

According to available data and presented indicators, in Montenegro agriculture has an impact on the environment and to obtain complete information on mutual influence and the state of the environment as seen through indicators it is necessary to conduct further research and gather information for the listed indicators. The Regulation on the national list of indicators includes three indicators, namely: PO1 - Consumption of mineral fertilizers, PO2 - Consumption of plant protection products and PO3 - Area under organic farming.

P01 Consumption of Mineral Fertilizers

Key Question:

Is the use of fertilizers in agriculture going down?

Key Message:

Based on the results obtained, it can be concluded that there has been a significant drop in consumption of fertilizers.
Land is one of the main natural resources without which mankind can not survive. However, land is a limited resource, and the need of modern mankind for arable land is growing.
Fertilizing crops is a necessary measure to be applied to obtain high yields and high-quality products, and is performed before planting and during plant growth. It is necessary to apply a specific type of fertilizer, depending on the results one wants to achieve, whether in terms of growth, yield, quality or disease resistance.
Excessive use of fertilizers can be just as harmful as when it is too little. Using too much fertilizer can lead to so-called “burning", root drying, damage or even death of the plant.

Rating of Trends:

- Compared to the previous year 
- Compared to 2005 

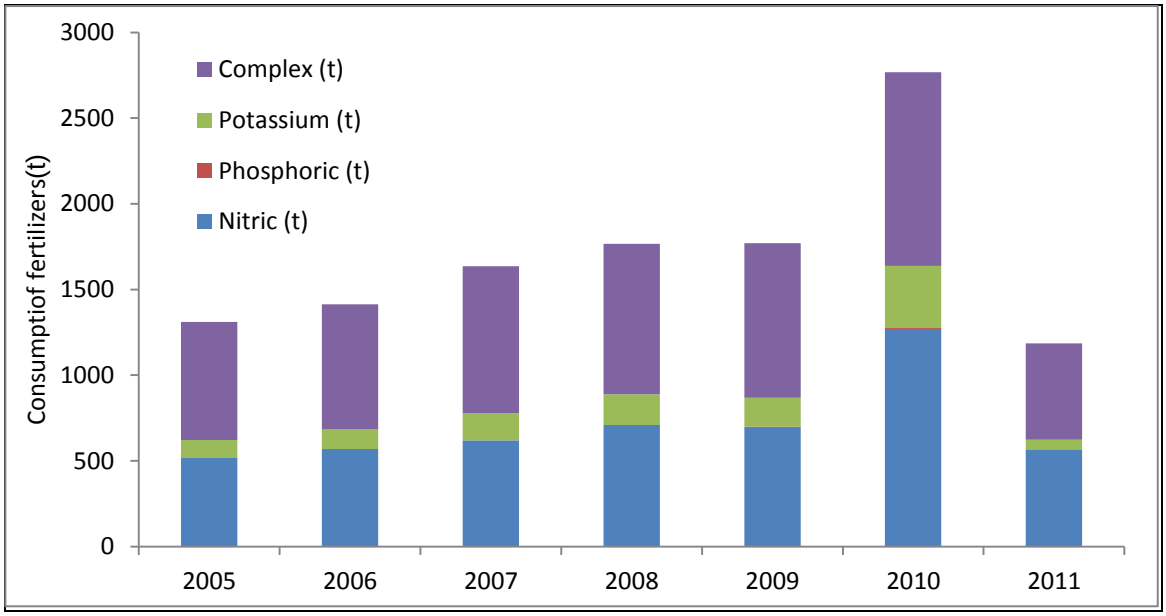
The indicator monitors the extent to which fertilizer is used per hectare of agricultural land. The total amount of used mineral fertilizer includes collective use of fertilizers based on nitrogen (N), phosphorus (P_2O_5) and potassium (K_2O) in agricultural production. Excessive use of fertilizers affects water and land pollution, but also disrupts the natural balance of land microflora.

Impact on Human Health and Ecosystems:

Mineral fertilizers and pesticides deteriorate the quality of soil and pollute groundwater and surface water. They lead to the loss of biodiversity of microorganisms in the soil and reduce the number of bird species. Also, they come into food and drinking water through the food chain.

Reference Legislation:

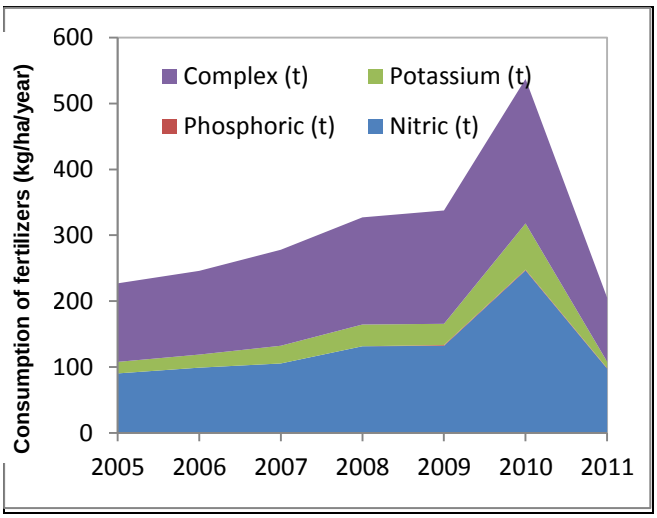
Law on Organic Agriculture (“Official Gazette of Montenegro”, 49/04),
Law on Food Safety (“Official Gazette of Montenegro”, 14/07),
Law on the Protection of Animal Welfare (“Official Gazette of Montenegro”, 14/08),
Law on Environment (“Official Gazette of Montenegro”, 48/08).



Graph 35. Total consumption of mineral fertilizers in Montenegro, 2005-2011

Indicator Evaluation

In the period of 2005-2010, a pronounced upward trend in consumption of mineral fertilizers is clearly visible both in the total sum and per unit area. In the same period the area under arable land was reduced by 11%, which actually made already drastically increased overall consumption of fertilizers even more pronounced when expressed per unit area.



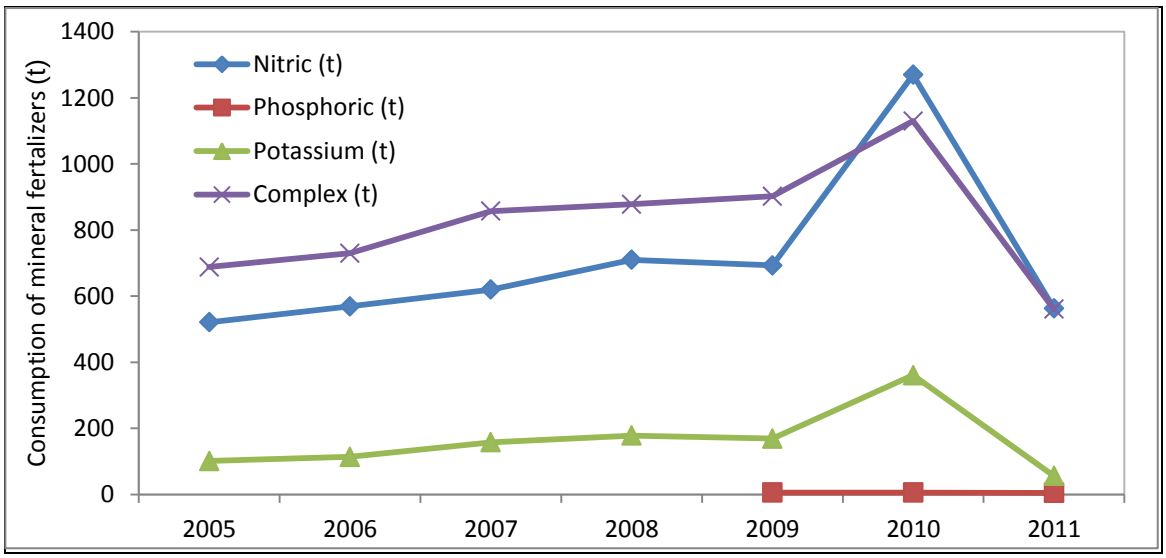
Graph 36. Total and unit consumption of mineral fertilizers per unit area in Montenegro, 2005-2011

The most significant increase occurs in the consumption of fertilizers based on potassium (K_2O), by 3.6 times in the last 5 years, while in the same period, growth in consumption of fertilizers based on nitrogen (N) increased by 2.4 times. A somewhat smaller increase was recorded in complex fertilizers and amounted to 64% for the reference period. Phosphorus fertilizers (P_2O_5) are used very little, a much lesser amount than other types (1 t/ha/year).

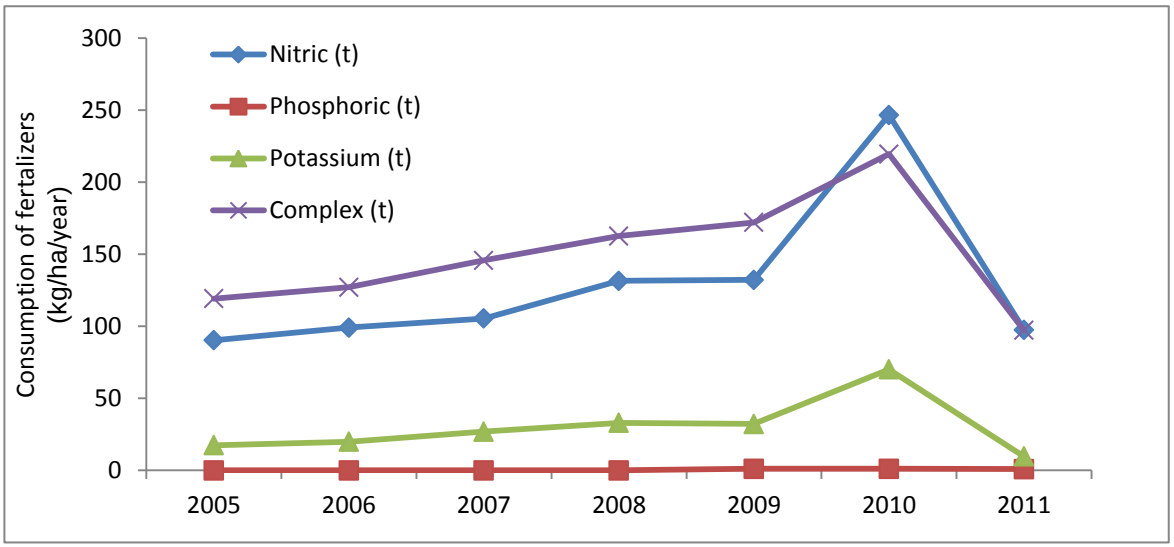
On the basis of the data in Table 9, it can be concluded that there was a certain change, namely: an increase in arable land by 12.155% in 2011 compared to the previous year, while the total consumption of mineral fertilizers in 2011 compared to 2010 was reduced by 57.173%. A significant decrease in consumption of mineral fertilizers can be seen in the consumption of fertilizers based on potassium (K_2O), by 84.48%, while for nitrogen fertilizers it can be conclude that the consumption was reduced by 44.33%.

Table 9. Arable land and consumption of fertilizers in Montenegro, 2005-2011

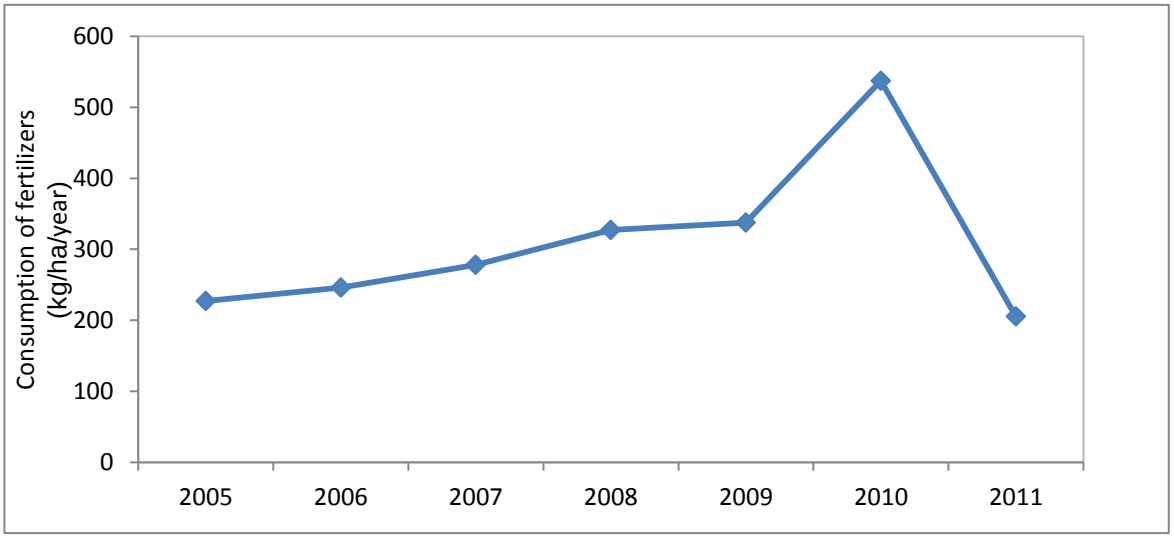
	2005	2006	2007	2008	2009	2010	2011
Arable land (ha)	5772	5746	5883	5399	5243	5150	5776
Total consumption of fertilizers (t)	1310	1413	1635	1766	1769	2767	1185



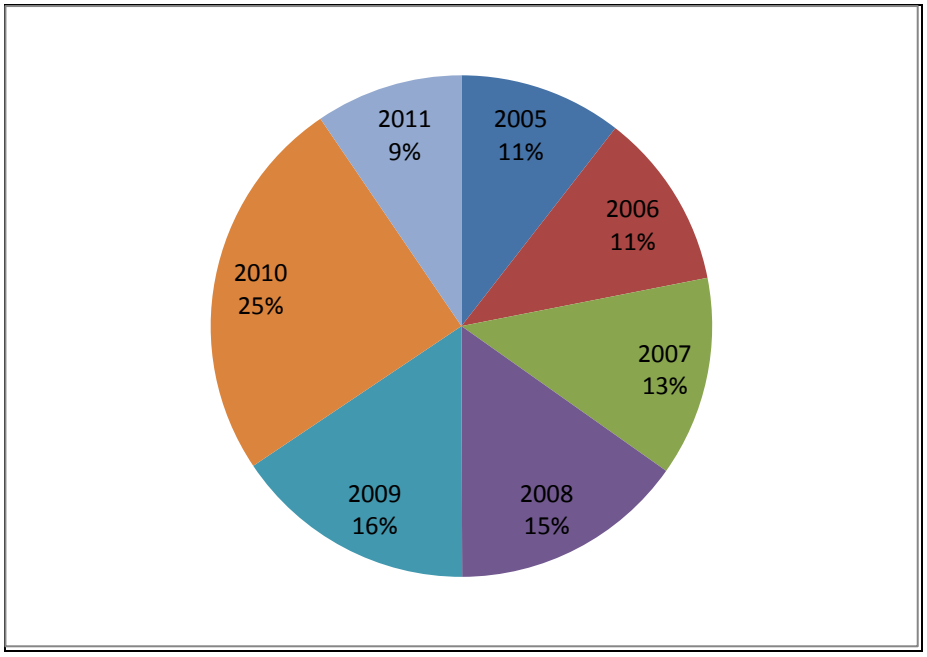
Graph 37. Consumption of mineral fertilizers in Montenegro by type in 2005-2011



Graph 38. Total and unit consumption of mineral fertilizers per surface area unit in Montenegro, 2005-2011



Graph 39. Total consumption of mineral fertilizers per surface area unit in Montenegro, 2005-2011



Graph 40. Total percentage consumption of mineral fertilizers in Montenegro, 2005-2011

Source of data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/p01
Reference to international indicators: EEA – Indicator "Total fertilizer consumption" (www.eea.europa.eu/data-and-maps/indicators/fertilizer-consumption-outlook-from-eea/fertilizer-consumption-outlook-from-eea)

P02 Consumption of Plant Protection Products

Key Question:

Is the consumption of plant protection products decreasing?

Key Message:

There are no reliable data on the consumption of pesticides. The graph shows data indicating possible consumption of pesticides, created on the basis of imported quantities of pesticides, but the fact that those pesticides were purchased does not mean that all of these were used, and as we are informed it is possible that the actual usage was less than stated. Graph 47 shows a percentage overview of the movement of total pesticide usage in the period from 2005 to 2011.

Rating of Trends:

- Compared to the previous year
- Compared to 2005

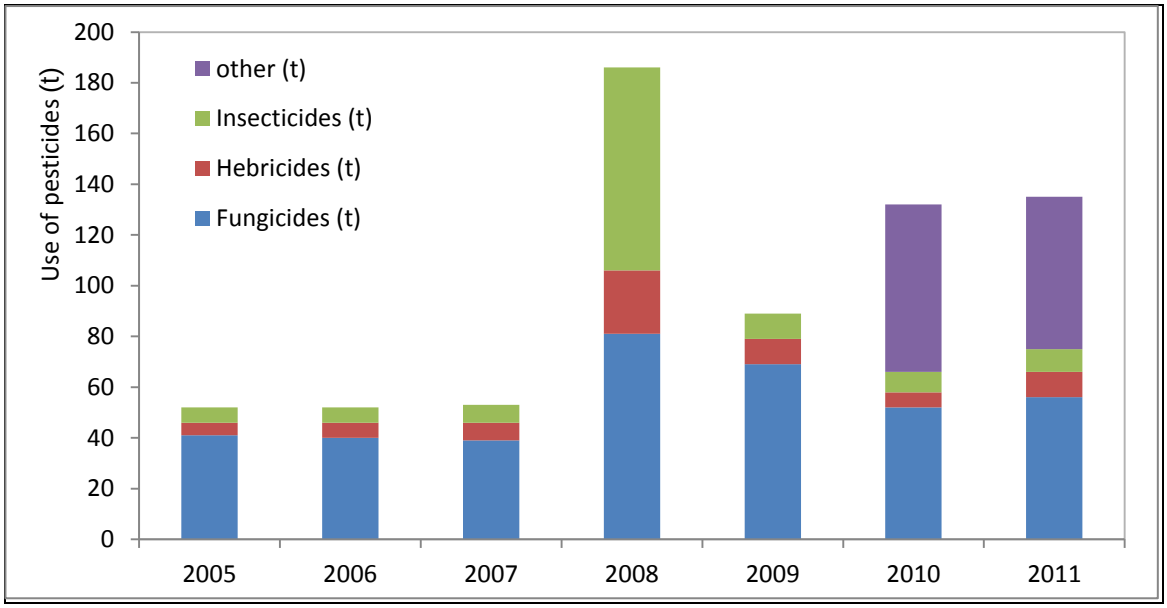
The indicator monitors the extent to which pesticides are used per hectare of agricultural land. The total amount of used pesticides includes the total of pesticides, fungicides, herbicides, insecticides, etc. used in agricultural production.
Using appropriate pesticides and their proper and timely application will result in higher yields, better quality and adequate product safety in terms of human health.

Impact on Human Health and Ecosystems:

Pesticides include products of either chemical or biological origin intended for the protection of economically important plants and animals against weeds, diseases, pests, mites and other harmful organisms. Since pesticides are more or less toxic substances, there is a natural interest for their presence in the environment and the effects on human health and environmental quality.
In particular it should be noted that a waiting period is specified for each product – the allowed number of days from its application to use of fruits, in addition to tolerance - the minimum allowed amount of pesticide residues in plant (mg/kg).
As it has a large impact on human and animal health and the environment, special attention is paid to this area.

Reference Legislation:

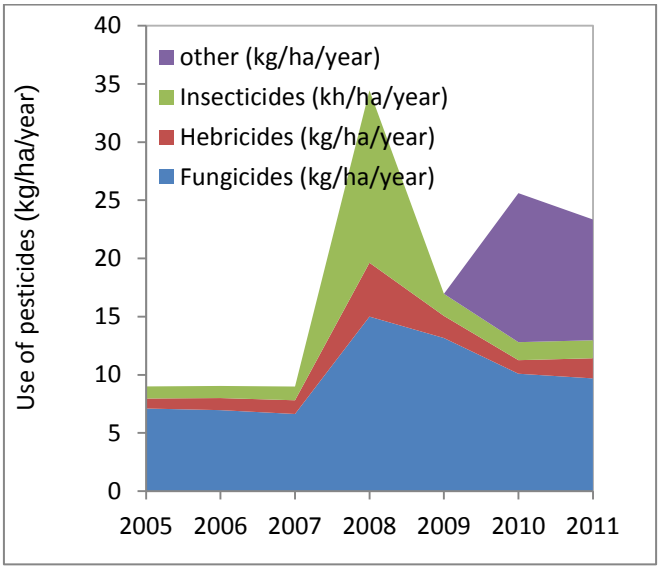
Law on Organic Agriculture (“Official Gazette of Montenegro”, 49/04),
Law on Food Safety (“Official Gazette of Montenegro”, 14/07),
Law on the Protection of Animal Welfare (“Official Gazette of Montenegro”, 14/08),
Law on Environment (“Official Gazette of Montenegro”, 48/08).



Graph 41. Total use of plant protection products in Montenegro, 2005- 2011

Indicator Evaluation

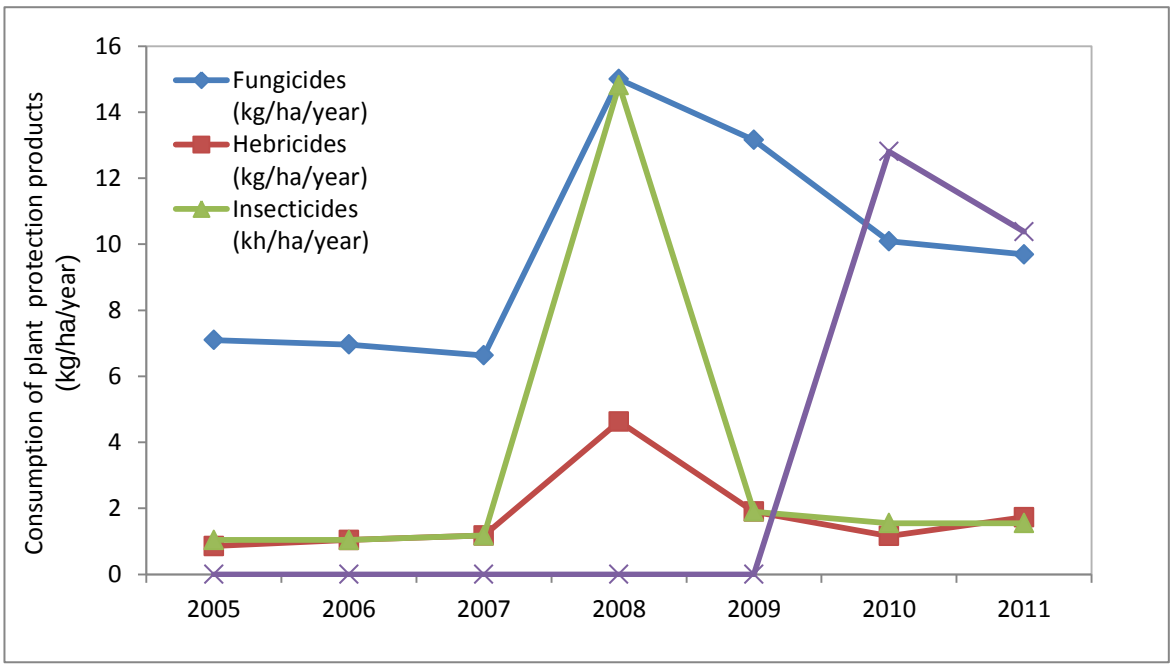
Based on the results shown in Table 10, it can be seen that there was very little increase in the total use of pesticides in 2011, compared to the previous year. And yet, Graph 42 shows that following the chart that represents the use of certain pesticides per unit area, fungicides (kg/ha/year), insecticides (kg/ha/year) and other (kg /ha/year), the use of pesticides per unit area went down, as the surface of arable land increased by 12.15%. As observed, from 2005 to 2011 the surface of arable land tended to be reduced and in 2011 it reached the value recorded in 2005, increased by 4 hectares. The use of plant protection products in the period 2005-2011 varied, and comparing the values for these two years it increased by 161.35%.



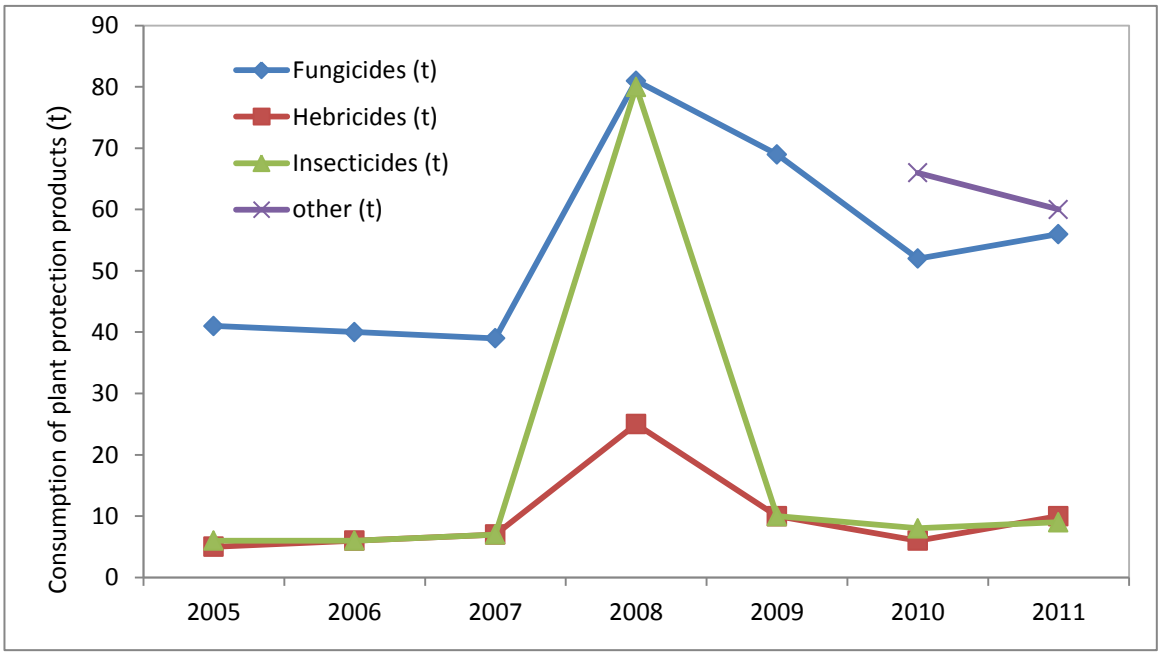
Graph 42. Use of pesticides by type and surface area unit n Montenegro, 2005-2011

Table 10. Arable land and the use of plant protection products in Montenegro, 2005-2011

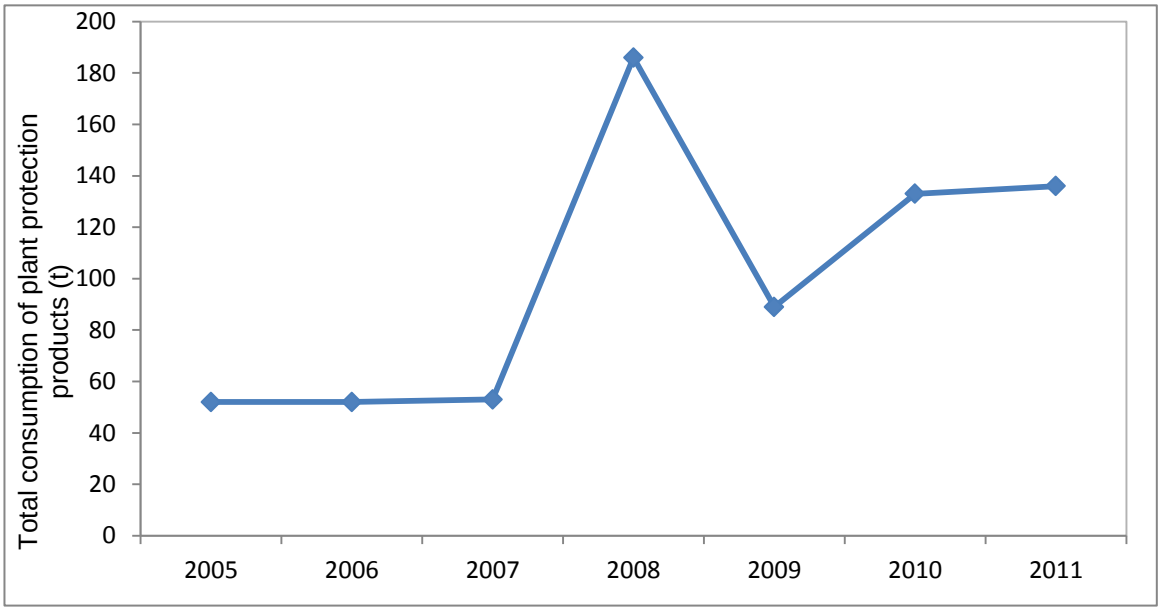
	2005	2006	2007	2008	2009	2010	2011
Arable land (ha)	5772	5746	5883	5399	5243	5150	5776
Total use of plant protection products (t)	52	52	53	186	89	133	136



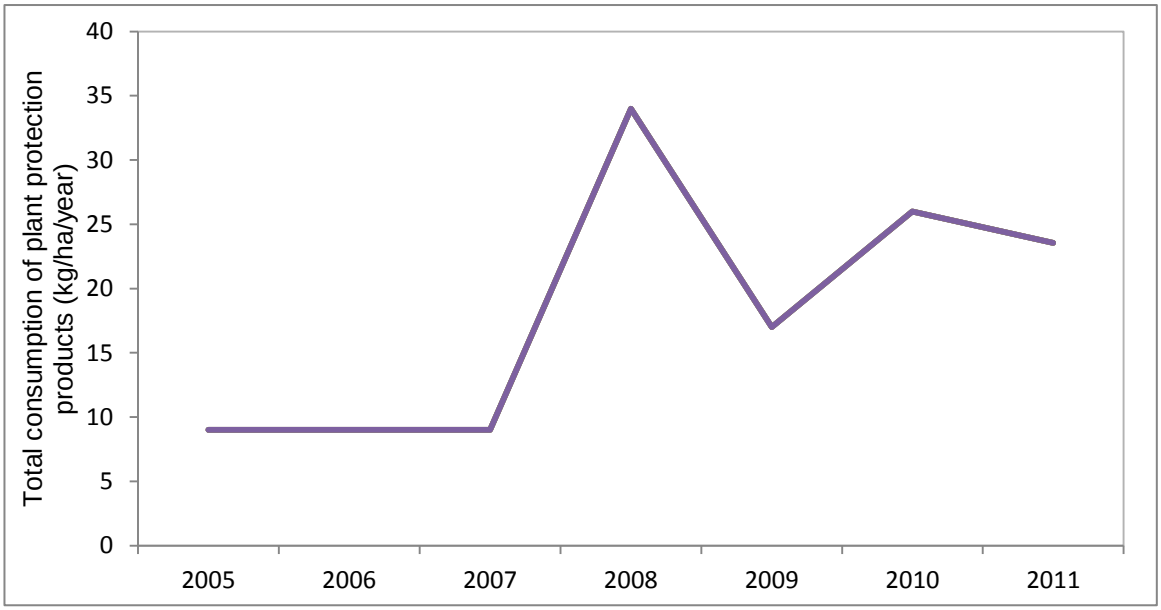
Graph 43. Consumption of plant protection products by type and surface area unit in Montenegro, 2005- 2011



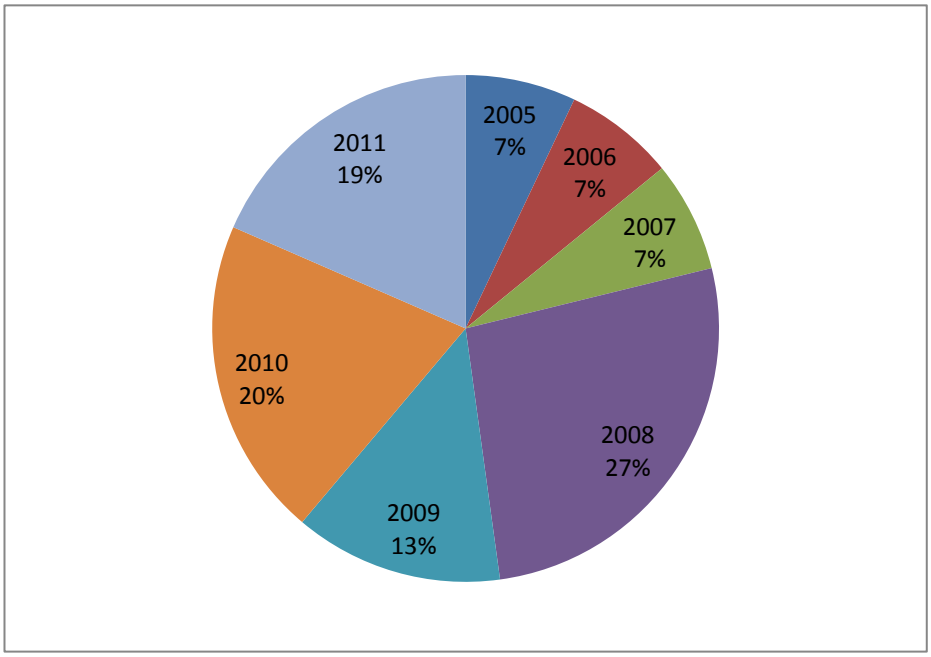
Graph 44. Total consumption of plant protection products in Montenegro by type, 2005- 2011



Graph 45. Total consumption of plant protection products in Montenegro, 2005- 2011



Graph 46. Total consumption of plant protection products by surface area unit n Montenegro, 2005-2011



Graph 47. Percentage overview of total consumption of plant protection products in Montenegro, 2005-2011

Source of data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/p02
Reference to international indicators: /

P03 Area under Organic Farming

Key Question:

Is the area under organic farming increasing?

Key Message:

Surfaces where organic production takes place are negligible compared to the surface of agricultural land where the conventional production is carried out.

Organic production in Montenegro is increasingly popular and economically important, and thanks to the resources that are reflected in the small-scale farms and land that is not contaminated with harmful substances, this kind of agriculture can contribute significantly to the development of rural areas.

Organic production without the use of insecticides, pesticides, fungicides and fertilizers, growth regulators, hormones, antibiotics and genetically modified organisms is the choice of every nation that takes care of their health.

Rating of Trends:

- Compared to the previous year 

The indicator shows trends towards increasing the areas under organic farming and their share in total agricultural production. Organic farming means farming with the best use of soil fertility and water availability, natural properties of plants and animals, allowing for increased yield and plant resistance with the prescribed (and limited) use of fertilizers and pesticides.

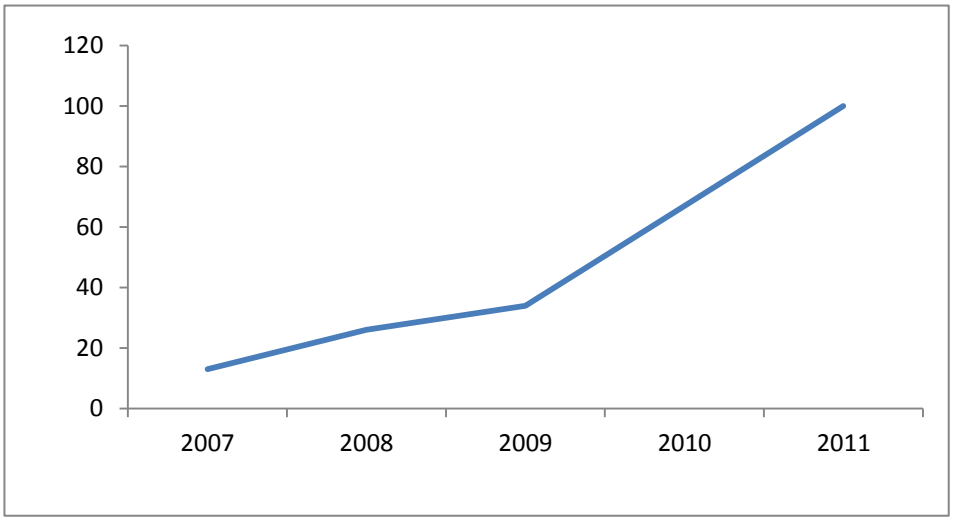
The indicator was prepared on the basis of data on the share of land under organic production and their share in total agricultural production.

Impact on Human Health and Ecosystems:

Organic production is fully controlled production. Organic products are delicious and healthy, of high nutritional value, rich in minerals, especially potassium, iron, and contain higher levels of magnesium, phosphorus and vitamin C. Organic food is free from the presence of any artificial substances, including pesticides, and in addition it makes it possible to consume food products of a higher nutritional value than those from conventional production. Organic food farms do not discharge any pesticides in the environment, do not disturb the flora and fauna and have a lower energy demand for their activity. Also, consumption of organic food is healthier for consumers, thereby reducing the risk of many diseases and potential costs of medical treatment.

Reference Legislation:

Law on Organic Agriculture ("Official Gazette of Montenegro", 49/04),
Law on Food Safety ("Official Gazette of Montenegro", 14/07),
Law on the Protection of Animal Welfare ("Official Gazette of Montenegro", 14/08),
Law on Environment ("Official Gazette of Montenegro", 48/08).



Graph 48. Number of registered producers in Montenegro, 2007-2011

Indicator Evaluation

The organic agriculture development program is a three-year program that started in June 2009. According to the data of the Ministry of Agriculture and Rural Development (MARD) and the Control and Certification Body "Monteorganica" there were 13 registered producers in 2007, 26 in 2008, 34 in 2009, 67 in 2010 and 100 in 2011. In 2011, "Monteorganica" issued 10 certificates (7 for organic production, 3 for production in the interim period in organic agriculture). In 2011, the area under organic farming covered 0.6% of the total agricultural land. In total, 3086.07 hectares of arable land under organic faming was registered.

Table 11. Number of registered organic producers in Montenegro, 2007--2011

	2007	2008	2009	2010	2011
The number of registered organic producers	13	26	34	67	100

Source of data: Ministry of agriculture and rural development (www.minpolj.gov.me) and "Monteorganica" (www.orgcg.org)
Detailed description of indicators: www.epa.org.me/nli/p03
Reference to international indicators: EEA CSI026 (http://www.eea.europa.eu/data-and-maps/indicators/area-under-organic-farming-1/area-under-organic-farming-assessment)

ENERGY

The environment is significantly polluted by the energy sector. In accordance with the Methodology of the European Environment Agency and internationally recognized model (DPSIR model: Driving Forces - Pressures - State - Impact - Responses), energy as a sector belongs to the driving factors, i.e. the basic drivers of negative impacts on the environment (environmental pollution). In Montenegro, the adverse effects mainly come from the Thermal Power Plant Pljevlja that uses coal as fuel.

The economic system and overall quality of life in a country are directly affected by the level of development of the energy sector. Therefore, it is natural to expect that the development of the energy sector is based on better and more efficient utilization of own resources.

The National List of Indicators identified five indicators in the field of energy. This report, according to available data, addresses the following indicators: E01 - Primary energy consumption by fuel, E02 - Final energy consumption by sector and E03 - Energy intensity.

An indicator-based overview allows us exactly to monitor events and trends of various parameters relevant to the assessment of impacts and state of the environment, during a time interval. Thus, the production and consumption of coal as a primary energy source (on which E01 indicator relies) and the production of final energy in the Power Plant Pljevlja have a direct, while its consumption (which is shown by E02 indicator) has an indirect impact on the environmental pollution.

E03 (energy intensity) indicator indicates the ratio of primary energy consumption and economic activity whose analysis is given when the indicator is processed.

E01 Primary Energy Consumption by Fuel

Key Question:

Is the consumption of primary energy going down, thus reducing the load on the environment?

Key Message:

Total primary energy consumption is the amount of energy needed to meet the demand in Montenegro.

It represents the sum of the total energy demand for solid fuels, petroleum products, renewable and other sources.

The indicator monitors the trend of energy consumption by fuel and thus the use of renewable energy, implementation of energy efficiency policy and energy conservation. The structure of primary energy consumption includes coal (42%), petroleum products (30%), and other fuels (28%).

In the period of 2000-2011, there was a decrease in consumption of primary energy (about 21%), with an annual rate of 1.9%. However, during the period of 2002-2004 and 2005-2008, an increase of 21.4% and 17.23%, respectively, was recorded.

The year 2009 was characteristic for reduced energy consumption (coal and electricity).

Rating of Trends:

- Compared to the previous year
- Compared to 2005
- Compared to 2000

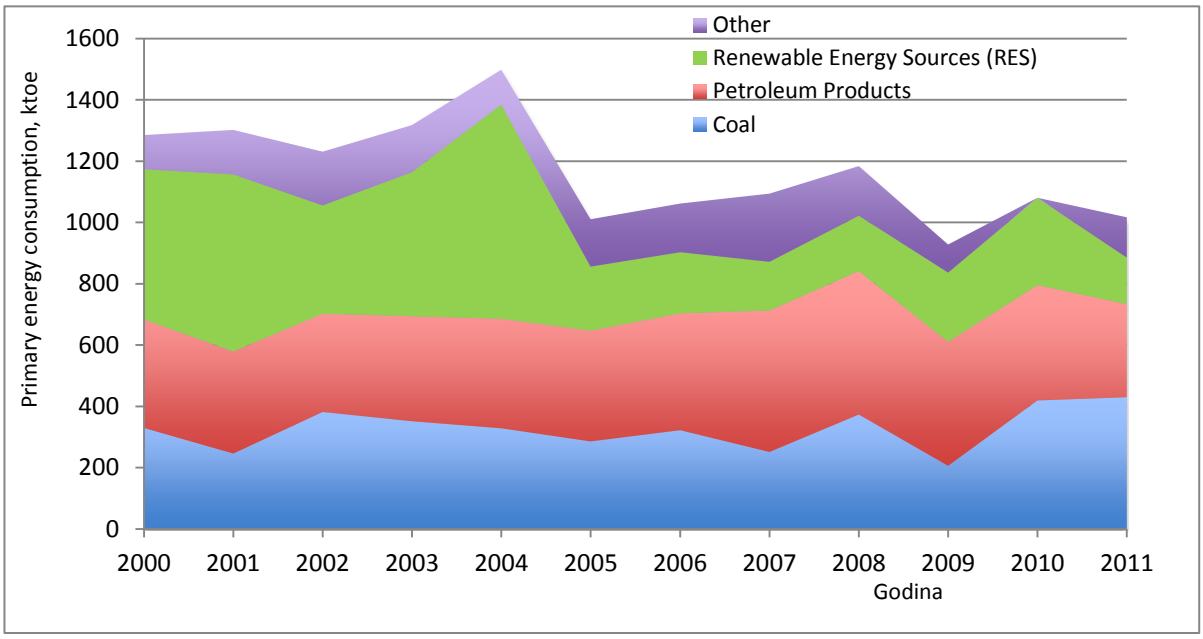
Impact on Human Health and Ecosystems:

Energy consumption requires energy generation, which is closely associated with the emission of pollutants and greenhouse gases into the atmosphere. GHG emissions have a negative effect on climate change and the increasing occurrence of extreme meteorological phenomena - droughts, floods and waves of extreme temperatures. Generation of electrical and thermal energy is also followed by air pollution, which results in higher incidence of respiratory problems and allergies, asthma and reduced immunity.

By combustion, the chemical energy of fuels is transformed into internal thermal energy, and flue gases of varying composition are released into the atmosphere [carbon monoxide (CO), carbon dioxide (CO_2), water vapor (H_2O), sulfur dioxide (SO_2), nitrogen oxides (NOx) and hydrocarbons (CmHn)]. The very amount and composition of the resulting specific emissions of combustion products depend on the physical and chemical properties of fuels (e.g. share of combustible sulfur, moisture content), the type of equipment, size and mode of operation of the electricity generation plant (steam, gas, combined, condensing power plants, thermal power plants-heating plants and industrial power plants, etc.), as well as the potential impact (aesthetic and visual pollution, operational reliability and risks of accidents, the load of radioactive radiation, thermal pollution, solid and liquid waste, occupancy and change of use of space, etc.).

Reference Legislation:

Law on Environment, the Law on Official Statistics and the System of Official statistics, Energy Law, Law on Energy Efficiency, Strategy on Energy Efficiency, Energy Development Strategy of Montenegro until 2025, Energy Policy of Montenegro until 2030, Law on Ratification of the Agreement between the European Community and Montenegro on the Establishment of the Energy Community.



Graph 49. Primary energy consumption by sector in Montenegro, 2000-2011

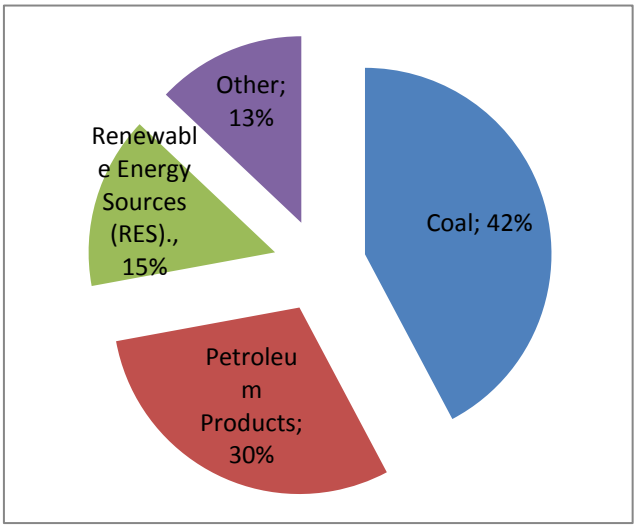
Indicator Evaluation

Previous decade is characterized by variable trend of primary energy consumption: 2000 - 1285 kilo tonnes, 2004 - 1495 kilo tonnes, 2008 - 1184 kilo tonnes, 2010 - 1081 kilo tonnes, 2011 - 1017 kilo tonnes.

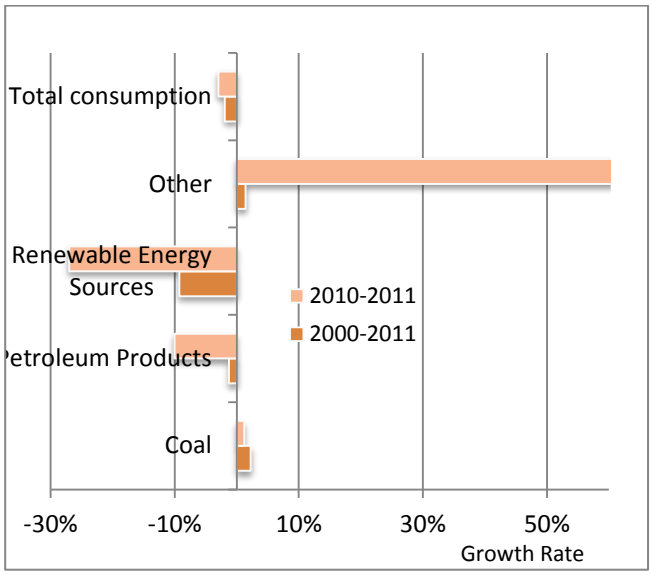
The structure of consumption in 2011 is dominated by fossil fuels, 72% (coal - 42%, oil products - 30%) while the share of renewable energy is 15%.

In comparison to 2000, the consumption of coal and electricity is increasing while the consumption of oil and renewable energy is decreasing. The same "growth" trend is also recorded compared to 2010.

Ultimately, the consumption of renewable energy is reduced compared to the initial decades (until 2004), which is a negative response to the implementation of the energy policy and environmental protection.



Graph 50. The structure of primary energy consumption by energy generating products in 2011



Graph 51. Average annual growth rate for various energy generating products (%)

Incomparably high annual growth rate of consumption of "other" energy generating products (electricity) 2010-2011 (2903.2%) is explained by the fact that there was no electricity deficit at all in 2010. Specifically, 2010 was a very rainy year, and the planned hydroelectric power generation was exceeded by the power plants.

Renewable energy sources have a significant negative growth rate of 27% for the reasons already explained.

In the primary consumption, the share of electricity occurs in the form of difference between the import and export of electricity. The core power consumption is, in fact, its final consumption.

Source of Data: Ministry of Economy (www.minekon.gov.me)
Detailed description of indicators: www.epa.org.me/nli/e01
Reference to international indicators: http://www.eea.europa.eu/data-and-maps/indicators/primary-energy-consumption-by-fuel/primary-energy-consumption-by-fuel-7

E02 Final Energy Consumption by Sector

Key Question:

Is the consumption of final energy going down, thus reducing the environmental load?

Key Message:

The indicator monitors progress in reducing energy consumption by sector (energy consumed by end users) through the implementation of energy efficiency policy and energy conservation. In this period (2000-2011) there was an increase of final energy consumption by only 1%, and if in the same period the consumption in industry decreased by 30%, and in the service sector and households increased by 54% and 25%, respectively, until 2007 the total final energy consumption was increasing and then decreasing.

Rating of Trends:

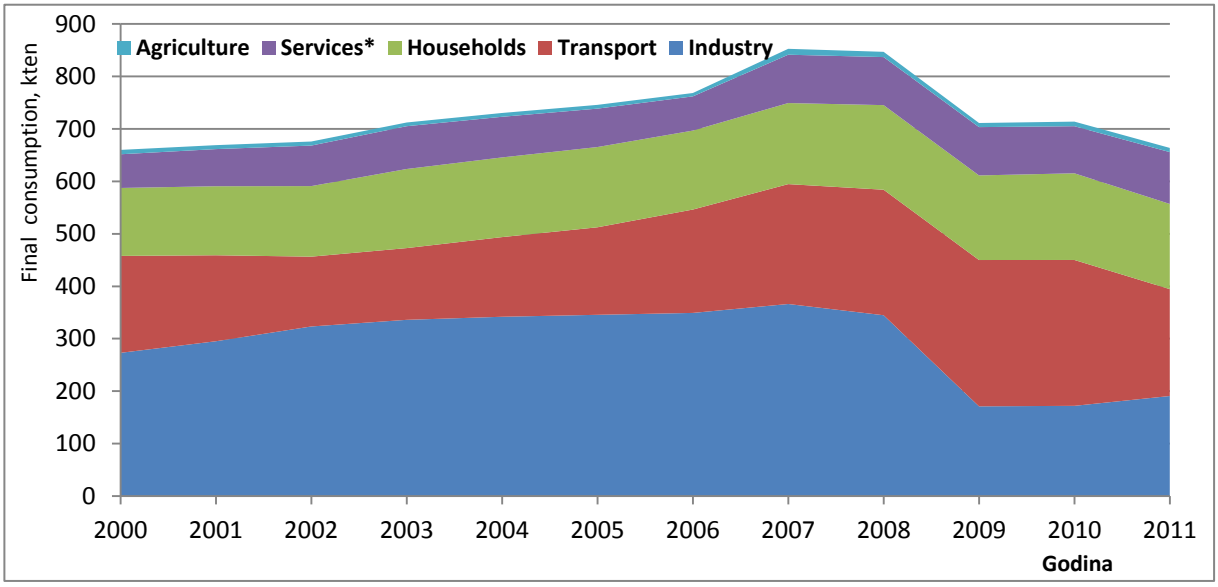
- Compared to the previous year 
- Compared to 2005 
- Compared to 2000 

Impact on Human Health and Ecosystems:

Energy consumption requires energy generation which is closely associated with the emission of pollutants and greenhouse gases into the atmosphere. GHG emissions have a negative effect on climate change and increased occurrence of extreme meteorological phenomena - droughts, floods and waves of extreme temperatures. Generation of electrical and thermal energy is also followed by air pollution, which results in higher incidence of respiratory problems and allergies, asthma and reduced immunity.

Reference Legislation:

Law on Environment, Law on Official Statistics and the System of Official statistics, Energy Law, Law on Energy Efficiency, Strategy on Energy Efficiency, Energy Development Strategy of Montenegro until 2025, Energy Policy of Montenegro until 2030, Law on Ratification of the Agreement between the European Community and Montenegro on the Establishment of the Energy Community.



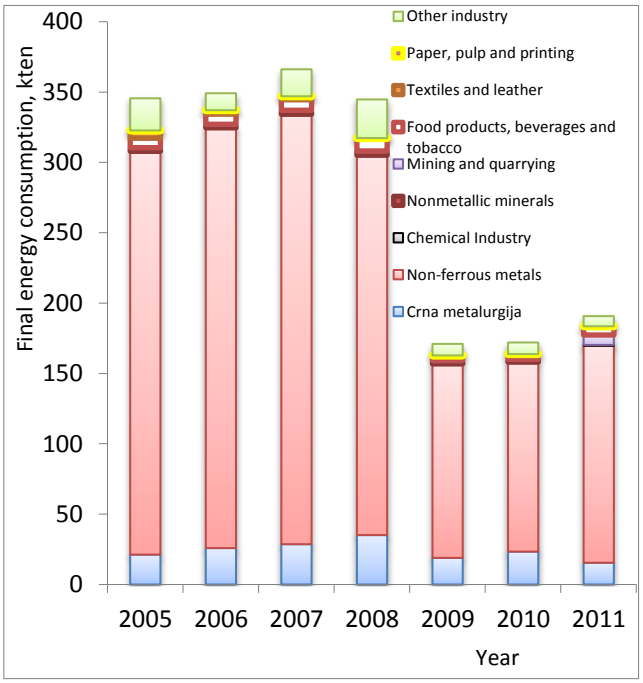
Graph 52. Final energy consumption by sector in Montenegro, 2000-2011

(The service sector from 2005 to 2010 includes trade, public administration, and before 2005 services and construction industry)*

Indicator Evaluation

In the reporting period, from 2000 to 2012, there was a slight increase in final energy consumption, with an annual growth rate of 0.05% for the reference period. However, in the period 2007-2010, consumption actually declined by as much as 16% during this period. The largest contribution to this decline resulted from the decrease in final energy consumption in the industrial sector by as much as 53% for a period of three years. So that in spite of the consumption increase in the transport sector (22% in the same period), the total final energy consumption continued to stagnate.

Within the energy sector, the bearer of final energy consumption was the non-ferrous metal industry, whose share in the total industrial consumption did not fall below 70% in the period 2005-2011. So it can be concluded that in fact only a drop in production in the nonferrous metal industry (46% in the period 2005-2011) generated a total decrease of final energy consumption at the level of Montenegro.



Grafik 53. Potrošnja finalne energije po industrijskim granama u Crnoj Gori u kten, 2005-2011

Similarly, given the marginal change in the population of Montenegro in the same period, the total final energy consumption per capita had an identical trend. For the whole period of data availability it was increasing by about 3%, and yet, however, for the past four years it actually decreased by 20% with the trend of stagnation.

Table 12. Total final energy consumption per capita

	2000	2005	2006	2007	2008	2009	2010	2011
Total final energy consumption	660	746	768	853	847	711	714	664
Population	63266	626739	627074	627962	629185	630435	625266	620029
Energy consu-mption per capita	1.04	1.19	1.23	1.36	1.35	1.13	1.14	1.07

Source of Data: Ministry of Economy (www.minekon.gov.me)
Detailed description of indicators: www.epa.org.me/nli/e02
Reference to international indicators: http://www.eea.europa.eu/data-and-maps/indicators/final-energy-consumption-by-sector-2/final-energy-consumption-by-sector-7

E03 Energy Intensity

Key Question:

Is economic growth accompanied by the growth of energy consumption?

Key Message:

Energy intensity is a measure of the total energy consumption in relation to economic activity. It is calculated as the ratio between the total primary energy consumption and gross domestic product (GDP).

The indicator identifies the extent to which the separation between energy consumption and economic growth takes place.

In the reporting period, 2000-2011, the total primary energy consumption was reduced by about 21% (with an average annual rate of 1.9%), while the gross domestic product increased threefold. This means that economic growth is accompanied by reduction of energy use. Thus, there is an absolute separation.

Rating of Trends:

- Compared to the previous year 
- Compared to 2005 
- Compared to 2000 

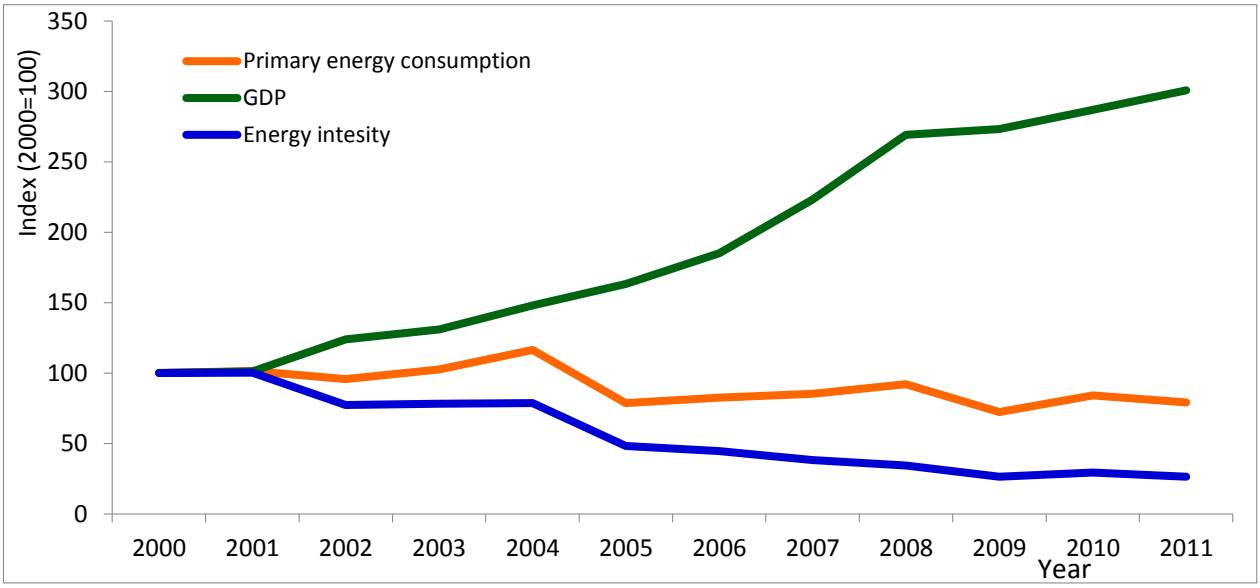
A slight decrease in consumption of primary energy is a result of reduced volume of economic activity. The GDP has a rising trend. As a result of the functional dependence of the two above-mentioned parameters, this indicator shows a declining trend. This means that economic growth was accompanied by reduction of energy use, with the total energy consumption on the decline. It should be noted that in Montenegro about 1.64 tonnes of oil equivalent per capita (in 2011) is used, which is far below the EU-27 average, which is 3.6 tonnes of oil equivalent per capita. The world average is 8.1 tonnes/capita.

Impact on Human Health and Ecosystems:

Energy consumption requires energy generation, which is closely associated with the emission of pollutants and greenhouse gases into the atmosphere. GHG emissions have a negative effect on climate change and the increasing occurrence of extreme meteorological phenomena - droughts, floods and waves of extreme temperatures. Electrical and thermal energy generation is also followed by air pollution, which results in higher incidence of respiratory problems and allergies, asthma and reduced immunity

Reference Legislation:

Law on Environment, Law on Official Statistics and the System of Official statistics, Energy Law, Law on Energy Efficiency, Strategy on Energy Efficiency, Energy Development Strategy of Montenegro until 2025, Energy Policy of Montenegro until 2030, Law on Ratification of the Agreement between the European Community and Montenegro on the Establishment of the Energy Community.



Graph 54. Energy intensity in Montenegro, 2000-2011

Indicator Evaluation

There was an obvious continuous shift of the energy intensity trend from 2000 to 2011. Basically it was a trend of decreasing energy intensity (a slight increase compared to the previous year was recorded in 2003, 2004 and 2010).
An expressed separation of energy consumption and gross domestic product has happened since 2004.
A decline in overall primary consumption and hence the energy intensity is the result of reduction of total industrial production. Accordingly, it is pointless to look for the recorded trend in increasing energy efficiency. The GDP growth is a result of the service industry function.
One of the major problems in energy consumption is that over 71% of energy consumption takes place in activities that are not productive, but energy is consumed by public utilities and service companies, agriculture and households. From the standpoint of environmental protection, the impact of energy depends on the total energy consumption, but also the type of energy generating products and the technology used to produce energy.

Table 13. Energy intensity in Montenegro, 2000-2011

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Primary energy consumption (kt)	1285	1302	1231	1316	1495	1010	1062	1095	1184	928	1081	1017
Gross Domestic Product (mil €)	1065	1077	1320	1394	1577	1740	1970	2378	2866	2911	3054	3204
Energy Intensity (kt/mil€)	1.2	1.2	0 9	0.9	0.9	0.6	0.5	0.5	0.4	0.3	0.4	0.3
INDEX 2000=100												
Primary energy consumption	100	101	96	102	116	79	83	85	2	7	84	79
Gross Domestic Product	100	101	2	1	148	163	185	223	269	273	287	301
Energy Intensity	100	100	77	78	79	48	45	38	34	26	29	26

Source of Data: Ministry of Economy (www.minekon.gov.me)
Detailed description of indicators: www.epa.org.me/nli/e03
Reference to international indicators: http://www.eea.europa.eu/data-and-maps/indicators/total-primary-energy-intensity/total-primary-energy-intensity-assessment-7

Tourism affects the quality of the environment as a consumer of natural and other resources: land, water, fuel, electricity, food, but also as a producer of significant quantities of wastes and emissions.

The positive effects of tourism in relation to the environment are reflected in the fact that this is an activity that tends to adequately use the natural resources, improve the landscape and maintain the ecological, economic and socio-cultural values of the local community.

Negative impacts of tourism on the environment are expressed through the pressure on natural resources, flora and fauna and habitats, as well as generation of waste and pollution.

The National List of indicators identified five indicators in the field of tourism. These are: T01 - Tourist arrivals, T02 - Overnight stays, T03 - Tourism Intensity, T04 - The number of tourists on cruise lines, T05 - The number of visitors to national parks.

The report deals with indicators T01 - Tourist arrivals, T02 - Overnight stays, T04 - The number of tourists on cruise lines, according to available data. The indicators show the density of tourist traffic and thus the pressure on the environment in the tourist areas.

T01 Tourist Arrivals

Key Question:

Is the number of tourist arrivals increasing, thereby putting pressure on the environment?

Key Message:

The indicator monitors the trend of tourist arrivals (foreign and domestic) in total and by country of origin, according to the type of tourist sites. In the period 2000-2012, Montenegro recorded virtually a permanent growth in the total number of tourists and, it can be said, the number of domestic tourist arrivals was unchanged, with a share in the total number of arrivals of 12% in 2012. The annual growth rate of total tourist arrivals is around 9% and foreign tourists about 24%.

Such a significant increase was mainly due to the fact that Montenegro gained independence in 2006, so it is realistic to analyze the period of 2007-2012 when the number of foreign tourist arrivals increased by about 4%.

Rating of Trends:

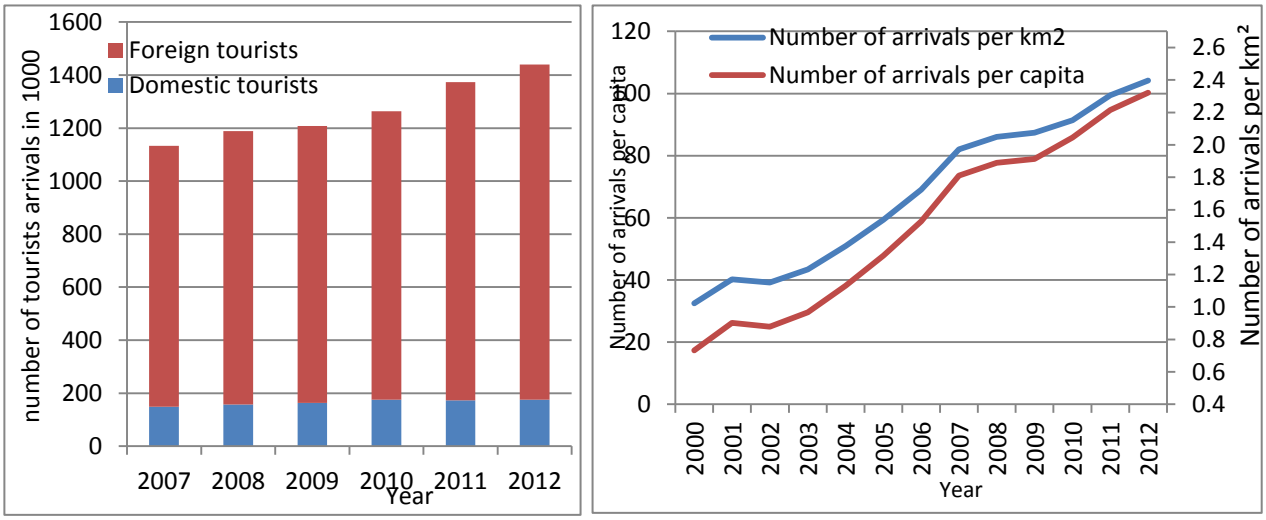
- Compared to the previous year
- Compared to 2005
- Compared to 2000

Impact on Human Health and Ecosystems:

Tourism affects the quality of the environment as a consumer of natural and other resources: land, water, fuel, electricity and food, but also as a producer of significant quantities of wastes and emissions. Negative impacts of tourism on the environment are expressed through the pressure on natural resources, flora and fauna and habitats, as well as generation of waste and pollution. The protected areas are also threatened, given that a large number of tourists chose exactly such places for rest and recreation.

Reference Legislation:

Law on Environment,
Law on Official Statistics and the System of Official statistics,
Tourism Law.



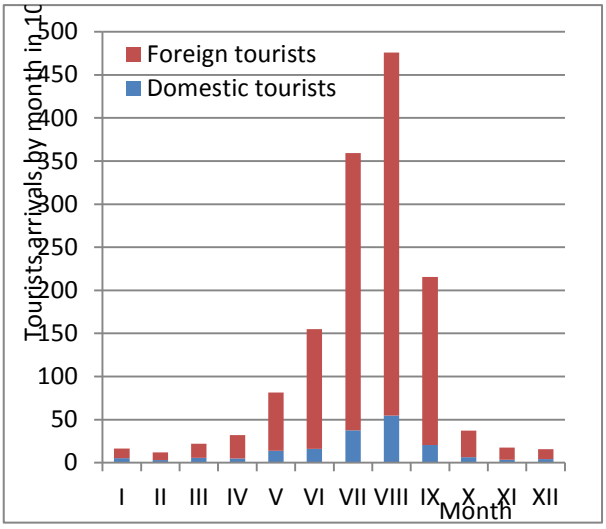
Graph 55. Number of arrivals of domestic and foreign tourists (left) and the total number of tourist arrivals per km² and per capita (right)

Indicator Evaluation

Data available for the period 2000-2012 show an overall increase in tourist arrivals at an annual rate of 9% with the trend of steady increase. The share of domestic and foreign tourists in the total number was stable at around 13% and 87% respectively.

The share of coastal towns as the dominant location for tourist arrivals amounted to 90.4% in the 2012, or 87-91% since 2000, which means that the pressure caused by the development of tourism is significantly higher on the coast.

When analyzing the distribution of arrivals per month on an annual basis (Graph 56, 2012.), a paraboloid distribution of arrivals is evident, where the top of the parabola is August. Accordingly, in August 2012 33% of the total number of arrivals in that year took place. Furthermore, the number of tourist arrivals is significant in July, September and June.



Graph 56. Tourist arrivals by month, 2012

In the winter months (December, January, February and March) 4.58% of the total number of arrivals in 2012 was registered, indicating that winter tourism is still underdeveloped.

Table 14. Tourist arrivals (in 1000) to Montenegro by type of tourist sites, 2000-2012

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Capital City	26	22	24	22	25	30	39	46	50	49	54	53	53
Coastal towns	376	438	476	542	640	748	860	1011	1059	1082	1131	1245	1301
Mountain sites	20	19	19	18	19	19	26	39	38	41	49	49	53
Other tourist sites	25	26	22	17	20	24	28	38	40	35	28	25	31
Other places	1	0	0	0	0	0	0	0	0	1	1	1	2
Share of coastal towns (%)	84	87	88	90	91	91	90	89	89	90	90	91	90
Total tourists	**448**	**505**	**542**	**599**	**703**	**820**	**954**	**1133**	**1188**	**1208**	**1263**	**1373**	**1440**

Source of Data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/t01
Reference to international indicators: EEA
(http://europa.eu.int/comm/enterprise/services/tourism/tourismeu.htm)

T02 Overnight Stays of Tourists

Key Question:

Is the density of tourist traffic increases, thus putting pressure on the environment?

Key Message:

The indicator monitors the trend of overnight stays of tourists (domestic and foreign), in total and by country of origin, according to the type of tourist sites and the type of accommodation facilities. In the period of 2000-2012, Montenegro recorded virtually permanent increase in the total number of overnight stays of tourists, and it can be said, uniform rates of domestic tourists whose share in the total number of overnight stays was very small (11% in 2012), and an annual growth rate of foreign tourists of about 25%. Such a significant increase is related primarily to the fact that in 2006 Montenegro gained independence and it is actually more realistic to consider the period of 2007-2011 in which the number of foreign tourists increased by approximately 26%.

Rating of Trends:

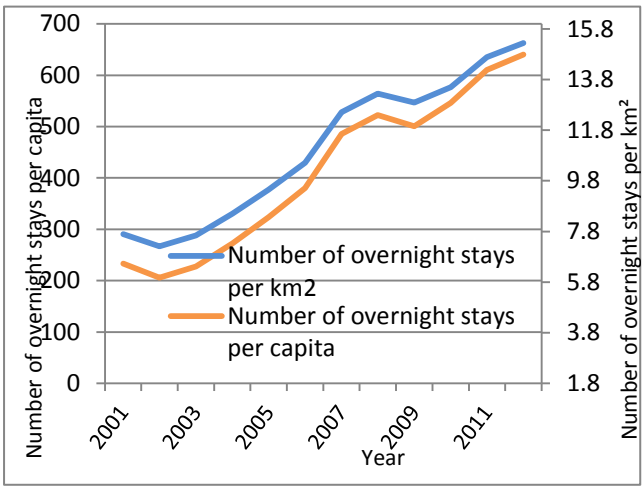
- Compared to the previous year
- Compared to 2005
- Compared to 2000

Impact on Human Health and Ecosystems:

The number of tourist overnight stays has a direct impact on both the environment and the gross national income of Montenegro. The impact on the environment is multiple, expressed through higher water abstraction, generation of wastewater and solid waste, and increased emissions due to the high intensity of traffic. Also the protected areas are at risk, given that a large number of tourists chose exactly such places for rest and recreation. On the other hand, a higher number of overnight stays leads to an increase in GDP, and thus enables significant investment in protecting the environment and natural resources.

Reference Legislation:

Law on Environment,
Law on Official Statistics and the System of Official statistics,
Tourism Law.



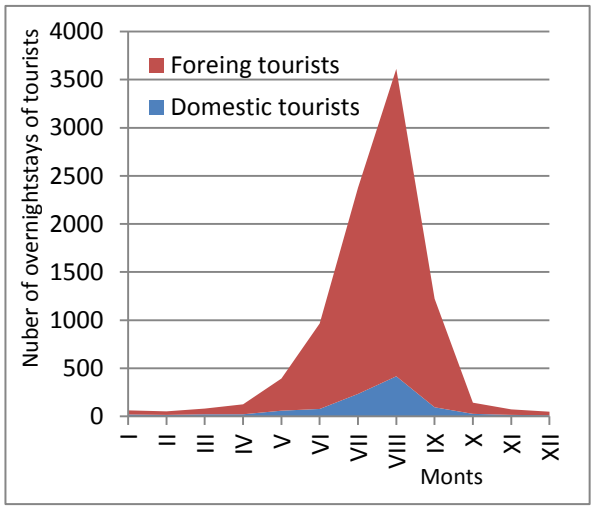
Graph 57. Number of overnight stays of domestic and foreign tourists (left) and number of overnight stays by km2 and per capita (right)

Indicator Evaluation

Data available for the period 2000-2012 show an overall increase in the number of tourists at an annual rate of 8% with the trend of constant increase, which naturally leads to an increase in the number of overnight stays per capita and territory surface unit. The share of foreign tourists is actually stable at around 89%.

The share of coastal towns as the dominant location for overnight stays of tourists was as much as 97% in 2012, which actually makes the pressure that comes from tourism activities significantly higher on the coast.

Attention should also be paid to the significant change of chosen types of accommodation in the total number of overnight stays, so in 2000 hotel accommodation provided nearly 60% of accommodation facilities while private accommodation accounted for 16% and tourist resorts for 18%



Graph 58. Distribution of overnight stays by month, 2012

In contrast, in 2012 hotel accommodation made up 25% while tourist resorts had a practically negligible contribution. Even 65.3% of tourist overnight stays are realized in private accommodation. This change of type of accommodation, as well as a huge time imbalance of overnight stays in seasonal terms place additional pressure on the environment, requiring the construction of infrastructure facilities (water, sewage, etc.) that would ensure the sustainability of further development of tourism in Montenegro.

Table 15. Overnight stays (in 1000) for the selected types of accommodation in Montenegro, 2000-2012

Facilities	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Hotels	1459	1674	1571	1472	1746	1825	1989	2337	2306	1870	2074	2213	2290
Tourist resorts	455	454	494	507	592	590	546	588	547	437	440	423	409
Spa	143	176	185	194	201	200	214	209	199	177	189	202	184
Private accommodation	402	925	682	1088	1401	1878	2687	3578	3924	4644	4950	5605	5978

Source of Data: The Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/t02
Reference to international indicators: EEA (http://www.eea.europa.eu/data-and-maps/indicators/#b_start=0&c5=tourism)

T04 The Number of Tourists on Cruise Lines

Key Question:

Is the number of tourists on cruise lines increasing thus putting pressure on the environment?

Key Message:

The indicator tracks the number of cruise trips generated in the territorial waters of Montenegro, as well as the number of travelers who visited Montenegro. A cruise is a tourist journey lasting for several days according to a specific, elaborated plan of cruises. The number of passengers on board is the number of passengers not including crew members.

A cruise passenger is any person who arrived by ship, regardless of age, and is not a member of the crew.

It is very demanding to organize the reception of tourists and the infrastructure necessary for the reception, so it is necessary to define the direction of the development of this type of tourism, and limitations of concrete measures in order to avoid negative impacts on the environment and local residents.

Rating of Trends:

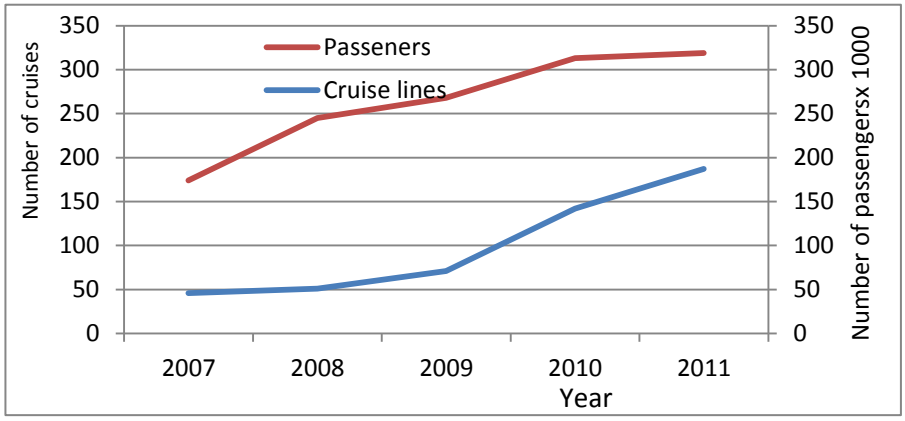
- Compared to the previous year 
- Compared to 2005 

Impact on Human Health and Ecosystems:

The number of tourist overnight stays has a direct impact on both the environment and the gross national income of Montenegro. The impact on the environment is multiple, needs greater water abstraction, generation of wastewater and solid waste, and increased emissions due to the high intensity of traffic. Also at risk are protected areas, given that a large number of tourists just chosen this place for rest and recreation. On the other hand, increased rates leads to an increase in GDP, and thus enables significant investment in environmental protection and natural resources.

Reference Legislation:

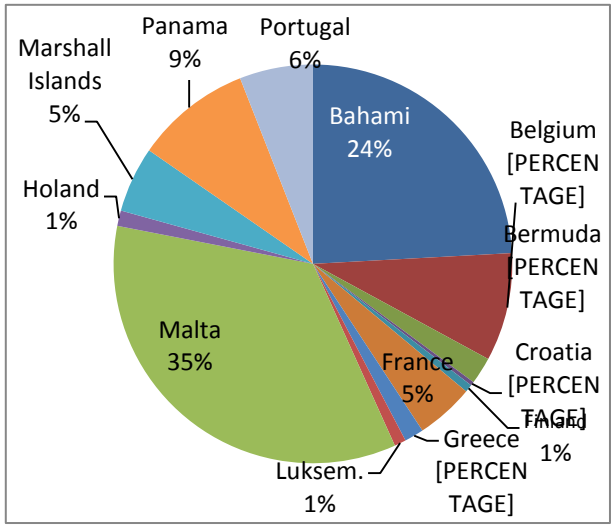
Law on Environment,
Law on Official Statistics and the System of Official statistics,
Tourism Law.



Graph 59. The trend of international cruise lines, 2007-2011

Indicator Evaluation

Data available for the period 2007-2011 show the overall increase of tourists on cruises. The number of trips also had a slight growth trend.
In 2011 there were 319 international cruise lines in Montenegro with 187,171 passengers.
In comparison to 2010, the number of cruises increased by 1.9%, while the number of passengers on these cruises increased by 31.6%.
According to the flag that they flied, the structure of ships that sailed into the territorial waters of Montenegro in 2011 was as follows: Malta (34.8%), Bahamas (24.1%), Panama (9.4%), Belgium (8.8%), Portugal (6.0%), Marshall Islands (5.3 %), France (4.7%), Bermuda (2.2%), Greece (1.6%) and others.



Graph 60. The structure of ships on cruise trips, 2011

Table 16. International cruise lines in the territorial waters of Montenegro, 2011

Ship's Flag State	Voyages	Passenges	Structure
Bahamas	77	40614	24
Belgium	28	4180	9
Bermuda	7	8109	2
Croatia	1	20	0
Finland	2	658	1
France	15	3235	5
Greece	5	189	2
Luxembourg	3	379	1
Malta	111	56736	35
Holland	4	4594	1
Marshall Islands	17	10215	5
Panama	30	52586	9
Portugal	19	5656	6
Total	**319**	**187171**	**1**

Source of Data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/t04
Reference to international indicators: /

TRANSPORT

Transport is a very important factor in the overall economic and social development. For transport significance, the quality of life and overall economic development occupy a dominant position.

Therefore, one should strive for a good, efficient and cheap transport which, as such, affects the reduction of production costs. The transport system has to reach a level of development in order to have a positive influence on economic development. The current state of the system is a consequence of the economic decline in the period 1990-2000, and also the global economic crisis in recent years. Therefore, transport has to be focused on the quality of life and preserving the environment.

The volume and composition of passenger transport is an important indicator of the effects of the transportation system because it shows how much and how the inhabitants of a country or city travel. Tracking the number of passengers and passenger kilometers (PKM) in road and rail transport is very important for analyzing the impact of transport on the environment and the link to GDP. Registered data are related to internal transport (within the borders of Montenegro).

Passenger transport includes road and rail transport, carried out by organizational units registered for passenger transport, which took place within the jurisdiction of Montenegro.

Analysis of passenger transport is carried out using two sub-indicators: the amount of passenger kilometers (PKM) per year in Montenegro in relation to the rate of GDP growth, and land passenger transport by type of transport (trend relying on the EU methodology established in 2001): The report addresses the Indicators: S01 - Passenger transport, S02 - Freight traffic, S03 - Average fleet age (from the National List of Indicators) and S04 - Number of motor vehicles.

S01 Passenger Transport

Key Question:

Is there a separation between the demand for passenger transport and changes in GDP?

Key Message:

Passenger transport is defined as the number of passenger kilometers (PKM) per year in Montenegro. Land passenger transport involves the transportation of passengers by road and railroad. The indicator monitors the changing demand for passenger transport in relation to changes in GDP. In this period (2000-2012), GDP had a growth rate of 8.79%, while the passenger transport demand in Montenegro decreased at an annual rate of 6.1%, which obviously led to the separation of GDP growth from passenger transport demand. Given the prepared analysis, it can be concluded that the pressure on the environment caused by the action of passenger transport declines.

Rating of Trends:

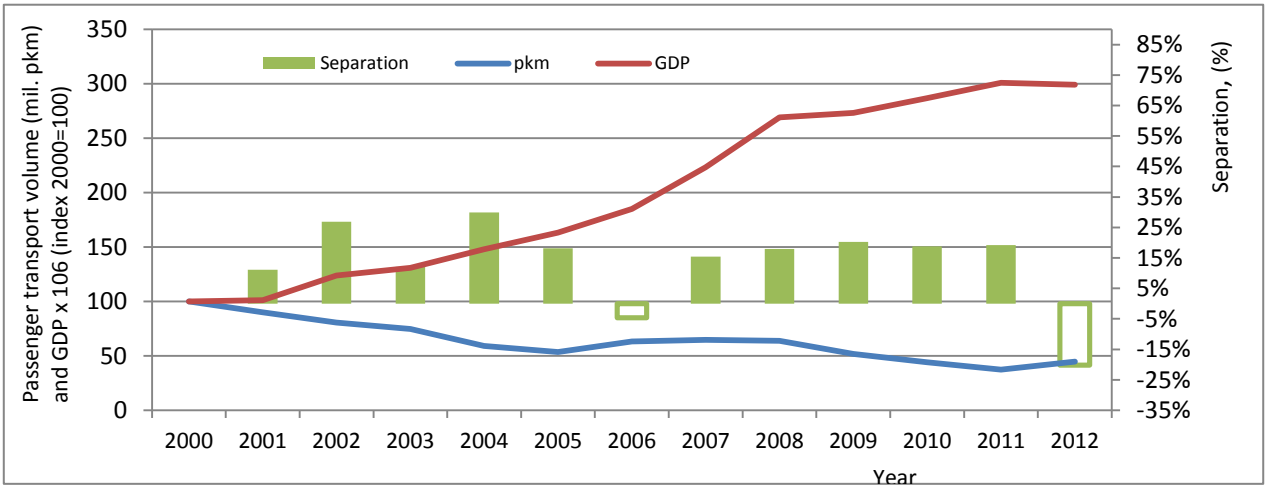
- Compared to the previous year 
- Compared to 2005 
- Compared to 2000 

Impact on Human Health and Ecosystems:

Transport, especially road transport, has an impact on air quality and creates noise that affects the population.
In terms of human health, the greatest risk is exposure to fine suspended particles ($PM_{2.5}$) produced by combustion (especially diesel engines) and as a result of wear of the brakes and tires. Excessive noise disrupts sleep, affects the circulatory system, weakens the immune system and can exacerbate mental illness. Fine particles cause respiratory illness and can, because of their chemical composition, especially in the case of high levels of cancer-causing substances, lead to other serious diseases. Vegetation and ecosystems are being damaged by pollutants (ground-level ozone), which are formed from precursors produced by traffic, especially nitrogen oxides and volatile organic compounds.

Reference Legislation:

Law on Environment,
Law on Statistics and Statistical System of Montenegro,
Law on Roads and the Law on Amendments to the Law on Roads,
Transport Development Strategy of Montenegro,
Strategy for Development and Maintenance of State Roads.



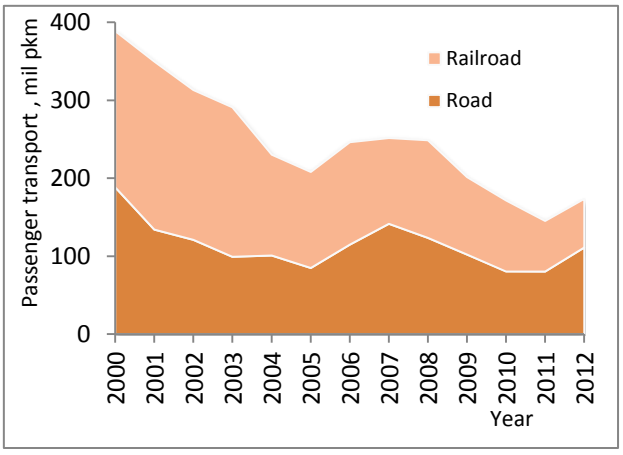
Graph 61. Passenger transport and GDO trend in Montenegro, 2000-2012

Indicator Evaluation

Data available for the period 2000-2012 show a significant reduction in demand for passenger transport in Montenegro by as much as 55%. At the same time GDP increased three times. These facts lead to the conclusion that there was an obvious separation of GDP growth and the demand for transport, which significantly reduced the pressure on the environment by the passenger transport.

The demand for passenger transport recorded a steady downward trend, which was briefly interrupted in 2006 and 2007, and yet already after 2008 the trend continued to go down.

Passenger transport, in 2012, increased as a result of increased demand for road transport. At the same time GDP recorded a steady growth until 2012, when a decrease of 1% was recorded compared to 2011.



Graph 62. Passenger transport by mode of transport in Montenegro, 2000-2012

Also in the same period the share of railroad transport was reduced, going down from baseline 52% to 36% at the end of the period under review. At the level of modes of transport, in 2012 approximately 47.6% of passengers travelled by railroad compared to 2000, while the decline in road transport was about 6.3%.

At the same time, rail and road infrastructure in this period did not change or changed insignificantly which probably had an impact on demand for passenger transport (transport of passengers) as well as the uncertainty of passengers caused by the traffic accident in Bioče in 2006.

Table 17. Passenger transport by mode of transport in Montenegro, 2000-2012

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Road	188	134	121	99	101	85	115	141	123	102	81	80	111
Railroad	200	215	192	192	130	123	132	110	125	99	91	65	62
Total (mil pkm)	388	349	313	291	230	208	246	251	248	201	171	145	174
Share of road transport (%)	48	38	39	34	44	41	47	56	50	51	47	55	64
Share of railroad transport (%)	52	62	61	66	56	59	53	44	50	49	53	45	36

Source of data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/t01
Reference to international indicators: EEA (http://www.eea.europa.eu/data-and-maps/indicators/passenger-transport-demand-version-2/assessment)

S02 Freight Transport

Key Question:

Is there a separation in the demand for freight transport and changes in GDP?

Key Message:

Freight traffic is defined as the amount of actual tonne-kilometers (tkm) during a year in Montenegro. Road freight transport includes freight transport by road and railroad. The indicator follows the changing demand for freight transport in relation to changes in GDP. In this period (2000-2012) the demand for freight transport in Montenegro was growing at an annual rate of 5.67%. At the same time, GDP was growing at an annual rate of 11%. Thus there was a relative separation of GDP growth and demand for freight transport (to a large extent) whereby the pressure on the environment increased.

Rating of Trends:

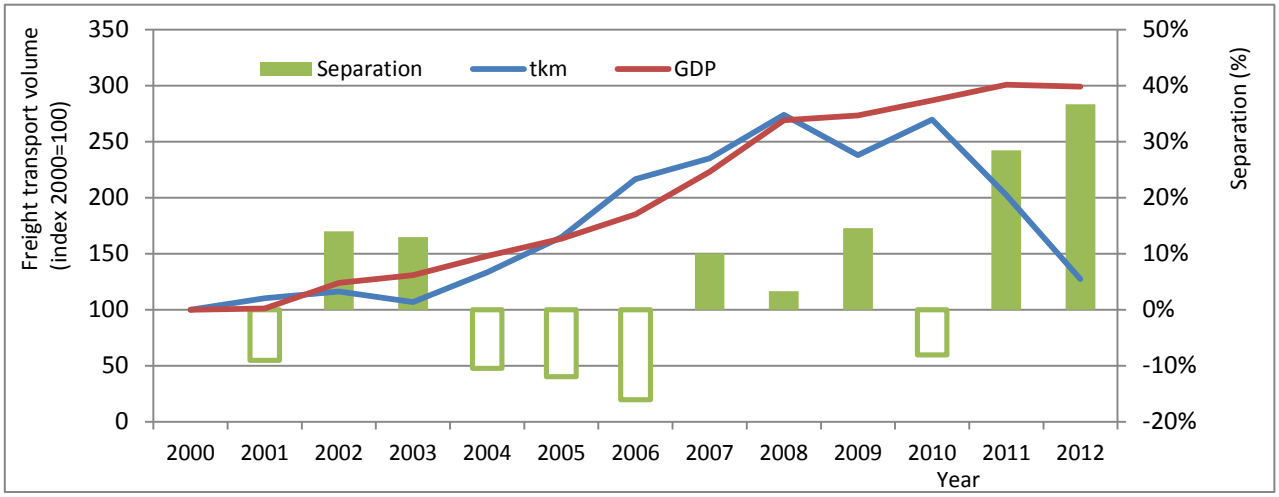
- Compared to the previous year 
- Compared to 2005 
- Compared to 2000 

Impact on Human Health and Ecosystems:

Transport, especially road transport, has an impact on air quality and creates noise that affects the population.
In terms of human health, the greatest risk is exposure to fine suspended particles ($PM_{2.5}$) produced by combustion (especially diesel engines) and as a result of wear of the brakes and tires. Excessive noise disrupts sleep, affects the circulatory system, weakens the immune system and can exacerbate mental illness. Fine particles cause respiratory illness and can, because of their chemical composition, especially in the case of high levels of cancer-causing substances, lead to other serious diseases. Vegetation and ecosystems are being damaged by pollutants (ground-level ozone), which are formed from precursors produced by traffic, especially nitrogen oxides and volatile organic compounds.

Reference Legislation:

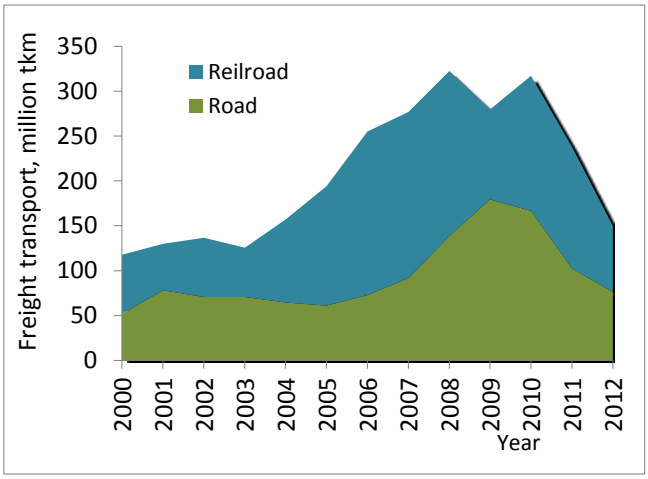
Law on Environment,
Law on Statistics and Statistical System of Montenegro,
Law on Roads and the Law on Amendments to the Law on Roads,
Transport Development Strategy of Montenegro,
Strategy for Development and Maintenance of State Roads.



Graph 63. Freight transport and GDP trend in Montenegro, 2000-2012

Indicator Evaluation

Data available for the period 2000-2012 show a significant increase in demand for freight transport in Montenegro until 2008, by even 272.88%. After that, the demand for freight transport went down by 13% until 2009, continued to increase by 2010, and dropped in 2011. At the same time, GDP went up by about 2.9 times.Graph 12 figuratively suggests that the separation was of a varying character in the analyzed period, i.e.: relative separation (faster growth in demand for freight transport from GDP growth) was present in 2001, 2004, 2005, 2006 and 2010 (white columns) and absolute separation (slower growth or decline in demand) in 2002, 2003, 2007, 2008, 2009 and 2011 (green columns). There was an obvious decline in demand for freight transport between 2008 and 2009, 2010 and 2011.



Graph 64. Freight transport in Montenegro by mode of transport, 2000-2012

Aligned trend of GDP and demand for freight transport (growth) indicates that freight transport has a significant (direct) participation in the increase of GDP. In 2011, the GDP increased compared to 2010, but due to the reduced demand for freight transport, the causes of GDP growth are different. Also, freight transport caused an increased pressure on the environment in the analyzed period compared to the previous year (not including 2003, 2009, 2011). Also, in the same period, a majority of freight was transported by rail, other than in 2001, 2002, 2003, 2009, and 2010. At the beginning and end of the reviewed period, the proportion was similar. No matter that the infrastructure for road transport in this period did not change or changed insignificantly, tonne kilometers were increasing, probably as a result of increased real demand for freight transport.

Table 18. Freight transport by mode of transport in Montenegro, 2000-2012

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Road	52	78	71	71	65	61	73	92	139	179	167	102	76
Railroad	66	51	66	55	93	133	182	185	184	101	151	136	73
Total (mil tkm)	118	130	137	126	157	194	255	277	322	280	317	238	150
Share of road transport (%)	44%	60%	52%	56%	41%	32%	29%	33%	43%	64%	53%	43%	51%
Share of railroad transport (%)	56%	40%	48%	44%	59%	68%	71%	67%	57%	36%	47%	57%	49%

Source of data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/t02
Reference to international indicators: EEA (http://www.eea.europa.eu/data-and-maps/indicators/freight-transport-demand-version-2/assessment)

S03 Average Motor Pool Age

Key Question:

Is the average age of the motor pool increasing, thus putting pressure on the environment?

Key Message:

The average age of the motor pool belongs to the group of driving factors (driver of negative impacts on the environment), in accordance with internationally accepted DPSIR model. Due to improper combustion in older vehicles, the atmosphere is polluted by exhaust gases that put pressure on the environment.

Motor-bikes are the newest type of motor vehicles in the analyzed structure of vehicles. Their age ranges from 3.42 to 8.86 years (5.53 on average). From 2000 to 2008, the motor pool of "motor-bikes" was significantly renewed. Compared to 2008, in 2012 an average age increased by 86.55%. In the period from 2000 to 2012, the number of registered motor-bikes increased from 401 to 4389.

Rating of Trends:

- Compared to the previous year
- Compared to 2005
- Compared to 2000

The average age of the towing vehicles has been consistent for years and ranges from 9.94 to 11.21 years. Also, the number of towing vehicles has not significantly increased (from 794 to 1001).

An average age of passenger cars, buses, vans and trucks is also high. However, an important place is occupied by passenger cars, whose negative effect on the environment is reinforced due to the incomparably larger number compared to all other motor vehicles (passenger cars account for 88% of the total number of motor vehicles). Since 2009 new cars have been purchased less because of the economic crisis, thus increasing the average age of vehicles.

In the period 2000-2012, the average age of motor vehicles was 14.2 years, and by vehicle type it was as follows: passenger car (14), truck (15), bus (14.5), truck (14), towing vehicle (13) years. A graphic overview of the farm tractors' age line showed a changing trend from one year to the other in the analyzed period.

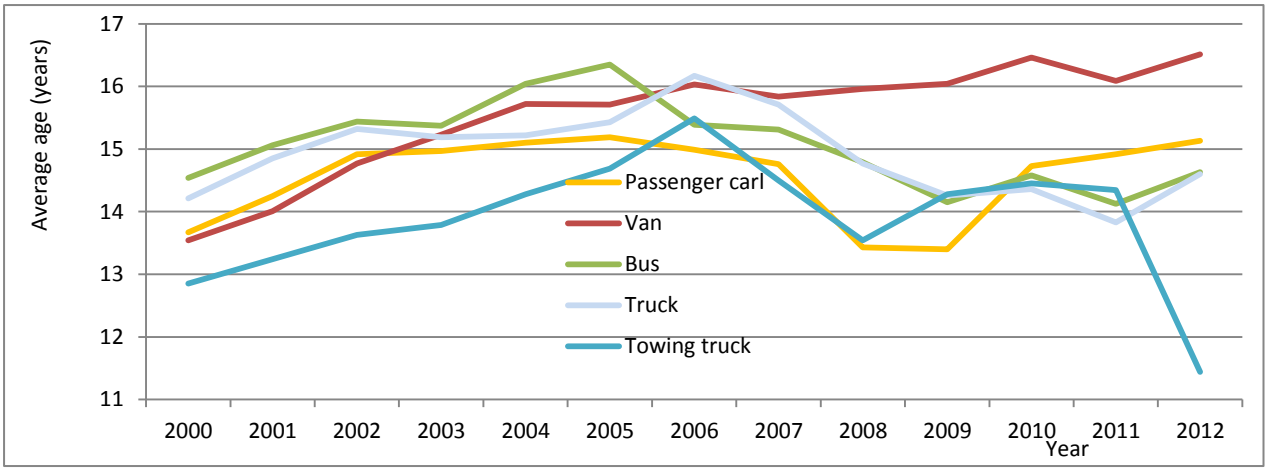
At this moment there is no explanation for this. The impact of operation of agricultural tractors is reflected mainly in rural areas.

Impact on Human Health and Ecosystems:

As for the impact on human health, all the negative consequences already mentioned in previous indicators in the field of transport are increasing with the increase of the average age of motor vehicles, and air quality is especially affected by road transport which also generates noise that burdens the population.

Reference Legislation:

Law on Environment, Law on Statistics and Statistical System of Montenegro, Law on Roads and the Law on Amendments to the Law on Roads, Transport Development Strategy of Montenegro, Strategy for Development and Maintenance of State Roads.



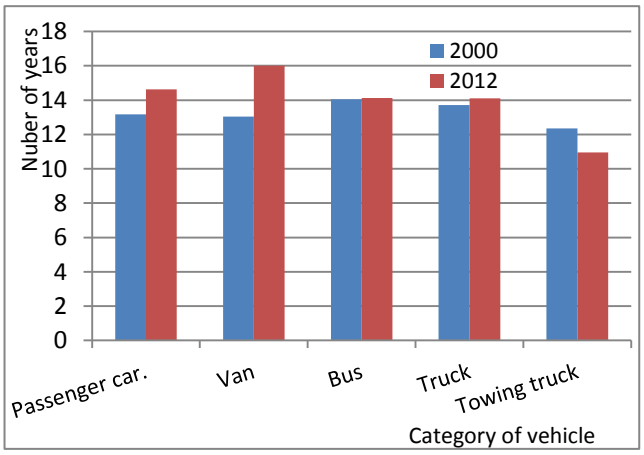
Graph 65. The average age of selected categories of motor vehicles in Montenegro, 2000-2012

Indicator Evaluation

Data available for the period 2000-2012 indicate an increase in the average age of vehicles by ~4%. As in recent years, the purchase of new vehicles has gone down due to global crisis, the motor pool is not renewed, which results in increased emissions of exhaust gases.

In 2012, by vehicle category, the share of vehicles older than 10 was 97.6%.

Only the average age of motor-bikes (6.38 years) and farm tractors (8.65 years) was under 10 years.



Graph 66.The average age of selected categories of road vehicles in Montenegro, 2000- 2012

Table 19. The average age of motor vehicles by year

	Type of Motor Vehicle								
Year	**Motor-bike**	**Passenger car**	**Van**	**Bus**	**Truck**	**Special vehicle**	**Towing vehicle**	**Trailer**	**Farm tractor**
2000	8.86	13.17	13.04	14.04	13.71	12.35	10.18	13.33	11.36
2001	7.16	13.75	13.51	14.56	14.35	12.74	10.46	13.62	13.25
2002	6.05	14.2	14.27	14.94	14.82	13.13	11.09	14.09	15.81
2003	6.07	14.47	1473	14.87	14.69	13.29	10.44	13.76	11.55
2004	5.36	14.60	15.22	15.54	14.72	13.78	11.06	14.69	18.75
2005	4.88	14.69	15.21	15.85	14.93	14.19	11.62	14.96	15.80
2006	4.98	14.49	15.53	14.89	15.67	14.99	11.21	15.46	11.90
2007	3.67	14.26	15.34	14.81	15.21	14.00	11.15	15.62	14.37
2008	3.42	12.93	15.46	14.29	14.27	13.04	9.96	14.09	9.96
2009	4.11	12.90	15.54	13.65	13.76	13.78	10.48	14.49	14.90
2010	5.13	14.23	15.96	14.08	13.86	13.95	10.47	14.89	16.95
2011	*5.79*	*14.42*	*15.59*	*13.62*	*13.33*	13.84	9.95	13.31	9.78
2012	6.38	14.63	16.01	14.13	14.10	15.27	10.94	14.60	8.65

Source of data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/s03
Reference to international indicators: http://www.eea.europa.eu/data-and-maps/indicators/average-age-of-the-vehicle-3

S04 Number of Motor Vehicles

Key Question:

Is the number of motor vehicles increasing thus putting a direct pressure on the environment?

Key Message:

The number of registered road motor vehicles by type of vehicle in the analyzed period (from 1990 to 2012) shows that passenger cars accounted for about 88% of the total number of road motor vehicles. This percentage was higher than 90% in 1997, 1998, and 2006.

As for the type of fuel used by motor vehicles, from 2009 to 2012, gasoline 98 and diesel fuel were used significantly more, which had a negative impact on the environment. Transport infrastructure for all modes of transport in Montenegro is generally unsatisfactory.

The number of motor vehicles, particularly in relation to the used fuel, indicates the amount of disadvantages in relation to environmental pollution.

Currently it is necessary to undertake efficient control of certain elements of the transport sector that negatively impact the environment in order to allow proper consideration of the problems, as well as taking measures to resolve them.

Rating of Trends:

- Compared to the previous year
- Compared to 2005
- Compared to 2000

Impact on Human Health and Ecosystems:

Number of registered motor vehicles is growing with the largest share of passenger vehicles. All the negative consequences, already listed in previous indicators in the field of transport, are amplified with the increasing number of motor vehicles.

Generally it can be said that the development of traffic has an adverse affect on the environment and human health, particularly in urban areas. There is a lack of basic information on pollutant emissions from vehicles, and fuel consumption data can be considered incomplete.

Each car annually emits three times more pollutants than its weight. This causes the deaths of hundreds of thousands of people annually. Only in America more than 60 000 people die of the consequences of a high level of air pollution every year. In the UK, the number is greater than 10.000. In Mexico City, 70% of children are behind in development because of harmful gases in the air.

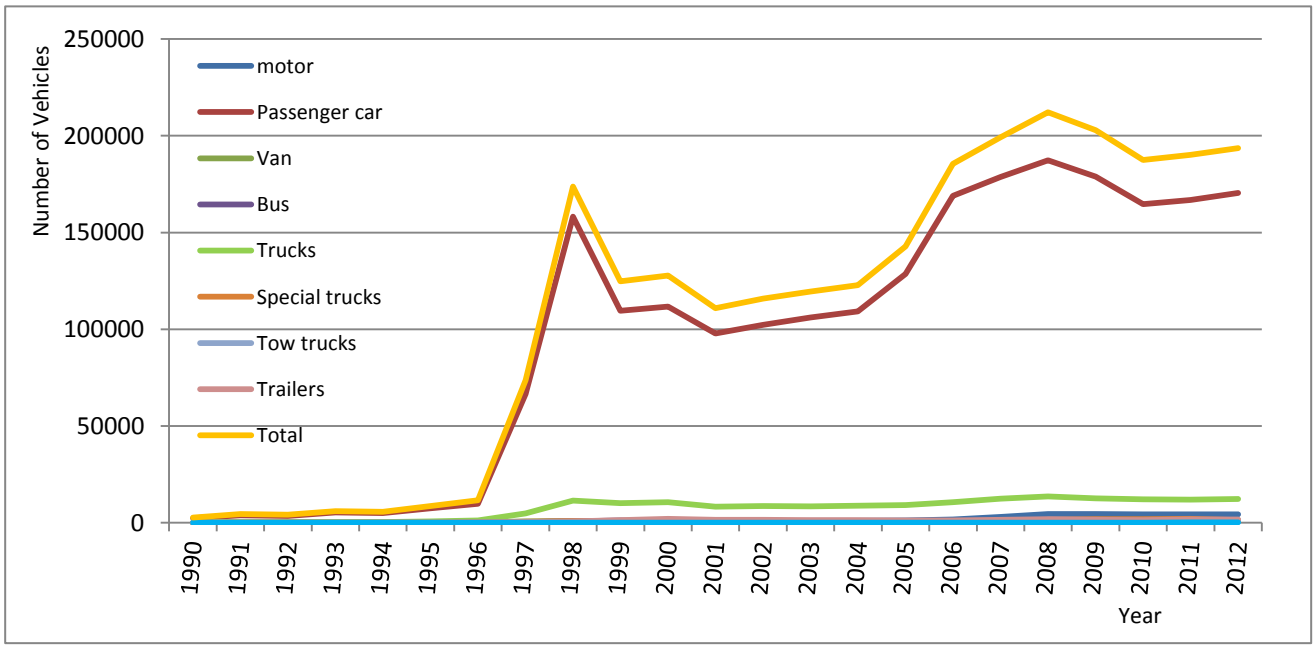
Motor vehicles emit harmful gases (PM, HMS, POPs, SO_2, NH_3, NOx, NMVOC, CO, CH_4, CO_2, N_2O), which adversely affect the health of humans and ecosystems.

The effects of emission of harmful gases can be grouped into: local (health), regional, acid rain, eutrophication, ground-level ozone, global effects of GHG (indirect) effects of GHG (direct). It can be said that nitrogen oxides (NOx) have the broadest impact, both individually and in combination, forming harmful compounds. Those adversely affect human health and the environment (all except CH_4-methane, carbon dioxide CO_2, N_2O-nitrous oxide), thus harming the organs (kidneys, liver, brain and nerves, and other organs). They can also lead to osteoporosis (weakening of bone strength) and reproductive disorders. In addition, they have a negative effect on the heart and blood.

Ozone can be transported by wind and cause health problems far away from the original source. Acid rains cause the following damage: damage to the vehicle, buildings and historical monuments, and the lakes and streams become acidic and no fish can live in them.
NOx particles react with ammonia, moisture, and other components in the form of nitric acid and related particles. Direct impacts on human health may be in the form of damage to lung tissue and respiratory tract as well as premature death. Small particles penetrate deeply into sensitive parts of the lungs and can cause or aggravate respiratory diseases such as emphysema and bronchitis, and aggravate existing heart disease.
Global warming - Nitric oxide comes from the family of NOx and is a greenhouse gas. It accumulates in the atmosphere with other greenhouse gases and causes a gradual increase in the temperature of the Earth. This will lead to an increased risk to human health, and therefore sea-level rise and other changes in plant and animal habitats.
Toxic chemicals - On the air, NOx immediately reacts with organic chemicals and even ozone in the form of a variety of toxic products, with which it can cause biological mutation. Impairment of visibility - nitrogen particles and NO_2 can block the transmission of light, reducing visibility in urban areas.

Reference Legislation:

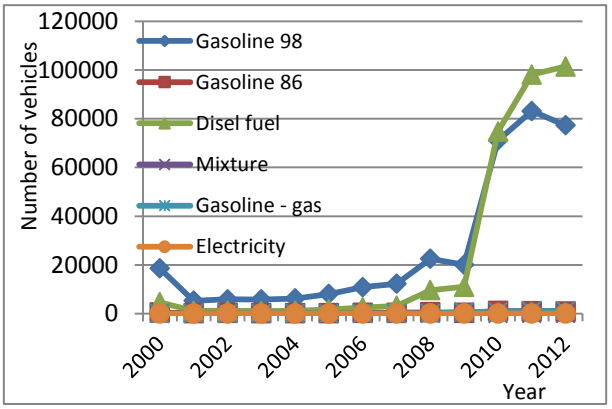
Law on Environment, Law on Statistics and Statistical System of Montenegro, Law on Roads and the Law on Amendments to the Law on Roads, Transport Development Strategy of Montenegro, Strategy for Development and Maintenance of State Roads.



Graph 67. Number of motor vehicles in Montenegro, 1990-2012

Indicator Evaluation

Data available for the period 2000-2012 suggest that passenger cars numerically dominate (88% of the total number of motor vehicles). There was a sharp rise in 1997 and then in 1998, whereas the following five years were almost stagnant in terms of increasing the number of cars. From 2005 to 2008, there was a jump in the purchase of passenger cars again.
As for the motor fuel consumption, in 2010 the same number of vehicles used gasoline 98 and diesel fuel. Since 2010, the largest number of vehicles have used diesel fuel, which had a bad reflection on the environment.
Thus in 2012 56.1% of the vehicles used diesel fuel, 42.75% gasoline 98, and 15.1% of the vehicles used all other fuels.



Graph 68. Number of registered motor vehicles, by type of fuel

Table 20. Number of registered motor vehicles, by year

Year	Motor Vehicle Type									
	Motor-bike		Motor-bike		Motor-bike		Motor-bike		Motor-bike	
1990	38	1990	38	1990	38	1990	38	1990	38	1990
1992	51	1992	51	1992	51	1992	51	1992	51	1992
1994	46	1994	46	1994	46	1994	46	1994	46	1994
1996	74	1996	74	1996	74	1996	74	1996	74	1996
1998	684	1998	684	1998	684	1998	684	1998	684	1998
2000	401	2000	401	2000	401	2000	401	2000	401	2000
2002	834	2002	834	2002	834	2002	834	2002	834	2002
2004	1021	2004	1021	2004	1021	2004	1021	2004	1021	2004
2006	1715	2006	1715	2006	1715	2006	1715	2006	1715	2006
2008	4483	2008	4483	2008	4483	2008	4483	2008	4483	2008
2010	4361	2010	4361	2010	4361	2010	4361	2010	4361	2010
2012	4389	2012	4389	2012	4389	2012	4389	2012	4389	2012

Source of Data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/s04
Reference to international indicators: http://www.eea.europa.eu/data-and-maps/indicators/size-of-the-vehicle-fleet/size-of-the-vehicle-fleet-2

The term fishery means growing and harvesting of fish for human consumption. Also, fish processing is an important activity in Montenegro. Fishing is usually done by residents of coastal regions, as well as those who live along the rivers and lakes. Fish is caught from the sea, rivers, lakes and ponds. Fish has a great importance in the diet because it contains a lot of proteins and omega-3 fatty acids.

In addition to the impact on the reduction of fish stock by catching fish and other marine organisms, a negative impact of fisheries on the ecosystem may be caused by trawling. There are also freshwater fisheries in Montenegro. Marine fisheries in Montenegro are organized as a business and sports and recreational activities. The Ministry of Agriculture and Rural Development is the authority responsible for fisheries. To monitor the status of sea fish stocks it is necessary to include the following indicators:

- R01 – Status of marine fish stock
- R02 – Aquaculture production
- R03 – Fishing fleet capacity.

The enforcement of the Law on fisheries is supervised by the inspectors responsible for the control of all fishery activities. As it is evidenced by a variety of domestic and foreign studies, the Adriatic sea is rich in fish. The legislation relating to the prohibition of discharging ballast water from ships has largely contributed to the preservation of fish stock capacity.

This Report addresses only R03 indicator relating to the fishing fleet capacity, because it is the only one for which minimum data are available for its illustration.

R03 Fishing Fleet Capacity

Key Question:

Is the fishing fleet capacity decreasing or increasing?

Key Message:

The fishing fleet capacity is measured by the number of vessels, their length and engine power as well as other important indicators. The pressure on marine fish stocks and thus marine ecosystems is measured by the results of this indicator. The fishing fleet capacity in Montenegro, at the end of the period under review (2005-2010), was lower by 30% than at the beginning and tends to keep going down.

Rating of Trends:

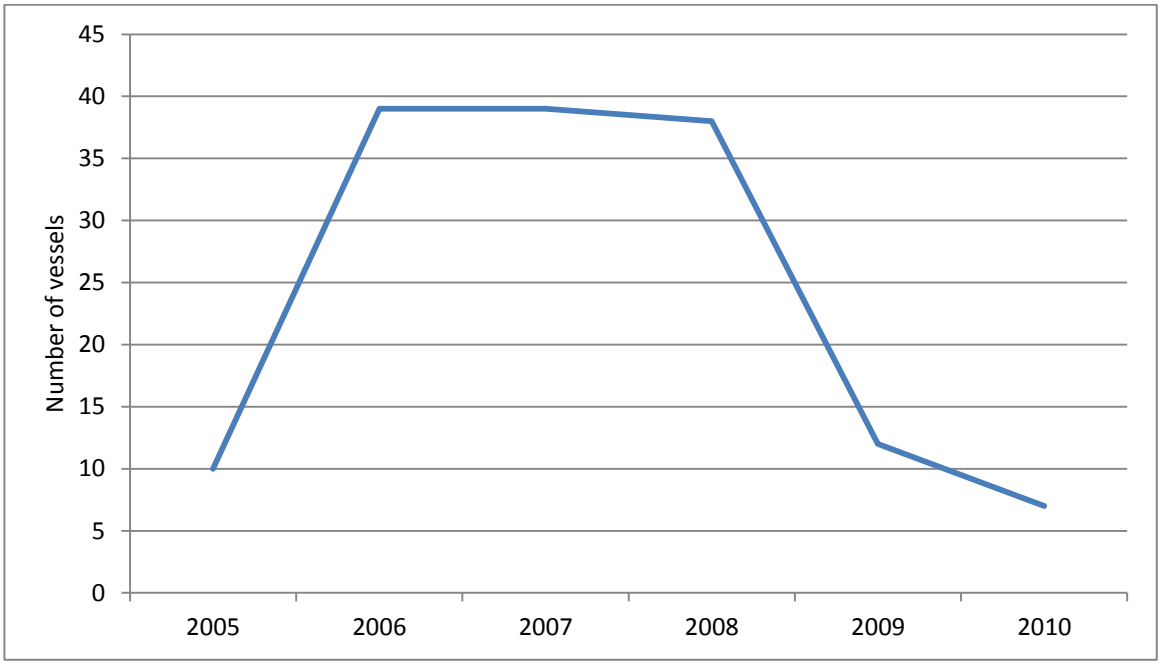
- Compared to the previous year 
- Compared to 2005 

Impact on Human Health and Ecosystems:

The fishing capacity, defined in terms of tonnage, engine power and the number of vessels, is one of the key factors that determine the mortality of fish stock. The average size of the vessel, although it is not usually considered a measure of the fishing capacity, is also an important parameter in the evaluation of the pressure on the ecosystem.
Simply put, excess capacity leads to over-fishing and increased pressure on the environment, which undermines the principle of sustainable use of marine resources. Management of fleet capacity is therefore an important factor in the management of fisheries, in order to obtain sustainable levels of fishing pressure.

Reference Legislation:

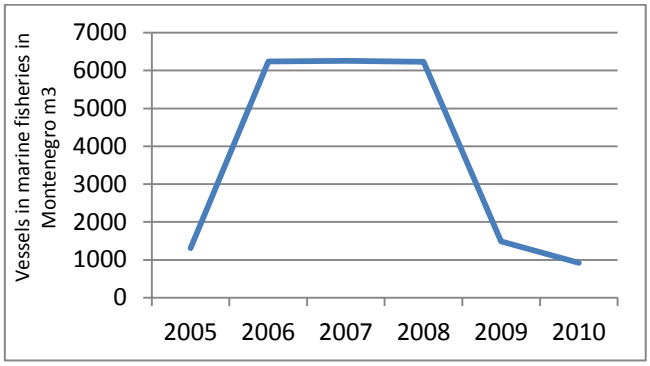
Law on Official Statistics and the System of Official Statistics,
Law on Marine Fisheries and Mariculture,
Fisheries Strategy of Montenegro and capacity building for the implementation of the Common Fisheries Policy of the EU.



Graph 69. Fishing fleet capacity in Montenegro: number of vessels, 2005-2010

Indicator Evaluation

In the reporting period of 2005-2010, after a sudden increase in the fishing fleet both in the number of vessels and capacity in 2006, there was a drastic reduction of the fleet in the last two years by as much as 83%. The reasons for this decrease are not known. In any case, this reduction led to a significant drop in pressure on fish stocks.
It was similar for smaller vessels - fishing boats, whose number went down by about 40% in the last three years of the period under review.



Graph 70. Vessels in marine fisheries in Montenegro in m^3, 2005-2010

Table 21. An overview of the capacity of marine fisheries in Montenegro, 2005-2010

		2005	2006	2007	2008	2009	2010
Ships in marine fisheries	Number	10	39	39	38	12	7
	m^3	1309	6236	6260	6230	1488	919
Boats in marine fisheries	With engine	117	194	194	117	153	122
	Without engine		5	5	5	4	4

Source of data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/r03
Reference to international indicators: EEA CSI034 (http://www.eea.europa.eu/data-and-maps/indicators/fishing-fleet-capacity/fishing-fleet-capacity-assessment-published-2)

Modern society demonstrates an increasingly prominent concern about the uncontrolled exploitation of natural resources and environmental degradation.

Given that it is generated during all human activities, waste is a serious environmental, social and economic problem of all modern development economics. The manner in which the waste is generated and treated has an impact on all citizens, businesses, government authorities and government, as well as the international market.

On the one hand, waste generation and operation results in environmental pollution. On the other hand, waste has a great potential as a resource of raw materials and energy. To better examine the current situation and make decisions in the field of possible exploitation of this potential, it is necessary to encourage the provision of high quality relevant data.

The Regulation on National List of Environmental Indicators in Montenegro includes three indicators in the field of waste management: O01 - Municipal waste generation, O02 - Industrial waste generation and O03 - Hazardous waste generation.

The main objective of this indicator-based presentation is to show the movement of trends in the generation of certain types of waste. Given that this kind of report is prepared for the first time, it was not possible to show the trend for the indicators O02 and O03, because no data were collected in earlier periods, when there was no defined obligation to collect such data in a manner and in accordance with the methodology specified by the Regulation on National List of Indicators.

Certainly, we believe that, in order to further monitor trends and follow the situation, it is relevant to show the data that are currently available.

O01 Municipal Waste Generation

Key Question:

Is the generation of municipal waste decreasing?

Key Message:

One of the main objectives of sustainable development is to decouple municipal waste generation from economic growth in the country.
For the reference period of 2009-2012, the amount of generated waste was reduced, while the GDP increased by 3.5%, which indicated that the pressure on the environment was also decreasing.

Rating of Trends:

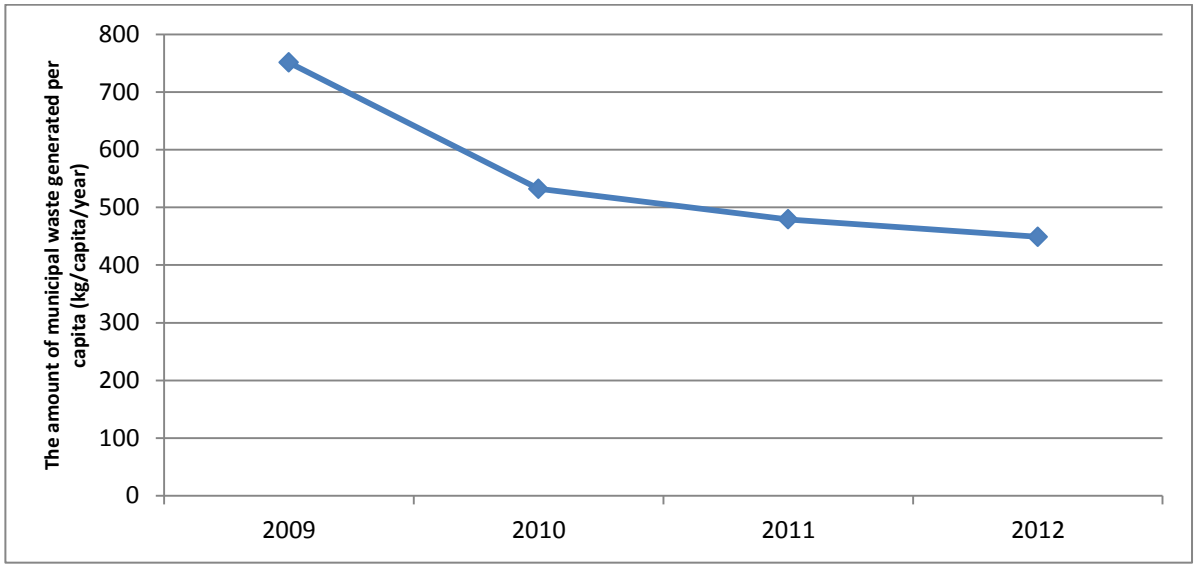
- Compared to the previous year 

Impact on Human Health and Ecosystems:

The society usually comes in contact with municipal waste, which is why the environmental policy focuses on the proper management of municipal waste. Given its diversity, and often dangerous properties, this type of waste may pose a risk to human health.
The so-called “wild” or unregulated waste disposal sites have a negative impact on segments of the environment (air, ground and surface water, and land) and human health. They also contribute to negative landscape characteristics of an area. Also in the case of controlled municipal waste disposal, landfills are a source of methane gas, which causes a significant greenhouse effect and is generated through the process of anaerobic decomposition of organic carbon. There is no direct and immediate impact of landfill operation on human health, but it may be threatened indirectly, when litter is scattered around in the immediate environment by wind or by animals, due to uncontrolled release of gaseous pollutants in concentrations hazardous to human health, spreading odor, burning waste and emissions of combustion products, uncontrolled penetration of water contaminated by the landfill and endangering wells and streams in the surrounding areas.

Reference Legislation:

Law on Waste Management ("Official Gazette of Montenegro", 64/11),
Law on Official Statistics and the System of Official Statistics ("Official Gazette of Montenegro", 18/12).



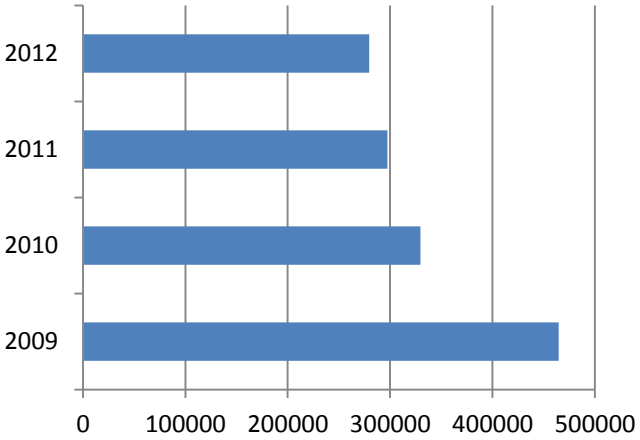
Graph 71. The amount of municipal waste generated in Montenegro for the period 2009-2012 (in kg per capita per year)

Indicator Evaluation

After 2009, when an error in reporting led to unrealistic data of approximately 465,000 tons, a gradual decline in the amount of municipal waste in Montenegro has been observed every year.

This is primarily associated with quality reporting, i.e. methodology of higher quality, but also with the impact of the financial crisis on reducing the purchasing power of the population.

Bearing in mind that at the European level, the generation of municipal waste is kept at a stable level of about 520 kg/capita/year, it is assumed that the amount of generated municipal waste in Montenegro will continue to decline until reaching a stable and realistic level, if the consequences of the global economic crisis do not lead to stabilization at an even lower level.



Graph 72. The amount of municipal waste generated in 2009-2012 (tons)

Table 22. The amount of municipal waste generated in Montenegro, 2009-2012

	2009	2010	2011	2012
Total amount of municipal waste generated (t)[1]	464617	329610	297428	279667
Population[2]	618294	619428	620556	622008
The amount of municipal waste generated per capita (kg/capita/year)	751	532	479	449
Daily generation of municipal waste per capita (kg/capita/day)	2.05	1.45	1.31	1.23

[1] **Source of data:** Statistical Office of Montenegro (www.monstat.org)
[2] Source of data: Statistical Office of Montenegro (www.monstat.org)

Detailed description of indicators: www.epa.org.me/nli/O01
Reference to international indicator: EEA CSI016 (http://www.eea.europa.eu/data-and-maps/indicators/municipal-waste-generation/municipal-waste-generation-assessment-published-4)

O02 Industrial Waste Generation

Key Question:

Is the generation of industrial waste decreasing?

Key Message:

One of the necessary steps in achieving the objectives of sustainable development is monitoring the intensity of production of industrial waste, as well as addressing that issue, particularly relating to the amount of waste "inherited" from earlier industrially more developed periods of our economy.

Rating of Trends:

- Compared to the previous year 

Impact on Human Health and Ecosystems:

Industrial waste is a source of extreme pressure on all aspects of the environment, especially in cases of inadequate management. Heavy metals, polychlorinated biphenyls (PCB group), dioxins and polycyclic aromatic hydrocarbons (PAHs) are some of the pollutants in industrial waste which usually affect the composition and quality and pollution of surface and ground water, soil or air.

There are several ways in which the listed contaminants affect human health and each of them is associated with particular food chains in ecosystems, i.e. cultivation of animals and plants on contaminated soil, as well as using the water and food that is contaminated with substances derived from industrial waste.

Reference Legislation:

Law on Waste Management ("Official Gazette of Montenegro", 64/11),
Law on Official Statistics and the System of Official Statistics ("Official Gazette of Montenegro", 18/12).

Indicator Evaluation

Although the industrial production in Montenegro has been in stagnation since the 1990s, and therefore less industrial waste has been generated annually, there is a need to carry out valid statistical researches in this area.
As the data are available only for the years of 2011 and 2012, other than a simple comparison of the two previous years, it is not possible to develop any trends or realistic forecasts for the future.
However, according to the current industrial situation in Montenegro, the data available, which specifically concerns the year of 2011 (557,635 tons), can give no real picture of the industrial waste generation. This is most likely the result of mistakes in the process of reporting, in the terms of inadequate waste classification or including the stored amounts of waste generated during the previous years of expansionary production of large industrial systems (such as the Aluminum Plant in Podgorica, Steel Production Plant in Nikšić and Thermal Power Plant in Pljevlja). This is also confirmed by the fact that the amount of industrial waste generated was significantly lower already in 2012. For the same reason, it is realistic to expect even more pronounced reduction of those amounts in the future.

Table 23. Industrial waste generation in Montenegro, 2011-2012

	2011	**2012**
Total amount of industrial waste generated (in tons)[1]	557635	457610
Gross Domestic Product (BDP)[2] **– (million EUR)**	3234	3151
Intensity of industrial waste generation (kg/1000 EUR)	172	145

[1] **Source of data:** Statistical Office of Montenegro (www.monstat.org)
[2] Source of data: Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicator: www.epa.org.me/nli/O02
Reference to international indicator: /

O03 Hazardous Waste Generation

Key Question:

Is the generation of hazardous waste decreasing?

Key Message:

In Montenegro, there is no infrastructure for the disposal of hazardous waste, technically and technologically equipped in accordance with European standards. Addressing this issue would ensure the implementation of control over the pressure made by the stored, or even inadequately deposited amounts of hazardous waste on the environment, as well as the issue of valid records of the amounts of hazardous waste which do not exist in Montenegro at this point.

Rating of Trends:

- Compared to the previous year 

Impact on Human Health and Ecosystems:

Hazardous waste is the waste that has at least one of the properties that make it hazardous (explosive, flammable, oxidation tendency, acute toxicity, infectivity, the tendency to corrosion, in contact with air releases flammable gases, in contact with air or water releases toxic substances, contains toxic substance with delayed chronic effects, and ecotoxic characteristics), and packaging in which any hazardous waste was or is packaged.
The statutory definition of hazardous waste covers all aspects of its negative impact on all aspects of the environment and human health.

Reference Legislation:

Law on Waste Management ("Official Gazette of Montenegro", 64/11),
Law on Official Statistics and the System of Official Statistics ("Official Gazette of Montenegro", 18/12).

Indicator Evaluation

In Montenegro, there are no valid records of the amounts of hazardous waste generated. Given that there is no infrastructure for the disposal of hazardous waste, which is technically and technologically designed by European standards, hazardous waste is exported from Montenegro, in accordance with the Law on Waste Management and the requirements of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

Hazardous municipal waste is generated as a result of activities in households and institutions. Given that there are no specific mechanisms for monitoring the production of this type of waste, and that it is regarded as part of the total municipal waste, there are no data on its annual production. Based on indicators in the countries of similar economic development, the Strategic Master Plan assessed that the annual production of hazardous waste from households was around 950 t.

Hazardous industrial waste is generated as a result of various technological processes. According to the only available official data, the amount of 6576 tons of hazardous industrial waste was generated in Montenegro in 2011. In 2012 the amount was much lower. Due to the decrease in the intensity of industrial production in Montenegro, the values specified are expected to show a decreasing trend in the following years.

Table 24. Generation of hazardous industrial waste in Montenegro, 2011-2012

	2011	**2012**
Total amount of hazardous industrial waste generated (in tons)[1]	6576	3819

[1] **Source of data:** Statistical Office of Montenegro (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/O03
Reference to international indicator: /

Natural Resources, in which biological diversity is one of the key components, can be completely equated with natural capital. Nature is seen as a storehouse of natural resources from which to obtain a wide range of visible goods and ecosystem services such as sources of energy, food and materials; a tank for waste and pollution; climate, water and land regulating services, as well as the environment for life and rest. So in essence, it can be concluded that the natural capital is the basic fabric of society. However, what turned out to be certainly evident is that the resources and services provided by nature are not indestructible and unlimited. Therefore, the possibility of finding balance in a sustainable limit of potential for using natural resources versus their protection rests on the existence of adequate analysis and data necessary for adequate decision-making process.

The Regulation on National List of Indicators in Montenegro includes 7 indicators as follows: B01 - Species diversity, B02 - Distribution and state of selected species; B03 - Deadwood in forests, B04 - Abundance and dynamics of wildlife populations in hunting areas; B05 – Non-native and/or invasive species; B06 - Forest fires and B07 - Designated areas.

In creating a list and developing a methodology, the following was taken into account: the availability of data, the relevance of indicators at the national level, relevance and ability to comply with the terms of international practice and commitments. The data that are used, according to the adopted standard methodologies, in the preparation of the national list of indicators, are obtained as a result of monitoring the state of the environment or statistical research. Therefore, aiming to provide a complete indicator overview, it is necessary to adjust and adapt the entire data collection system to the methodology of indicator overview.

Certainly, one of the main goals of indicator overview is based on an overview of trends, however, as this kind of report is prepared for the first time for the indicators B01 - Species diversity, B03 - Deadwood in forests, B04 - Abundance and dynamics of wildlife populations in hunting areas and B05 - Invasive and/or non-native species, it was not possible to express the trend because no information was collected in earlier periods over time considering that there was no defined obligation of collecting this information in a manner and in accordance with the methodology defined by the Regulation on National List of Indicators. Certainly we believed, in order to further monitor trends and follow the situation, that it was relevant to show the currently available data.

B01 Species Diversity

Key Question:

What is the level of diversity of species in Montenegro?

Raitng of Trends: /

Key Message:

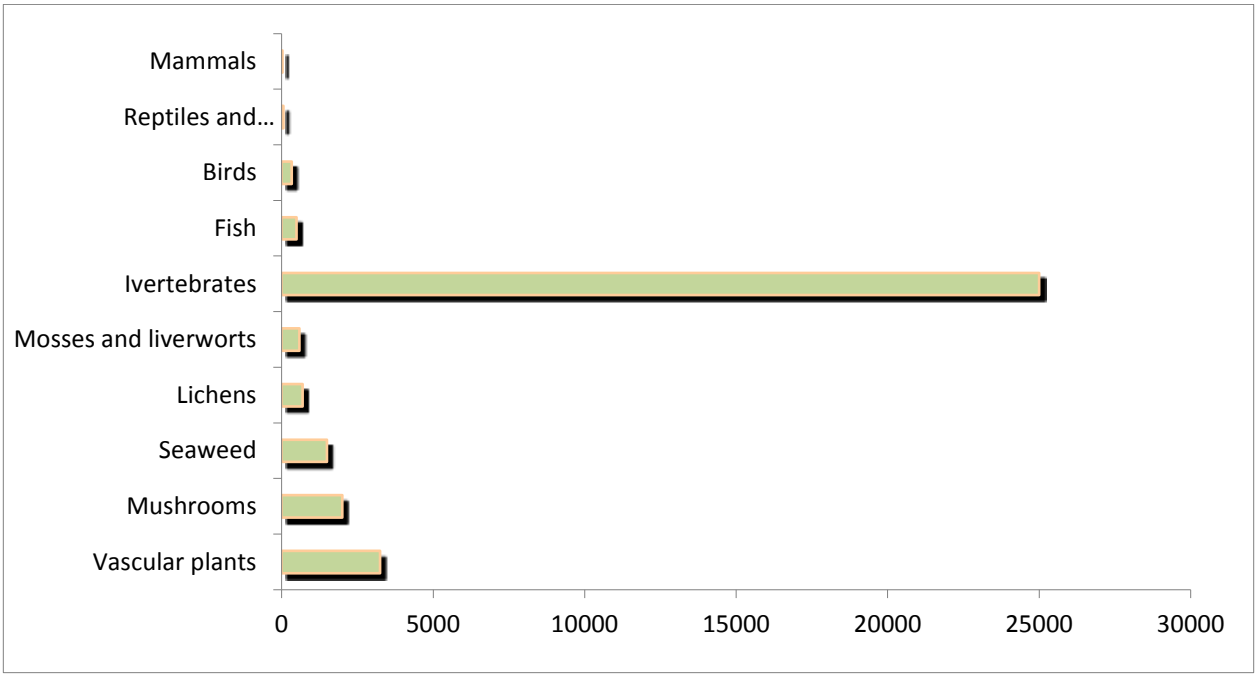
Montenegro is one of the countries that are classified as biodiversity "hot-spots" both at the European and global level of biodiversity. Due to lack of funds, no Red List or books of flora and fauna have been made in Montenegro, which are the main instrument at the international level, for assessing the situation and status of species as well as plan for their adequate protection and conservation measures.

Impact on Human Health and Ecosystems:

Biological diversity provides to human civilization a very wide range of benefits, goods, processes and services which are called "ecosystem services". Preserving biodiversity, as a key prerequisite for sustaining the food chain, is the basis for maintaining favorable conditions for the survival of the human species. Ecosystem services can be very simple and reduced to renewable natural resources such as animal feed and various types of fruit, or a very complex operation for preventing natural disasters, climate change mitigation, maintaining the stability of aquifers, soil fertility, etc.

Reference Legislation:

Nature Protection Law ("Official Gazette of Montenegro", 51/08, 21/09), Rulebook on detailed content of the annual program for monitoring the state of nature conservation and the conditions that must be met by the legal entity that monitors ("Official Gazette of Montenegro", 35/10), Rulebook on monitoring the number and status of the population of wild birds ("Official Gazette of Montenegro", 76/06), Decision on placing some plant and animal species under protection ("Official Gazette of Montenegro", 76/06).



Graph 73. Estimated number of species per group in Montenegro

Indicator Evaluation

The indicator is an indicator of the current state and at this point it is not possible to express a trend because due to the lack of red lists and books there is no reliable data available that could be compared with the previous period. Certainly, the presentation of data aims to show comprehensively the wealth of Montenegro in biodiversity. The numbers are estimates set out on the basis of previous research.

Table 25. Estimated number of species per group in Montenegro

Species	Estimated Number	Number of protected species
Vascular plants	3250	272
Mushrooms	2000	111
Seaweed	1500	6
Invertebrates	<25000	69
Fish	497	11
Birds	330	298
Reptiles and amphibians	56	42
Mammals	29	10 + all bats

Source of Data: The data were obtained from the National Biodiversity Strategy with an Action Plan of 2010-2015; in the case of birds, from the database of the Environmental Protection Agency.
Detailed description of indicators: www.epa.org.me/nli/b01
Reference to international indicators: EEA CSI Species diversity 009, Environmental indicators and indicator-based assessment reports Eastern Europe, Caucasus and Central Asia, United Nations, New York and Geneva, 2007- Threatened and protected species.

B02 Distribution and Status of Selected Species

Key Question:

How do the population trends of selected species change and how does this relate to the management of their habitats?

Key Message:

Speaking of mushrooms, the genus Hygrocybe (waxcap-grassland fungi) are indicators of semi-natural, dry pastures that are not used intensively – mushrooms picked by hand and grazing. This type of habitat is threatened in Montenegro due to inadequate management - overgrowth or translation into intensive use. On the basis of the results of the trend it can be concluded that it is necessary to frequently monitor the status of populations of the species Acer intermedium in most localities and have a more efficient protection at sites where it is the largest (between the villages of Rudinice and Dubljević in the Komarnica river canyon and the mountain of Bijela Gora near Grahovo). Also, it is necessary to monitor more frequently the status of the species *Dioscorea balcanica*, with efficient protection from forest fires, which are the main causes of endangering the populations of this forest species.

Rating of Trends:

• Compared to the previous year	Provided in tables
• Compared to 2005	Provided in tables
• Compared to 2000	Provided in tables
• Compared to 1990	Provided in tables

Cladocera is an important component of the zooplankton, and can reach very large numbers, making it a major stake in the biomass of zooplankton. The largest number of species are phytophagous forms, so to a large extent they influence the composition and abundance of phytoplankton (very important as a measure to control the number of phytoplankton forms), but also are an important food source for planktivorous fish. The composition and abundance of *Cladocera* largely represent a reflection of the conditions in the environment in which they live and are a good indicator of the state of the ecosystem in which they live.

These organisms are good indicators of water quality, i.e. indicate the soundness or saprobity of an aquatic ecosystem, for which reason it is very important to study this group of organisms. It was observed that the total number of the community *Cladocera* was going down on the level of the entire lake, so its monitoring is essential, in addition to tracking the numbers of given species. In 2007, 19 species were recorded in Lake Skadar. Based on the identified species and formulas by Pantle & Buck, the Saprobic Index was calculated. It was found that the value of this index was between 1.5 and 1.6. These Saprobic Index values show that Lake Skadar belongs to β - mezosaprobity degree (class II), i.e. the lake is moderately loaded with organic substances.

Amphibians are excellent bio-indicators of environmental changes because they inhabit both the aquatic and terrestrial environment, which makes them vulnerable to aquatic and terrestrial pollutants. Due to their permeable skin that quickly absorbs toxic substances, they are very sensitive to chemical pollution. Egg membranes and epithelium of their gills and skin, are largely permeable, and thus absorb more substances from the external environment (aquatic and terrestrial) than other groups, so they are considered as "bioindicators" of the quality of the environment. Most species are generally tolerant to a decrease of pH values in the environment,

but they are quite sensitive to aluminum, especially in terms of a decrease in pH values in both terrestrial and aquatic environments.
Indicator species of the genus *Triturus spp* showed a declining trend due to habitat disturbance and introduction of predators (fish). Fish are the predators of the first order in the adult and the larval stage.
An alarming situation was confirmed in the restocked waters where no individual newts were ascertained. Data for previous years indicate "good" populations in these localities. Reptiles can also be counted as quality indicators. According to the latest data, the trend of selected species is stable when it comes to the number of populations. It should be noted that the *Dinarolacerta montenegrina* is a new species in Montenegro and that its populations are insufficiently examined. Given the global interest in stopping the degradation processes that lead to disappearance of species or declining population size, we are confident that it is necessary to get the support of global associations for the research, and that Montenegro has to provide support primarily by intensifying research.
The entomophauna species are under a significant anthropogenic pressure, especially in the coastal and central parts of Montenegro.
When it comes to orintofauna, for some nesting birds, the number of pairs and breeding success varied considerably in the observation period. For example, pelicans (*Pelecanus crispus*) and the Collared Pratincole (*Glareola pratincola*) varied greatly in the number of pairs and the number of colonies on Lake Skadar and Ulcinj Salina. Their breeding success is directly dependent on water management in the salt pans and the water level on Lake Skadar, indicating a problem in managing habitats.

Impact on Human Health and Ecosystems:

The presence of certain indicator species, the species that are symbols of a habitat (flag species) or species of special concern (SSC) in an area that contribute to the attractiveness of the area and thus have a socio-cultural and economic value to the local population, indicate the state of the ecosystem and the quality of the environment generally in that area and serve the purpose of early warning to certain changes in environmental quality. Also, most of these species are directly related to the quality of managing their habitats, and therefore any movement in population trends is a response to the action or inaction of appropriate management measures and protection of habitats not to be lost.

Reference Legislation:

Law on Environment ("Official Gazette of Montenegro", 48/08), Law on Nature Protection ("Official Gazette of Montenegro", 51/08, 21/09), Rulebook on detailed content of the annual program for monitoring the state of nature conservation and the conditions that must be met by the legal entity that monitors ("Official Gazette of Montenegro", 35/10), Rulebook on monitoring the number and status of the population of wild birds ("Official Gazette of Montenegro", 76/06), Decision on placing some plant and animal species under protection ("Official Gazette of Montenegro", 76/06).

Indicator Evaluation

The species *Acer intermedium* is Balkan endemic. It is present usually in small or very small populations (10-20 adult specimens, quite often less than 10 adult specimens, and very rarely those are slightly larger populations of several dozen adults). The species is very sensitive to environmental changes in the habitat, it is slow to recover and, in addition, a small number of individuals in the population is one of the main causes of its decline in the most established sites. Factors that threaten this species most frequently and the most are: logging, mostly of firewood trees of other species in the stands that include this species as well. This significantly changes environmental conditions of habitat, reduces seed germination of this forest species, which eventually leads to a reduced number of the entire population. When logging, it often happens that occasionally a tree of this rare forest species is cut down, which has a very significant impact on the rapidly decreasing number of some of its populations. In Montenegro, this species has been observed at about 20 sites so far, and is relatively largest in the canyon of the Komarnica river and the mountain of Bijela Gora near Grahovo.
The species *Dioscorea balcanica* is also endemic to the Balkan Peninsula and is represented only in Kosovo, near Prizren, and in the immediate vicinity of the town of Nikšić in Montenegro (lower part of the mountain Budoš, then between Stubica and Bogetić and in forest stands behind the Steel Production Plant (only a few kilometers from there). In this area its populations are more numerous but are often vulnerable to sudden forest fires and to a lesser extent the occasional cutting of firewood. When it comes to mushrooms, the largest number of species of the genus *Hygrocybe* has so far been registered to Crkvičko polje field (Piva), indicating a good preservation of habitat. In the future, it is necessary to made detailed studies of distribution and abundance of species of the genus *Hygrocybe* in other habitats of this kind in Montenegro, bearing in mind their importance in terms of monitoring the loss of semi-natural - dry pastures and livestock breeding opportunities in the traditional way.
For certain species of entomophauna there are only single findings, although their distribution can be expected to be larger than the existing indicators. Bearing in mind that in terms of space and time the research was (and still is) limited, one should count on a significant increase in the number of days of research and significant expansion of the in which research will be carried out. For most of the species that can be included among the quality indicators in terms of bird fauna, it is necessary to carry out detailed studies of all the habitats where they are recorded. In this table the majority of species have stable or slightly rising trend, which probably would not be analogous to other indicator species having higher quality data for the reference period, therefore, in order to improve the quality of data, a more substantial funding needs to be allocated for field research. Zooplankton species are specifically addressed because they contribute to the number of communities the most, especially in the months when the maximum is recorded. These species are also good indicators of clean water ecosystems.
Monitoring of reptiles and amphibians in the previous period included the aquatic ecosystems with the goal of continuous monitoring of populations of species of amphibians and reptiles. Indicator species of the genus *Triturus spp* were monitored in fresh and anthropogenic waters (ponds, springs and tanks made of stone).

Table 26. Mushrooms

Species Name	Year (period)		
	2010*	2011*	Trend 2010-2011
Hygrocybe clyptriforms	Stable	Stable	Stable
Hygrocybe chlorophana	Stable	Stable	Stable
Hygrocybe coccinea	Stable	Stable	Stable
Hygrocybe conica	Stable	Stable	Stable
Hygrocybe pratensis	Stable	Stable	Stable
Hygrocybe psittacina	Stable	Stable	Stable
Hygrocybe virginea	Stable	Stable	Stable

**Research carried out in 2010-2011, under the project "Feasibility Study for the Designation of the*

Regional Park Piva, the Mountains of Maglić, Bioč and Volujak", the Institute for Nature Protection, UNDP.

Table 27. Plant species

Species Name	Trend 2002 - 2012
Acer intermedium (Pancic's field maple)	Slightly downward
Dioscorea balcanica	Stable

Table 28. Entomofauna, the period from 2001 (and earlier) to 2012

Species Name	Indicator (the species found last)	Assessment Criteria	Category (IUCN)/ National (NL)
Lucanus cervus L.	2011	There are new findings/ there are no adequate measures to preserve habitats of the species.	LC/NL
Rosalia alpina L.	2011	There are new findings/ there are no adequate measures to preserve habitats of the species.	VU/NL
Cerambyx cerdo L.	2012	There are new findings / the population status of the species would be improved by preserving old oak trees.	VU
Iphiclides podalirius L.	2012	There are new findings/ population stable, optimal number of individuals	LC/NL
Papilio machaon L.	2012	There are new findings/ population stable, optimal number of individuals	LC/NL
Papilio alexanor Esp.	2010	There are new findings/ the population is limited to a few sites in small numbers	LC/NL
Parnassius apollo L	2011	There are new findings/ at some sites (Komovi) the population is stable with optimum abundance.	VU/NL

***Data source**: Published scientific sources, Biodiversity monitoring, Baseline studies, own research Dr. Dragan Roganović, PhD*

Table 29. Zooplankton

Species Name	Year (period)		
	Year 1981.*	Year 1981.*	Year 1981.*
Diaphanosoma brachurum	5.33 ind/l	60.5 ind/l	Increase
Bosmina longirostris	41.33 ind/l	49 ind/l	Increase
Daphnia cucullata	37.33ind/l	36.5ind/l	Decrease

***Data source**:*

**Petković, S. (1981): Seasonal abundance and distribution of planktonic Crustacea, in Monography: The Biota and Limnology of Lake Skadar – Chapter VI: 192- 199, "Prosveta" Belgrade.*

***Kralj, S. (2011): Additional knowledge on Cladocera (Crustacea) of Lake Skadar. Lake Skadar - status and perspectives. Montenegrin Academy of Sciences and Arts (CANU), 105(I), 257-263,*

Podgorica.

Table 30. Amphibians and Reptiles

Amphibians			
Species Name	**2008**	**2012**	**Trend 2008-2012**
*Mesotriton alpestris**	Medium-sized population	Small population	Downward trend
*Lissotriton vulgaris**	Medium-sized population	Small population	Downward trend
*Triturus macedonicus**	Small population	Small population	Downward trend
Reptiles			
Species Name	**2008**	**2012**	**Trend 2008-2012**
Testudo hermanii	Medium-sized population	Medium-sized population	Stable
Dinarolacerta montenegrina	Medium-sized population	Medium-sized population	Stable
Dalmatolacerta oxycephala	Medium-sized population	Medium-sized population	Stable

Source of Data:

** PhD Ruža Ćirović - Empirical assumption that the most common species is the most abundant and widely distributed species in comparison with species restricted in range ("theory of abundance - abundance; Gaston, 1996) is applicable in the case of European newts in the karst region of Montenegro. Populations were classified (by size) as follows: a small population (up to 10 individuals), medium-sized population (11-100) and large population (over 100 individuals).*

Table 31. Birds

Species Name	**Year (period)**		
	2002* (nesting pairs)	**2002* (nesting pairs)**	**2002* (nesting pairs)**
Pelecanus crispus	5	16	↑blago rastući
Phalacrocorax pygmeus	2300	2500	↑blago rastući
Aquila chrysaetos	25-32	≈	stabilan
Alectoris graeca	3000-4000	<1200	↓brzo opadajući
Glareola pratincola	70-80	≈	-stabilan
Coracias garullus	5-8	<25	↑blago rastući
*Porzana pussila****	80	<3	↓ brzo opadajući

Source of Data:

**BirdLife International (2002): Birds in Europe 2, population estimates, trends and conservation status. (BirdLife Conservation Series No.12.) Cambridge, UK.*

***Darko Saveljić*

****Schneider-Jacoby, M., Schwarz, U., Sackl, P., Dhora, D., Saveljić, D., Stumberger, B. (2006): Rapid assessment of ecological values of Bojana-Buna Delta (Albania/Montenegro). Radolfzell.*

Source of Data: Internal database of the Environmental Protection Agency experts for specific taxonomic groups
Detailed description of indicators: www.epa.org.me/nli/b02
Reference to international indicators: Environmental indicators and indicator-based assessment reports Eastern Europe, Caucasus and Central Asia, United Nations, New York and Geneva, 2007- Trends in the number and distribution of selected species; EEA SEBI 03 Change in status of threatened and/or protected species.

B03 Deadwood in Forests

Key Question:

What is the quantity of deadwood in the forests of Montenegro?

Rating of Trends: /

Key Message:

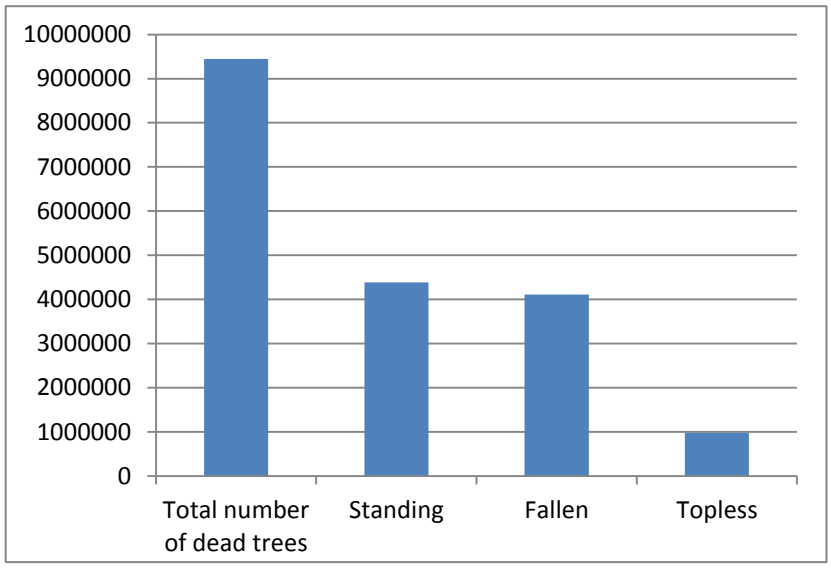
Deadwood in forests occur as a result of fire, disease, attacks by insects, storms, floods and intense droughts. Such trees are important habitats in forest ecosystems for species that are important in the cycle and the food chain of the ecosystem. They play a major role in the restoration of nutrients and organic matter. Therefore, it is not always necessary to remove them. The importance of trees for species depends on the age of dry trees, their size, tree species and stages of decomposition.

Impact on Human Health and Ecosystems:

Deadwood in forests play a crucial role in the functionality and productivity of forest ecosystems through impacts on biodiversity (habitat for fungi, as well as numerous small vertebrates and invertebrates), the storage of carbon dioxide, nitrogen cycle of land, energy flow, hydrological processes and natural regeneration of trees in forest ecosystems where they are present. Deadwood is indicator of the protective value of forests.

Reference Legislation:

Law on Environment ("Official Gazette of Montenegro", 48/08), Law on Official Statistics and the System of Official Statistics ("Official Gazette of Montenegro", 18/12), Law on Nature Protection ("Official Gazette Montenegro", 51/08, 21/09), Law on Forests ("Official Gazette of Montenegro", 74/10, 40/11).



Graph 74. Deadwood in forests in Montenegro

Indicator Evaluation

The indicator represents the status indicator at this time is not possible to express the trend in the presence of dead trees in the forests. This kind of statistics in accordance with the methodology of indicators was first maintained as part of the project "National Forest Inventory," which was implemented by the Ministry of Rural Development and Agriculture. Accordingly, the data in Table 32 represent a starting point for further data collection and assessment of trends and movements in the presence of dry trees in forests. Each presentation of the current situation serves as a comparative overview of the level of presence of dead trees in forests in Montenegro which can indicate the soundness of forest ecosystems and processes in them.

Table 32. Overview of dead trees by stand classification

Stand Classification	Surface Area Total ha	Volume Total	**Dead Trees Total No.**	Number of individual dead trees			
				Standing	**Fallen**	**Topless**	**Total No.**
1 Willow and poplar forests (Salix sp, Populus sp)	3,909.6	228,274.1	7,300.15	2,192.41	7,268.30	4,667.77	14,128.47
2 Hungarian oak forests (Quercus frainetto)	2,884.8	297,700.9	6,578.91	1,989.61	8,021.34	2,984.42	12,995.37
3 Holm oak forests (Quercus ilex)	990.9	21,939.4	0.0	0.0	0.0	0.0	0.0
4 Oriental Hornbeam forests (Carpinus orientalis)	19,171.6	555,792.4	5,065.37	16,971.05	1,997.19	1,994.31	20,962.55
5 Macedonian oak forests (Quercus trojana)	6,126.2	133,681.1	1,845.33		1,997.79	998.90	2,996.69
6 Downy oak forests (Quercus pubescens)	29,497.6	737,847.2	5,821.58	4,991.49	14,672.93	4,961.14	24,625.56
7 Turkey and Downy Oak forests (Qu. cerris and Qu. pubescens)	36,084.5	1,100,970.1	13,325.64	26,978.54	14,016.75	5,999.89	46,995.18
8 Turkey oak forests (Quercus cerris)	53,559.3	3,182,966.9	74,951.02	128,962.70	43,813.19	12,001.35	184,777.24
9 Šessile oak forests (Quercus petraea)	6,734.8	673,166.1	25,806.70	56,794.01	22,608.55	4,566.68	83,969.24
10 Šessile and Turkey oak forests (Qu.petraea and Qu.cerris)	15,014.5	1,596,537.6	33,248.77	56,288.79	40,114.11	5,019.18	101,422.08
11 Sessile oak and hornbeam forests (Qu. petraea and Carpinus betulus)	8,104.9	1,016,942.6	22,986.00	35,039.01	16,113.11	6,999.15	58,151.26
12 Hornbeam forests (Carpinus betulus)	10,655.2	995,402.6	17,335.39	7,096.45	23,094.82	3,871.13	34,062.39
13 Hop hornbeam forests (Ostrya carpinifolia)	7,164.1	333,354.2	5,304.22	3,920.30	2,994.89	998.30	7,913.49
14 Hop hornbeam and South European Flowering Ash (O. carpinifolia and Fraxinus ornus)	76,915.1	1,915,923.2	38,750.90	91,149.82	45,927.44	23,089.98	160,167.24
15 Beech and Hop hornbeam forests (Fragus moesiaca and Ostrya carpinifolia)	14,713.1	1,557,807.8	100,564.32	124,602.13	66,059.71	81,829.06	272,490.90
16 Beech and Sessile oak forests (Fagus moesiaca and Quercus petraea)	6,515.7	1,303,113.9	64,835.93	86,092.77	66,054.82	15,090.66	167,238.25
17 Beech and hornbeam forests (Fagus moesiaca and Carpinus betulus)	13,618.2	2,181,308.9	44,103.52	54,143.06	65,332.06	10,479.51	129,954.62
18 Beech forests (Fagus moesiaca)	143,697.5	34,905,496.4	1,199,239.91	830,292.06	1,069,776.41	331,148.01	2,231,216.48
19 Fir and beech forests (Abies alba and Fagus moesiaca)	44,568.3	13,877,514.8	975,991.49	494,999.00	660,875.40	142,361.56	1,298,235.96

20 Fir, spruce and beech forests (Abies alba, icea abies, Fagus moesiaca)	34,622.7	12,575,408.6	737,542.00	358,107.10	559,822.84	92,725.63	1,010,655.57
21 Fir and spruce forests (Abies alba, Picea abies)	26,564.0	11,232,625.1	528,122.69	376,943.03	507,490.70	52,540.43	936,974.15
22 Špruce forests (Picea abies)	54,140.3	13,085,182.8	666,436.82	680,340.59	412,253.98	45,078.31	1,137,672.88
23 Austrian pine forests (Pinus nigra)	12,213.4	2,339,135.5	153,914.96	193,753.13	94,514.38	18,478.12	306,745.64
24 Ščots pine forests (Pinus silvestris)	4,971.7	649,099.7	17,899.60	35,777.56	6,344.63	3,011.09	45,133.28
25 Ščots pine and spruce forests (Pinus silvestris and Picea abies)	7,397.6	2,047,120.3	55,279.63	86,994.71	23,009.76	2,004.63	112,009.10
26 Bosnian pine forests (Pinus heldreichii)	10,803.2	2,340,668.8	176,996.86	154,225.59	117,877.27	38,730.63	310,833.48
27 Macedonian pine forests (Pinus peuce)	3,840.5	692,398.8	52,595.73	39,312.03	23,433.74	7,313.13	70,058.91
28 Macedonian pine and spruce forests (Pinus peuce and Picea abies)	4,167.2	1,527,741.7	140,516.31	89,235.02	110,569.90	16,957.01	216,761.93
30 Coastal pine forests (Pinus halepensis, Pinus maritima, Pinus pinea)	1,864.3	273,517.2	22,899.92	47,395.84	7,743.91	5,820.20	60,959.95
31 Juniper forests (Juniperus sp)	298.6	0.0					
32 Birch forests (Betula verrucosa)	5,033.4	281,219.8	5,822.02	10,094.98	7,069.49	2,019.00	19,183.46
33 Forest culture of indigenous species (Pinus nigra and / or Pinus silvestris and / or Picea abies and / or other coniferous species) in habitats where they do not naturally appear, coniferous species	2,000.8	257,426.2	136.46		1,002.01		1,002.01
34 Forest culture of non-native species (Pinus strobus and/or Larix europea and/or Pseudotsuga taxifolia and/or coniferous species)	100.3	2,065.2	0.00	0.0	0.00	0.00	0.0
36 Forest culture of non-native species, broadleaved species	305.0	15,976.5	0.0	0.0	0.0	0.00	0.0
37 Other forests dominated by coniferous species	4,497.3	933,726.0	52,827.40	95,198.83	21,815.32	961.85	117,976.00
38 Other forests dominated by broadleaved species	58,768.5	2,564,107.0	65,140.72	194,375.20	44,011.82	12,901.15	251,288.17
TOTAL	732,519.1	117,433,159.4	5,319,186.29	4,384,256.79	4,107,698.56	957,602.17	9,449,557.52

Source of Data: Ministry of Rural Development and Agriculture (www.minpolj.gov.me), Forest Administration (www.upravazasume.me)
Detailed description of indicators: www.epa.org.me/nli/b03
Reference to international indicators: SEBI 018 (EEA) Deadwood forest

B04 Abundance and dynamics of wildlife populations in hunting areas

Key Question:

What is the level of hunting pressure on wildlife populations in the hunting areas?

Rating of Trends: /

Key Message:

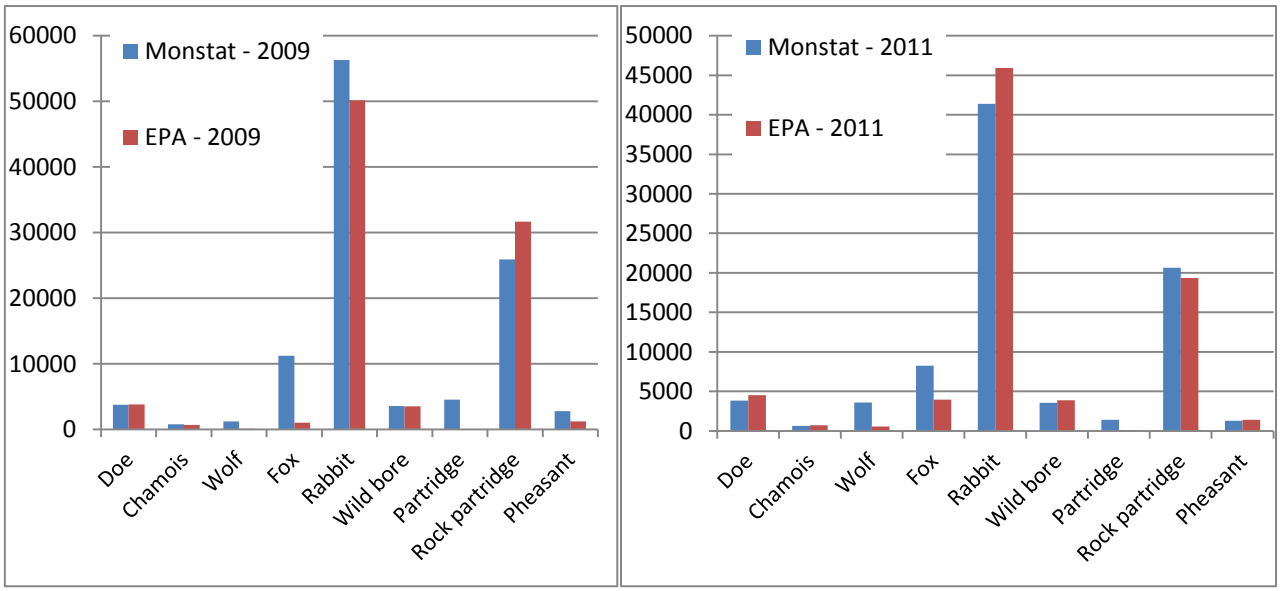
Sustainable hunting is, within predefined limits, a permitted activity that can be carried out for sports and recreational or other purposes. However, often sports and recreational hunting is abused and there is a common occurrence of poaching that takes place outside the hunting areas or in the periods when the hunting is banned. To have an idea about the level of hunting pressure on wildlife populations, it is necessary to have a uniform methodology for assessment of the condition and abundance of wildlife as well as to conduct systematic monitoring. In Montenegro, in accordance with the Law on Wildlife and Hunting ("Official Gazette of Montenegro", 52/08, Article 32) an inventory of hunting areas is kept by the users of hunting areas who provide information to the relevant Ministry, the ministry responsible for environmental protection and other institutions in the field of nature protection, while no uniform methodology for monitoring implementation has been developed yet, and hence the quality of the data is questionable. Also, the statistics in this field is kept by the Statistical Office of Montenegro - MONSTAT.

Impact on Human Health and Ecosystems:

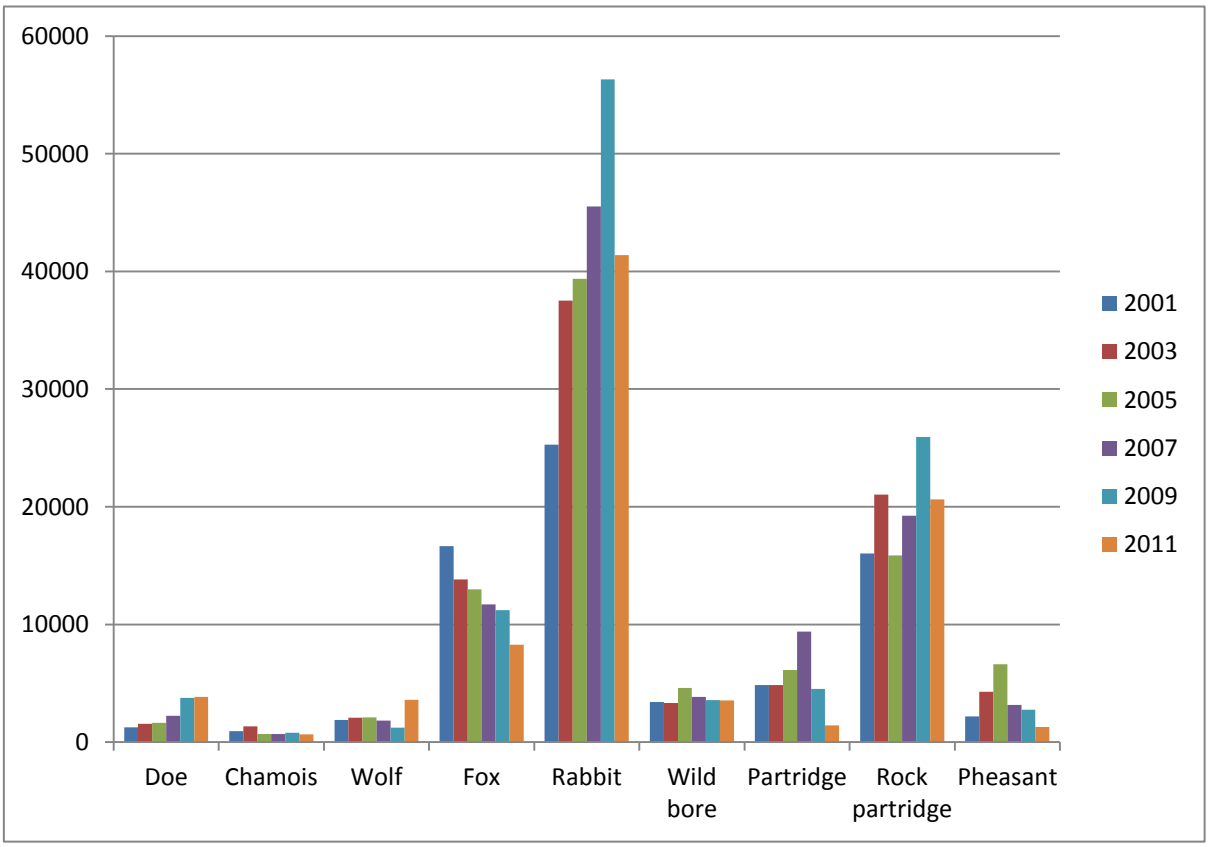
Excessive and unsustainable hunting leads to a reduction and endangering wildlife populations and therefore causes a number of disorders in the natural balance of food chain and therefore of the ecosystem.

Reference Legislation:

Law on Environment ("Official Gazette of Montenegro", 48/08), Law on Official Statistics and the System of Official Statistics ("Official Gazette of Montenegro",18/12), Law on Nature Protection ("Official Gazette Montenegro", 51/08, 21/09), Law on Wildlife and Hunting ("Official Gazette of Montenegro", 52/08).



Graph 75. An overview of comparative data of the Environmental Protection Agency (EPA) and Monstat on the number of wild animals in hunting areas



Graph 76. Game shot in hunting areas in Montenegro, 2001-2011

Indicator Evaluation

From the comparative overview of data of the Environmental Protection Agency and MONSTAT on the number of wild animals for 2009 and 2011, and the table showing the game shot in the hunting areas in 2009 and 2011, the conclusion is drawn that those are inconsistent and arbitrary (often due to inconsistent collection methodology), and as such can not be considered reliable. Moreover, in some cases the number of shot individuals of some species exceeds the declared number of population of the given species. This indicates that the statistics kept by the users of hunting areas is not at the level where a reliable assessment of hunting pressure on wildlife populations in the hunting areas can be provided. The question is whether it is an adequate solution to have this kind of statistics maintained by the users of hunting areas keeping in mind the factor of objectivity. Also there is a clear priority requirement for organizing different aspects of systematic monitoring, using the adopted and harmonized methodology.

Table 33. Comparative overview of data for 2009 and 2011,of the Environmental Protection Agency (**) and MONSTAT (*) on the number of wild animals

Types of Game	2009*	2009**	2011*	2011**
Doe	3751	3822	3832	4536
Chamois	785	706	661	742
Wolf	1233	122	3609	544
Fox	11218	1018	8269	3979
Rabbit	56306	50166	41391	45898
Wild bore	3584	3508	3549	3870
Partridge	4530	60	1410	65
Rock partridge	25928	31653	20636	19336
Pheasant	2768	1230	1278	1400

Table 34. Game shot in the hunting areas in Montenegro, 2001-2011

Types of Game	2001	2003	2005	2007	2009	2011
Doe		1	3	9	7	/
Chamois		3	1	10	10	/
Wolf	375	398	356	167	100	69
Fox	3659	3912	2811	1658	1261	1047
Rabbit	3109	3658	3172	2720	2142	2195
Wild bore	649	1015	1203	842	482	492
Partridge	76	194	64	35		10
Rock partridge	982	1465	805	883	553	571
Pheasant	700	1917	2224	521	247	212

Source of Data: Hunting area users, Environmental Protection Agency (www.epa.org.me), MONSTAT (www.monstat.org)
Detailed description of indicators: www.epa.org.me/nli/b04
Reference to international indicators:/

B05 Non-native and Invasive Species

Key Question:

Is the number of invasive species increasing and which species demonstrate the greatest degree of invasiveness based on distribution?

Rating of Trends: /

Key Message:

Seen on a global scale, after habitat loss biological invasions are considered the main cause of loss of species diversity. Therefore, all relevant documents at the international level recognized the necessity of the measures in this regard so that in the Strategic Plan for Biodiversity for the coming decade ("Aichi Biodiversity Targets"), the Strategic goal B. 9 by 2020 reads: "Invasive alien species and their pathways are identified and the priorities are set, priority species are either under control or eradicated, and measures are introduced to control their roads of introduction, in order to prevent their introduction and establishment."

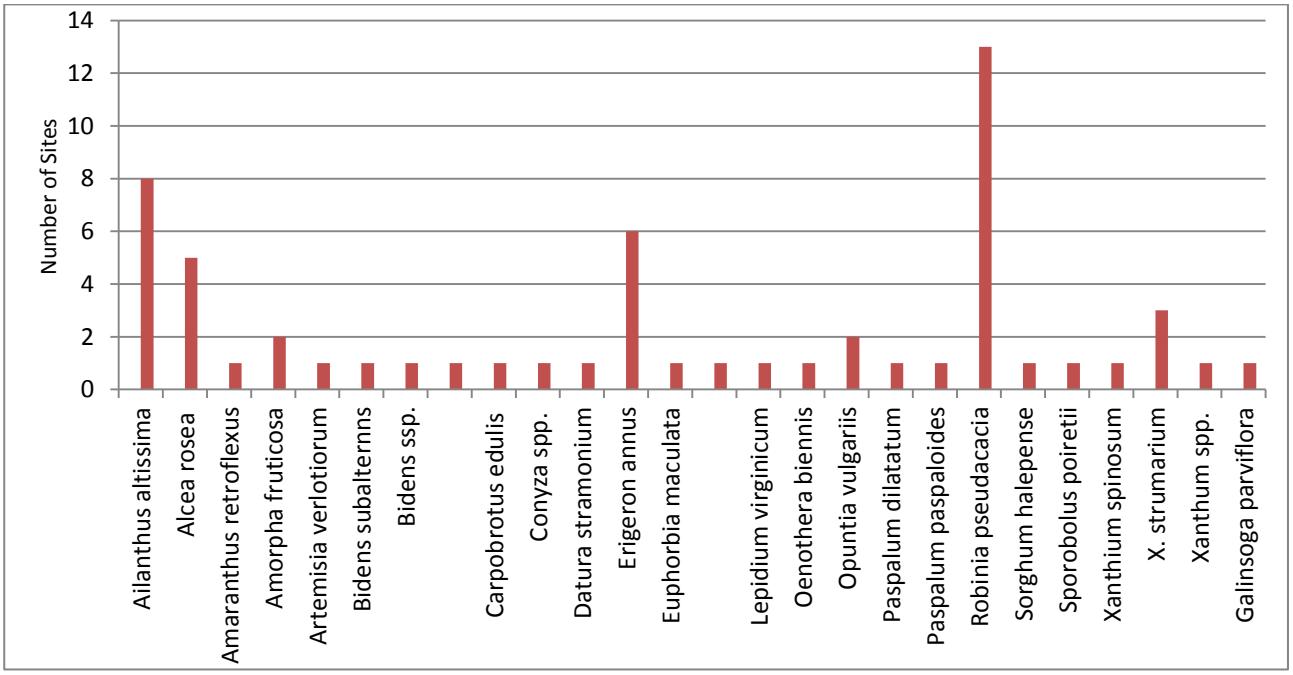
The National Biodiversity Strategy, in the Action Plan - a plan of measures and actions to be taken to protect the biological diversity for 2010–2015, recognized the need for an inventory of invasive plant species as a priority, keeping in mind that no detailed research in Montenegro was undertaken. It is necessary to monitor the trend of spreading, the degree of invasiveness, the method of introduction and population dynamics and take action to be able to meet the above objectives, defined at the international level.

Impact on Human Health and Ecosystems:

The effect of invasive species is usually reflected in the disturbance of the natural balance in the ecosystem where those are introduced, which often leads to the reduction of biodiversity, also often causes damage and reduced economic gain due to reducing the value of land or water, and can also affect human health through the transmission of disease, causing allergic reactions, toxic fruits etc.

Reference Legislation:

Law on Nature Protection ("Official Gazette of Montenegro", 51/08, 21/09), Rulebook on detailed content of the annual program for monitoring the state of nature conservation and the conditions that must be met by the legal entity that monitors ("Official Gazette of Montenegro", 35/10).



Graph 77. The distribution of plant invasive species based on the results of biodiversity monitoring program in 2011 on 22 locations

Indicator Evaluation

So far in Montenegro no systematic research of invasive plant species has been carried out, and yet the data were collected through individual research projects. Therefore there are no precise data on all taxa: their distribution, how much damage was already inflicted to natural ecosystems, which areas are the most vulnerable, etc. According to previous observations in the field, Black Locust (*Robinia pseudacacia*) and tree of heaven (*Ailanthus altissima*) represent the greatest danger. The propagation of these species was observed in the southern and central part of Montenegro. These are woody species and their spread to a greater extent disrupts the structure of natural ecosystems, compared to herbaceous plants. It is important to emphasize that these types of plants used to be planted as ornamental plants or for afforestation of bare land, and were soon spread and incorporated into natural ecosystems. As for herbaceous plants, Alcee rosea leads in terms of the frequency of occurrence and population density. This species is common in the coastal region of Montenegro, but was identified in the north as well. *Carpobrotus edulis* is also pointed out as dangerous, which was not identified in a number of localities (2), but these are fragile ecosystems on the rocks along the sea and on the beach. Species reproduce quickly and in a few years dozens of square meters may be covered. Also, Amorpha fruticosa in the region of Skadar lake is identified as a significant threat and problem.

When it comes to freshwater ecosystems, the invasive species perch and Chinese perch were identified on Skadar Lake and both populations are characterized by a growing trend and the number is very high. Also, the presence of rainbow trout in rivers is noticed, that is introduced in rivers due to non-indigenous fish planting. Of terrestrial invertebrates, *S. Caementarum*, which is present in large numbers on the Montenegrin coast, and *C. Californicum*, which is registered in southern Dalmatia, are noted, and yet as those species usually appear together, due to a specific relationship, a negative impact of the massive expansion of these non-native species can be expected in the Mediterranean and sub-Mediterranean part of Montenegro.

When it comes to marine species, according to the report, on the basis of literary data, a total of nine invasive species was recorded. In the field, during the research of 2008, only *Caulerpa racemosa var. Cylindracea* was recorded. Three species (*Asparagopsis taxiformis*, *Callinectes sapidus* and *Bursatella leachi*) were observed during these field studies, but their photos were documented by Dr. Vesna Mačić. According to the above mentioned report, five species are

considered to be established (stable) in our sea, three occur periodically, while the status of the species *Crassostrea gigas* is unknown, and otherwise this species is entered for aquaculture purposes, i.e. breeding.

Table 35. List and description species identified so far in Montenegro based on literature and field research

Family	Species	Country of Origin	Description
Plants	*Ailanthus altissima*	Asia, South America	The species was introduced in 1971. Invasive species of moderate distribution and frequent occurrence.
	Alce osea	Asia	
	Amaranthus retroflexus	North America	The species was introduced in 1875. Invasive species having an impact on the local biodiversity, of moderate distribution and frequent occurrence.
	Amorpha fruticosa	North and South America	The species was introduced in 1973. Invasive species having an impact on the local biodiversity, of high distribution and frequent occurrence.
	Artemisia verlotiorum	Asia	The species was introduced in 2006. Invasive species having an impact on the local biodiversity, of moderate distribution and frequent occurrence.
	Bidens subalternns	South America	The species was introduced in 1993. Invasive species having an impact on the local biodiversity, of high distribution and high frequency of occurrence.
	Bidens ssp.		
	Broussonetia papyrifera	Asia, South America	The species was introduced in 2005. Invasive species of high distribution and frequent occurrence.
	Carpobrotus edulis	Africa	The species was introduced in 2006. Invasive species of high distribution and high frequency of occurrence.
	Conyza s p.		
	Datura stramonium	North and South America	The species was introduced in 1875. Invasive species of high distribution and frequent occurrence.
	Erigeron annus	North America	The species was introduced in 1972. Invasive species of moderate distribution and frequent occurrence.
	Euphorbia maculata	North America and Canada	The species was introduced in 1979. Invasive species of high distribution and high frequency of occurrence
	Helianthus cf. tuberosus	North America	The species was introduced in 2005. Invasive species of moderate distribution and frequent occurrence
	Lepidium virginicum	South America	
	Oenothera biennis	North America	The species was introduced in 1976. Invasive species of moderate distribution and frequent occurrence
	Opuntia vu gariis	North (South) America	The species was introduced in 2005. Invasive species of moderate distribution and high frequency of occurrence
	Paspalum dilatatum	South America	The species was introduced in 1986. Invasive species of high distribution and high frequency of occurrence.
	Paspalum paspaloides	South America	The species was introduced in 1949. Invasive species of high distribution and high frequency of occurrence.
	Robinia pseudacacia	North America	The species was introduced in 1911. Invasive species of high distribution and high frequency of occurrence.
	Sorghum halepense	East Asia and South America	The species was introduced in 1847. Invasive species of moderate distribution and high frequency of occurrence.
	Sporobolus poiretii	North and South America	The species was introduced in 1998. Invasive species of high distribution and high frequency of occurrence.
	Xanthium spinosum	South America	The species was introduced in 1874. Invasive species of moderate distribution and high frequency of occurrence.
	X. strumarium	North America	
	Xanthum spp.		
	Galinsoga parviflora	North America	The species was introduced in 1968. Invasive species having an impact on local biodiversity, of moderate distribution and high frequency of occurrence.
	Acer negundo	North America	The species was introduced in 2005. Invasive species of high distribution and moderate frequency of occurrence.
	Artemisia annua	Asia	Invasive species of moderate distribution and high frequency of occurrence.
	Asclepias syriaca	America and Canada	The species was introduced in 2005. Invasive species of moderate distribution and high frequency of occurrence.

	Aster squamatus	South America	The species was introduced in 2004. Invasive species of having an impact on local biodiversity, of high distribution and moderate frequency of occurrence.
	Eleusine tristachya	South America	The species was introduced in 1998. Invasive species of high frequency of occurrence and high distribution.
	Cuscuta campestris	South America	The species was introduced in 1997. Invasive species of high frequency of occurrence and high distribution.
	Erigeron bonariensis	South America	Invasive species of high frequency of occurrence and high distribution.
	Erigeron sumatrensis		Invasive species of high frequency of occurrence and high distribution.
	Euphorbia prostrata	South America	The species was introduced in 1984. Invasive species of high frequency of occurrence and high distribution.
	Ligustrum japonicum	Asia	Invasive species of moderate distribution.
	Oenothera glazioviana	South America	Invasive species of high frequency of occurrence and moderate distribution.
	Phytolacca americana	Canada America	Invasive species of moderate distribution and high frequency of occurrence.
	Sporobolus vaginiiflorus	South America	The species was introduced in 2006. Invasive species of high frequency of occurrence and high distribution.
	Sycios angulatus	South America	Invasive species of moderate distribution and frequent occurrence.
	Veronica persica	South -West Asia	The species was introduced in 1900. Invasive species of moderate distribution and frequent occurrence.
	Xanthium orientale L.subsp. italicum	South America	Invasive species of high frequency of occurrence and moderate distribution.
	Amaranthus hybridus	South America	The species was introduced in 2005. Invasive species of high frequency of occurrence and moderate distribution.
	Ambrosia artemisiifolia	South America	The species was introduced in 2009. Invasive species of high frequency of occurrence and high distribution.
	Bidens frondosa	South America	The species was introduced in 2005. Invasive species of high frequency of occurrence and high distribution.
	Chamomilla suaveolens	South America	The species was introduced in 1986. Invasive species of low frequency of occurrence and low distribution.
	Conyza canadensis	South America	The species was introduced in 1874. Invasive species of high frequency of occurrence and high distribution.
	Cuscuta caesattiana	South America	The species was introduced in 1949. Invasive species of high frequency of occurrence and high distribution.
	Eleusine indica	South America	The species was introduced in 1959. Invasive species of high frequency of occurrence and moderate distribution.
	Reynoutria japonica	South America	The species was introduced in 2005. Invasive species of moderate distribution and frequent occurrence.
	Solanum elaeagnifolium	South America	The species was introduced in 2003. Invasive species of moderate distribution and frequent occurrence.
Invertebrates	*Sceliphron caementarium*		S. Caementarum is present in greater numbers on the Montenegrin coast, and C. californicum is registered in southern Dalmatia, and yet as these species usually occur together, due to a specific relationship, a negative impact of the massive expansion of these non-native species can also be expected in the Mediterranean and sub-Mediterranean area of Montenegro.
	Chalybion californicum		Colonization by these species at new locations is always preceded by a successful colonization of S. caementarum, due to the specific relationship that exists between them.
	Arion lusitanicus	Portugal	In 2001, invasive species of frequent occurrence and high distribution.
	Coccus hesperidum	Tropics	Invasive species first registered in 1993. The species is considered to be established.
	Corythucha ciliata	North America	Invasive species first registered in 1998. The species is considered to be established.
	Coccus pseudomagnoliarum	Middle East	Invasive species first registered in 1999. The species is considered to be established.
	Icerya purchasi	Australia	Invasive species introduced in 1950, and registered for the first time in 1953. The species is considered to be established.
	Japananus hyalinus	East Asia	The species is considered to be established.

	Leptinotarsa decemlineata	North America	The species is considered to be established.
	Megastigmus wachtli	Asia	Invasive species first registered in 2002. The species is considered to be established.
	Metcalfa pruinosa	North America	Invasive species first registered in 2003. The species is considered to be established.
	Planococcus citri	Middle East	Invasive species first registered in 1999. The species is considered to be established.
	Pulvinaria floccifera	East Pacific	Invasive species first registered in 1950. The species is considered to be established.
	Saissetia oleae	African tropics	Invasive species first registered in 1952. The species is considered to be established.
	Acizzia uncatoides	Australia	
	Aedes albopictus	Southeast Asia	The species is considered to be established.
	Alphitobius diaperinus	Tropics	Invasive species introduced for the first time in 1921. The species is considered to be established.
	Anagyrus pseudococci	Mediterranean regions	
	Carpophilus bifenestratus		
	Ceratitis capitata		Invasive species introduced for the first time in 1959.
	Chrysomphalus dictyospermi	Tropics	Invasive species first registered in 1953. The species is considered to be established.
	Chymomyza amoena	North America	Invasive species introduced for the first time in 1991. The species is considered to be established.
	Encarsia barlesei	East Asia	
	Glischrochilus quadrisignatus		
	Grapholita molesta	East Asia	Invasive species introduced before 1999 and registered for the first time in 1999. The species is considered to be established.
	Hyphantria cunea	North America	Invasive species introduced before 1999. The species is considered to be established.
	Lyctocoris campestris	Tropical	
	Lyphia tetraphylla	North America	Invasive species introduced before 1945. The species is considered to be established.
	Megastigmus spermotrophus	North America	
	Monomorium pharaonis	South Asia	Invasive species introduced before 1934. The species is considered to be established.
	Neoclytus acuminatus	North America	Invasive species introduced before 1984.
	Nosopsyllus fasciatus	South Asia	
	Pheidole megacephala	Mauritius	Invasive species introduced before 1998. The species is considered to be established.
	Philonthus rectangulus	East Asia	
	Plodia interpunctella		
	Podisus maculiventris		The species is considered not to be established.
	Pristophora laricis		
	Pseudaonidia paeoniae		
	Pulvinaria horii		
	Sceliphron deforme		
	Stictocephala bisonia		
	Toxoptera aurantii (Boyer de Fonscolombe)	Cosmopolitan, tropical, subtropical	Invasive species introduced before 1978. The species is considered to be established.
	Urophorus humeralis		
	Zygogramma saturalis	North America	

Fish	*Perca fluvitillis*		Can be found in all lake habitats, enters the tributaries, the younger age of the class is characterized by extremely high numbers, with a noticeable upward trend and evidently high numbers of youngest categories.
	Carrasius gibelio		Can be found in all lake habitats. Enters the tributaries. Extremely high numbers, the trend is stable.
	Oncorhynchus mykiss		This invasive species is found in all habitats except whirlpools. The population is not numerous. It populated the rivers by non-native fish planting, and this species (line) is not naturally spawn in rivers so that the population has not been established. There is a danger that by such improper fish planting lines that are free spawning in the wild may be introduced into the rivers and establish a population, which would enter into a fierce competition with native brown trout.
Mammals	*Herpestes ichneumon L. - mungos*	Egypt	2006, invasive species of high frequency of occurence.
Marine species phytobenthos	*Caulerpa racemosa var. cylindracea*	South-West Pacific	The species was recorded in the research for the first time in 2004, and then on the basis of literary data in 2005, 2006 and 2008. It is considered to be established. The species is of moderate distribution and frequent occurrence.
	Womersleyella setacea	Indo-Pacific	The species was recorded in the research for the first time in 2003, and then on the basis of literary data in 2008 It is considered to be locally established.
	Asparagopsis taxiformis	Pantropical region	The species was recorded in the research for the first time in 2006, and in 2008 its presence was confirmed during the RAC SPA research. It is considered to be established.
Marine species Invertebrates	*Callinectes sapidus*	West Pacific	The species was recorded in the research for the first time in 2006, and in 2008 its presence was confirmed during the RAC SPA research. It is considered to be established.
	Melibe viridis	Indo-Pacific	The species was recorded in the research for the first time in 2006, and in 2008 its presence was confirmed during the RAC SPA research. It is considered to be established.
	Crassostrea gigas	North-West Pacific	The species was recorded based on literary data in 1976, and since its presence was not subsequently confirmed, the status of the species is not known.
Marine species Fish	*Fistularia commersonii*	Indo-Pacific	The species was recorded for the first time in 2007, and then based on literary data in 2008. It is considered to be intermittent.
	Sphoeroides pachygaster	Tropical Atlantic	The species was recorded for the first time in 2008 and is considered to be intermittent.

Source of Data: The 2011 Report on the State of the Environment, "Assessment of Invasive Species in Montenegro and Albania", developed as a result of the RAC SPA Center research in 2008; the internal database of the Environmental Protection Agency.
Detailed description of indicators: www.epa.org.me/nli/b05
Reference to international indicators: EEA Invasive alien species (SEBI 010), Indicators of Sustainable Development: Guidelines and Methodologies — Third Edition – Biodiversity; United Nations, 2007.

B06 Forest fires

Key Question:

What are the trends in forest fire occurrences in the previous period?

Key Message:

The indicator tracks the number of fires and the size of affected areas. In the period of 2001-2012, the trends in surface areas affected by wildfires were unstable and experienced a drastic deterioration in 2007, 2011 and 2012. Specifically, although in other years areas affected by wildfires ranged in the scale of 1:9, in 2007 it was 38 times higher than in 2001, while in 2011 this area was even 102 times larger what implies need for more intensive development and implementation of preventive and protection measures.

Rating of Trends:

Compared to the previous year

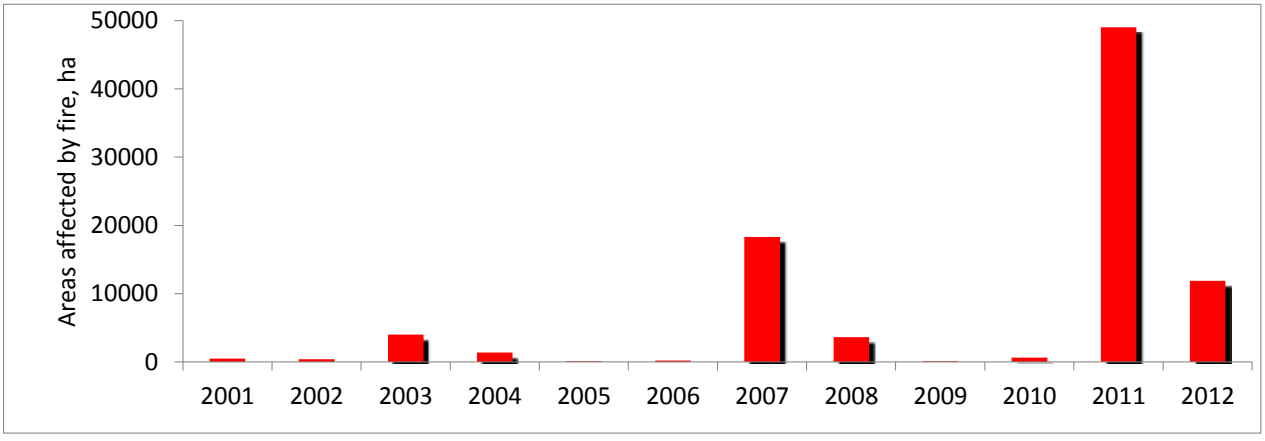
- Compared to 2005
- Compared to 2000

Impact on Human Health and Ecosystems:

Forest fires cause a number of adverse effects on the environment: loss and degradation of habitat, erosion, increasing emissions of carbon dioxide, the vulnerability of human life and health, the disappearance of plant and animal species, etc. Fires also negatively affecting the agriculture and tourism.

Reference Legislation:

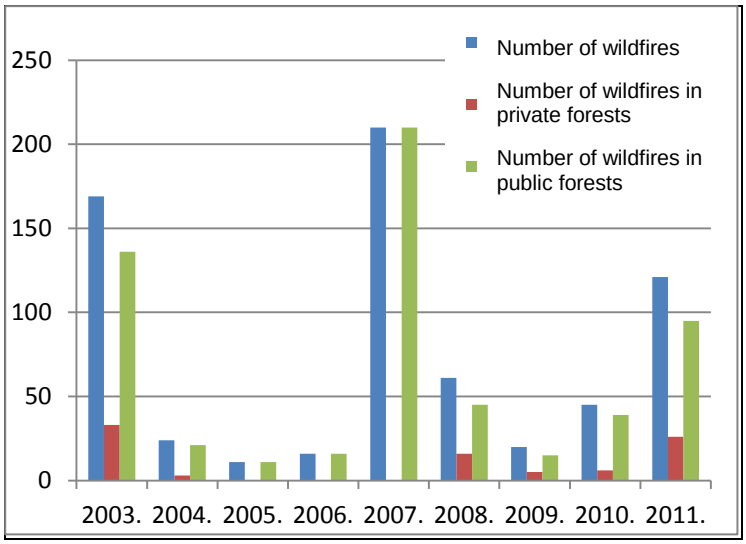
Law on Environment, Law on Official Statistics and the System of Official Statistics, Law on Nature Protection, Law on Forests.



Graph 79. Forest fires in Montenegro – areas affected by fire, 2001-2012

Indicator Evaluation

An unstable trend in the number and surface area affected by forest fires is obvious for the period 2001-2011. Generally, an increase in the number of forest fires may be due to an increase in mean annual temperature, higher number of tropical days in a row as well as the increasing number of tourists and the reduction of financial resources in the field of fire protection and training for the prevention of forest fires.
The fact that in 2011 even 3.5% of the national territory was affected by wildfires sufficiently speaks in favor of the opinion that it is necessary to undertake significant measures regarding environmental policy both in terms of prevention and in the implementation of repressive measures against those who start wildfires, when caused by the human factor.



Graph 80. Forest fires in Montenegro – number of wildfires, 2001-2011

Table 36. Forest fires in Montenegro, statistics for the period 2003-2012

Year	Total area affected by fire (ha)	The share of forest area affected by fire (%)	Total area affected by fire in private forests (ha)	Total area affected by fire in public forests (ha)	Number of fires	Number of fires in private forests	Number of fires in public forests
2003	3645	0.48	2345	1300	169	33	136
2004	550	0.07	2	547	24	3	21
2005	65	0.01		65	11		11
2006	195	0.03		159	16		16
2007	5840	0.8		5840	210		210
2008	2333	0.3	1613	719	61	16	45
2009	88	0.02	42	46	20	5	15
2010	695	0.09	212	482	45	6	39
2011	49009	6.6	44947	4062	121	26	95
2012	11858	1.59					

Source of Data: Data for the period 2003-2012 are taken from the Forest Administration, Ministry of Agriculture and Rural Development (www.minpolj.gov.me)
Detailed description of indicators: www.epa.org.me/nli/b06
Reference to international indicators: /

B07 Designated Areas

Key Question:

Is the size of protected areas in Montenegro increasing?

Key Message:

The national network of protected areas now covers 124,964.24 hectares, or 9,047% of the territory of Montenegro, of which the largest part (101.733 ha or 7.77%) consists of five national parks: NP "Durmitor", NP "Skadar Lake", NP "Lovćen", NP "Biogradska gora" and NP "Prokletije". The remaining part covers more than 45 protected areas in the following categories: natural monument, an area of unique natural features and (general and specific) reserves.

Rating of Trends:

- Compared to the previous year
- Compared to 2005
- Compared to 2000
- Compared to 1990

The international protected areas include the Tara river basin, M&B UNESCO Biosphere Reserve, including the NP Durmitor with the Tara River Canyon (182 889 ha), the National Park "Skadar Lake" – Ramsar site (List of Wetlands of International Importance, especially as habitat for waterfowl - 20,000 ha), Tivat Salina, also Ramsar site (150 ha), Kotor - Risan bay, the Municipality of Kotor (UNESCO - 15,000 ha).

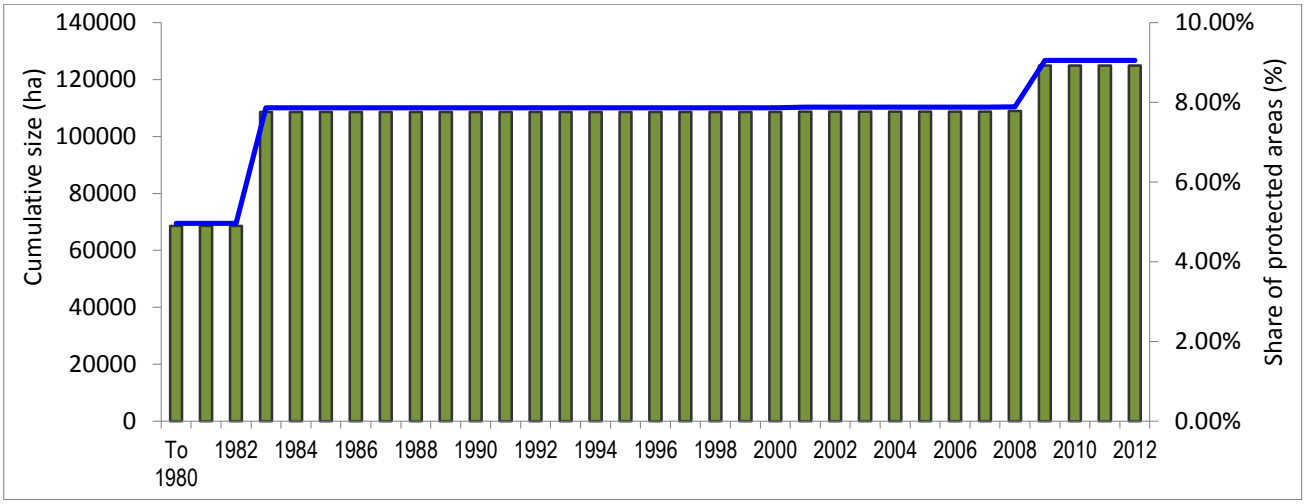
The National Biodiversity Strategy and the National Strategy for Sustainable Development established the objective of extending the protected nature areas to 10% of the terrestrial territory and to protect 10% of the marine area. Likewise, at the international level, a unique goal was established by the Secretariat of the Convention on Biological Diversity by 2020, which indicates that in the coming period some intensive activities have to be carried out towards improving the trend of declaration of designated areas and creating a coherent ecological network in Montenegro, especially bearing in mind the high level of biodiversity index and the necessity to review the current system of designated areas as regards their full adequacy in terms of covering important habitats and species that are of interest to the European Community (Natura 2000) and in relation to the importance of protecting some significant habitats and species at the national level.

Impact on Human Health and Ecosystems:

Protected areas, in addition to their primary function related to the adequate protection of habitats and species, and therefore the ecosystem as a whole, represent areas that encourage the development of sustainable tourism and by protecting them provide sustainable use of ecosystem services that are primarily manifested through the functions of mitigating climate change and disasters, maintaining the quality of water and water supply sources, preservation of cultural values and areas for recreational activities, and maintenance of landscape role of space, historical and traditional values, etc.

Reference Legislation:

Law on Environment ("Official Gazette of Montenegro", 48/08); Law on Nature Protection ("Official Gazette of Montenegro", 51/08, 21/09); Rulebook on the types and criteria for determining habitat types, the method of preparing maps of habitats, methods of monitoring the status and threat of habitats, the content of annual reports, measures of protection and preservation of habitat types ("Official Gazette of Montenegro", 80/08).



Graph 81. The cumulative size of protected areas in Montenegro to 2012

Indicator Evaluation

The trend of increasing protected areas can be characterized as unstable, primarily due to the evident stagnation in the period of 1983-2009. Specifically, the size of protected areas in this period increased slightly. Since the protected areas, in this period, were relatively modest areas and as a such did not significantly contribute to increasing the share of nationally protected natural areas compering with total territory of Montenegro. The proclamation of the National Park "Prokletije" in 2009 made a significant contribution to the increase of protected areas but still insufficient to meet the established national and international objectives. After 2009, stagnation in proclaiming new protected areas was again recorded. Particularly, it is necessary to note that Montenegro is the only country in the Mediterranean which has no protected marine areas. In the future, the Regional Parks of Piva and Komovi will clearly be designated whereby the goal of 10% of the protected territory of Montenegro will be achieved. Certainly, in the following period, it is necessary to intensify activities to designate protected areas in Montenegro.

Table 37. Cumulative surface of protected areas in Montenegro until 2012

Year	Total cumulative size of protected areas (ha)	Total national territory (ha)	Protected areas (%)
Until 1980	68588	1381200	4.97%
2001	108784	1381200	7.88%
2008	108934	1381200	7.89%
2009	124972	1381200	9.05%
2010	124972	1381200	9.05%
2011	124972	1381200	9.05%
2012	124972	1381200	9.05%

Source of Data: Data for the period 1981-2012 were obtained from the Register of Protected Areas of the Environmental Protection Agency www.epa.org.me
Detailed description of indicators: www.epa.org.me/nli/b07
Reference to international indicators: EEA CSI Designated areas 008, Environmental indicators and indicator-based assessment reports Eastern Europe, Caucasus and Central Asia, United Nations, New York and Geneva, 2007- Protected areas.

MARINE ECOSYSTEM

The sea, as part of the environment, is an area in which the oldest living communities developed. Marine ecosystem has become significant both economically and as an environmental resource. Nevertheless, this ecosystem is threatened by human activity, primarily by the pollution caused by wastewater discharge, over-fishing, climate change, the introduction of invasive species, as well as the growing number of tourists who come during the summer, as well as the careless attitude of the population living along the coast. Marine organisms have a high tolerance to gradual changes in the environment (through adaptation, acclimatization and evolution) - however, this must not be misused, because certain species are facing extinction.

The coastline of Montenegro is 300 km long, including 6 municipalities (Ulcinj, Bar, Budva, Tivat, Kotor and Herceg Novi) with a total population of 117,819 inhabitants (according to the census of 2011), which is 19% of the total population of Montenegro. Since Montenegro does not have a rugged coastline, the number of islands in the Adriatic Sea is small, 13 in total, with 9 islands in the Boka Kotorska Bay, while the other four are located along the southern coast. Samples of seawater and sediment samples are taken from 26 locations, covering all the municipalities on the Montenegrin coast. Tests are carried out in accordance with the requirements of the European Environmental Agency and MEDPOL, which relies on the recommendations of the Barcelona Convention.

The Regulation on the National list of environmental indicators includes six indicators that relate to the marine ecosystem, and yet since the monitoring of marine ecosystem began in 2008, there is no trend that would describe the existing situation in this segment of the environment. For this reason, this report includes only the indicator that shows the degree of eutrophication, TRIX index. After developing the methodology for calculating the remaining five indicators, it is expected that the following reports will include the remaining indicators of the state of marine ecosystems.

M04 Trophic Index (TRIX)

Key Question:

Is there any progress, i.e. decrease in the level of eutriphication of transitional, coastal and marine waters?

Key Message:

Data for this indicator are available for the period 2009-2011. Trophic status depends on the availability of nitrogen and phosphorus for primary production, in terms of determining phytoplankton biomass and oxygen saturation. Classification of the coastal area was done according to the trophic Index TRIX, which distinguishes four classes according to the degree of eutrophication: oligotrophic – good, mesotrophic - fair, eutrophic – poor and extreme eutrophic - very poor.

Rating of Trends:

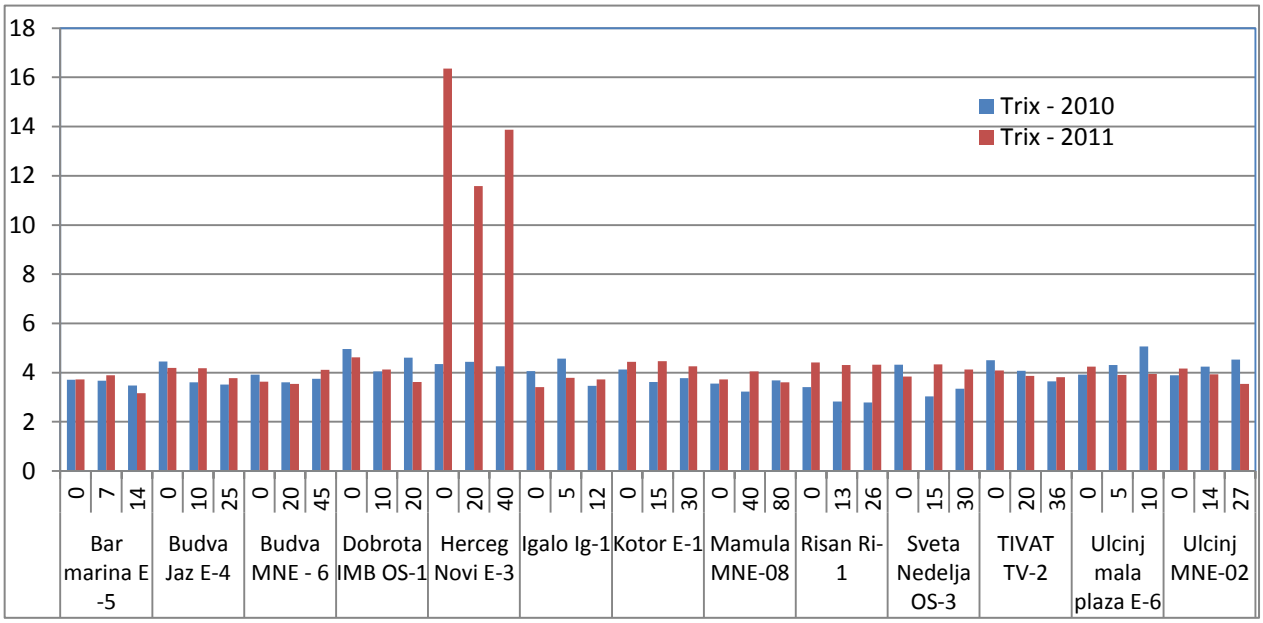
- Compared to the previous year 

Impact on Human Health and Ecosystems:

Occasional rapid increase in phytoplankton ("algal blooms") is a natural phenomenon, but it can also be a consequence of anthropogenic pollution due to increased intake of nutrients into the sea, directly or by watercourses. Blooms of certain phytoplankton species is characterized by the production of large amounts of mucus, which makes the sea unpleasant for bathing, but are not harmful to human health. However, some groups of phytoplankton release toxins that accumulate in marine organisms, and their consumption through the food chain (e.g. shellfish) may threaten human health.

Reference Legislation:

Law on Environment ("Official Gazette of the Republic of Montenegro", 40/10), Law on Official Statistics and the System of Official Statistics ("Official Gazette of Montenegro", 18/12).



Graph 82. Trix Index, 2010-2011

Indicator Evaluation

Information provided in the graph shows the results in 2010 and 2011, because the tests for 2009 were carried out only in the months of April and October, and based on the little information that we have it is difficult to make an assessment, because there is no trend of 5 years or more.
The TRIX index below 2 is usually related to the open sea and the low production of phytoplankton, and over 6 a very productive coastal sea. Values around 4 are typical of low-productive seas. The graph above shows that the TRIX index values are about 4 and we can say that this is an average value for the Adriatic Sea. However, on the basis of available data, the average value for 2009 was a little over 6 which was unusual for our sea, but the explanation for this may lie in the fact that in the summer of 2009 "sea blooms" were recorded.

Table 38. Trix Index values

		Bar marina E -5			Budva Jaz E-4			Budva MNE - 6			Dobrota IBM OS-1		
Depth (m)		**0**	**7**	**14**	**0**	**10**	**25**	**0**	**20**	**45**	**0**	**10**	**20**
Year	**2010**	3.71	3.67	3.47	4.45	3.6	3.51	3.92	3.6	3.75	4.96	4.04	4.61
	2011	3.72	3.9	3.17	4.2	4.18	3.78	3.64	3.54	4.12	4.63	4.13	3.62
		Kotor E-1			**Mamula MNE-08**			**Risan Ri-1**			**Sv. Nedelja OS-3**		
Depth (m)		**0**	**15**	**30**	**0**	**40**	**80**	**0**	**13**	**26**	**0**	**15**	**30**
Year	**2010**	4.12	3.62	3.78	3.56	3.23	3.68	3.41	2.83	2.79	4.32	3.03	3.34
	2011	4.44	4.46	4.26	3.72	4.05	3.6	4.41	4.31	4.33	3.85	4.33	4.13
		Herceg Novi E-3			**Igalo Ig-1**			**Tivat TV-2**			**Ulcinj m. plaza E-6**		
Depth (m)		**0**	**20**	**40**	**0**	**5**	**10**	**0**	**20**	**36**	**0**	**5**	**10**
Year	**2010**	4.34	4.44	4.25	4.06	4.57	3.46	4.5	4.07	3.64	3.91	4.31	5.06
	2011	16.36	11.58	13.87	3.41	3.79	3.373	4.09	3.87	3.82	4.25	3.91	3.94

Source of Data: Environmental Protection Agency (www.epa.org.me)
Detailed description of indicators: www.epa.org.me/nli/m04
Reference to international indicators: UNEPMAP, MEDPOL