Palacký University Olomouc
Faculty of Science
Department of Development and Environmental Studies

Bc. Darya Marusyk

Analysis of environmental aid to post-soviet countries of Eastern Europe

Diploma thesis

Supervisor: Doc. Mgr. Zdeněk OPRŠAL, Ph.D.

Olomouc, 2022

I hereby declare in lieu of oath that I wrote this diploma thesis by myself. All information derived from the work of others has been properly acknowledged in the text and in the list of references.

Olomouc, 2022

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Bc. Darya Marusyk

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The thesis deals with the issue of environmental burden as a result of communist regimes in the Post-Soviet countries of Eastern Europe after the collapse of the Soviet Union. The work will include identification and assessment of suitable indicators of environmental aid. Attention will be also paid to the correlation of the volume of environmental aid and selected variables.

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L.S.

doc. RNDr. Martin Kubala, Ph.D.
děkan

doc. RNDr. Pavel Nováček, CSc.
vedoucí katedry

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Abstract

During the 70 years of communist rule, the former Soviet Union was ready to sacrifice the well-being of the environment and the health of its citizens in order to gain military and economic power. The question of the environment was always secondary to Soviet governance. Now the USSR is in the past, the successor states have been independent for 31 years already and have carried the environmental burden of the Soviet regime. The diploma thesis focuses on the state of the environment of the post-soviet countries of Eastern Europe and environmental assistance to these countries. The chosen countries are Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine. After the collapse of the Soviet Union, these states strongly required environmental assistance from the developed countries and the involvement of the general public in solving ecological problems. The author gives information about the state of the environment in the observed countries before and after the collapse of the USSR. Specifically, talks about the air, water, land, waste, Chornobyl and other issues that were present during the Soviet period. Attention is also paid to the volume of general environmental protection aid and the implemented projects in the chosen countries.

Key words: Environment, USSR, Armenia, Azerbaijan, Belarus, Georgia, Moldova, Ukraine, environmental aid, pollution.

Abstrakt

Během sedmdesáti let komunistické vlády byl bývalý Sovětský svaz připraven obětovat své životní prostředí a zdraví svých občanů, aby získal vojenskou a ekonomickou moc. Otázka životního prostředí byla pro sovětské vládnutí vždy sekundární. Nyní je SSSR v minulostí, nástupnické státy jsou již jedenatřicet let samostatné a nesou ekologickou zátěž sovětského režimu. Diplomová práce se zaměřuje na stav životního prostředí postsovětských zemí východní Evropy a environmentální pomoc těmto zemím. Vybranými zeměmi jsou Arménie, Ázerbájdžán, Bělorusko, Gruzie, Moldavsko a Ukrajina. Po rozpadu Sovětského svazu tyto státy pevně potřebovaly environmentální pomoc vyspělých zemí a zapojení široké veřejnosti do řešení ekologických problémů. Autor podává informace o stavu životního prostředí ve sledovaných zemích před rozpadem SSSR a po něm. Konkrétně se hovoří o vzduchu, vodě, půdě, odpadech, Černobylu a dalších problémech, které byly přítomny během sovětského období. Pozornost je také věnována objemu obecné pomoci na ochranu životního prostředí a realizovaným projektům ve vybraných zemích.

Klíčová slova: Životní prostředí, SSSR, Arménie, Ázerbájdžán, Bělorusko, Gruzie, Moldavsko, Ukrajina, environmentální pomoc, znečištění.

List of Abbreviations

CRS	Creditor Reporting System
DAC	Development Assistance Committee
DDT	Dichlorodiphenyltrichloroethane
EPA	Environmental Protection Agency
EPI	Environmental Performance Index
EU	European Union
GDP	Gross domestic product
GNP	Gross national product
IAEA	International Atomic Energy Agency
IUCN	International Union for Conservation of Nature
NGO	Non-government organization
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
PPP	Public-Private Partnerships
SNMI	Sustainable Nitrogen Management Index
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USA	United States of America
USSR	Union of Soviet Socialist Republics
WHO	World Health Organization

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Introduction

With the development of civilization and scientific and technological progress, the rapid growth of the population, the volume of production, and subsequent pollution - the problem of relations between nature and society is becoming sharper. Famine, poisoned rivers and seas, harmful air in large industrial centres, loss of forests, hundreds of extinct species of animals and plants, erosion, the threat of climate anomalies, and almost complete depletion of soils in agricultural areas have become a horrible reality in many places. Because everything in our life depends on natural environment: the water that people drink, the air that people breath and even people's nutrition – the elimination of the global ecological crisis is one of the most important tasks of humanity.

Today, environmental issues are often highlighted among the global priorities of the world community. Awareness that the preservation and improvement of the environment are essential for sustainable development, quality of life, and the future of our civilization, is firmly established on the international agenda. In my thesis, I am not going to focus on the entire world, but just a part of it. I aim to explore the issue of environmental burden as a result of communist regimes, provide an overview of environmental situation in each selected country after the collapse of the Soviet Union, analyse and compare the environmental aid to post-soviet countries of eastern Europe.

In post-soviet countries, environmental protection requirements have traditionally been ignored. Excessive exploitation and improper management of natural resources pose a great threat to the environmental potential of these countries. *"For seventy years, the notion of development and progress in the Soviet Union was symbolized by the factory with its chimneys thrust into the sky, pumping out fulsome clouds of smoke. These clouds, always streaming out of the picture, evoked images of productivity and output. History has now shown that many of the achievements of the Soviet economy were never more than images. The smoke, however, was real."* (Peterson, 1993:1)

Methods and objectives

The purpose of this thesis is to characterize the issue of environmental burden as a result of communist regimes in the Post-Soviet countries of Eastern Europe after the collapse of the Soviet Union and evaluate the volume of environmental aid to these states. Six countries were chosen for the thesis: Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.
In order to achieve the aim of this thesis, the author should answer the following research questions:

- How did the Soviet Union regime impact the environment?
  - The situation with air in USSR
  - The situation with the waters
  - The situation with land
  - The question of hazardous waste
  - The problem of Chornobyl
- What environmental challenges were there after the collapse of the Soviet Union in the selected countries?
- What was the volume of environmental aid for the chosen countries?
  - Which projects were implemented?
- Comparison of total flows into countries during the selected period
- Comparison of environmental aid per capita

In order to answer these questions, the author is making literary research and data analysis. English, Ukrainian and Russian language sources were used.
Troubled Lands: The Legacy of Soviet Environmental Destruction by Peterson (1993) was one of the main sources for the second chapter of the thesis because he perfectly describes and gives an idea of the ecological situation of the times of the USSR. Peterson focuses on the main environmental issues such as air, water, land, waste etc. and provides explanations of the main problems in the USSR. Therefore, it is a significant source for the second chapter. Further important sources are "Communism and Environment" by Weiner (2017) and "Environmental Status Reports:1990 of USSR" by the IUCN East European Programme. Data from OECD Creditor Reporting System were used for calculating the total amount of aid, for comparing the flows between the years and countries and for the subsequent charts and tables. There was also information available about the implemented projects for each year. Environmental Performance Index 2020 provided information about the countries' scores and rankings on different issue categories. The World Bank's and United Nations' sources were used for maps, reports and Sustainable Development Goals country profiles, which also provided some information for the following charts and tables.

There are four main chapters of the thesis. The first chapter describes the selection of countries for the thesis and some similarities they have. The second chapter is dedicated to the issue of environmental burden as a result of the Soviet Union's government. There is presented a general review of the environmental issues of the Soviet Union with an emphasis on air, water resources, land resources, hazardous waste and Chornobyl. Tables indicating the cities with the worst air quality, atmospheric pollution emissions and wastewater treatment information are provided. The negative consequences of the Chornobyl disaster - its economic, environmental and health damages are defined. The situation prior to the collapse of the USSR is also described.
The third chapter includes a brief general overview of the selected countries and their environmental problems. The chapter also contains tables and charts comparing the countries' indicators like the proportion of the population using safely managed drinking water services, wastewater treatment, hazardous waste, environmental performance index scores, carbon dioxide emissions, agricultural nitrous oxide and methane emissions and their changes between the years.
The fourth chapter mostly talks about the chosen indicator of environmental aid and compares the number of flows to the countries. It also includes information about the main goals of the projects for which funds were allocated. There are also tables and charts for better visualization and understanding of the total flows and aid per capita.

1. Selection of countries (non-EU post-Soviet states)

The former Soviet Union consisted of fifteen states. Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan and Kyrgyzstan in Central Asia; Georgia, Armenia and Azerbaijan in Caucasus; Russia; Baltic republics - Estonia, Latvia and Lithuania; Belarus, Ukraine and Moldova. In this thesis the author is dealing with the environmental issues of the Post-Soviet developing countries of Eastern Europe and the following countries were selected: Ukraine, Belarus, Moldova, Georgia, Armenia and Azerbaijan.

There are different definitions of Eastern Europe. According to the United Nations Statistics Division (2021) classification and definition of regions, in Eastern Europe there are only four countries, which were included in the former Soviet Union, which are: Ukraine, Belarus, Republic of Moldova and Russian Federation. However, according to Potrebny et al. (2017), European subregions defined by EuroVoc include Georgia, Armenia and Azerbaijan in the Eastern Europe subregion.

It can be also said that the participant countries of the Eastern Partnership were chosen. All of the chosen countries are the participants of the Eastern Partnership, which is "*a joint policy initiative which aims to deepen and strengthen relations between the European Union, its Member States and its six Eastern neighbours: Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine*". The main issues of the partnership are divided into four thematic platforms: 1. Institution building and good governance; 2. Economic development and market opportunities; 3. Connectivity, energy efficiency, environment and climate change; 4. Mobility and interpersonal contacts. (European Commission, 2022) In 2011, dynamic cooperation has been established within the framework of the Eastern Partnership (Panel - Environment and Climate Change) on "Promoting the Green Economy in the Eastern Partnership Countries" (Ministry of Environment Protection of Georgia, 2012). In a wider context, the Eastern Partnership also supports the delivery of key global policy goals set by the UN 2030 Sustainable Development Goals and the Paris Agreement on Climate Change (EU Neighbours East, 2022).

All the six states have now been independent for 31 years, since 1991. These countries also fall into the group named "counties in transition". According to the World Bank (2004), the collapse of the Soviet Union is often referred to as a transition period. The term transition was used for countries that were transforming from centrally planned to market-based economic systems. This period is known for problems associated with deep economic distortions, significant market disruptions, the absence of trade institutions and the falling GDP at the beginning of the period. In the countries of the former Soviet Union, the decline was much worse than expected: at the beginning of the period, GDP fell by an average of more than 40%. Furthermore, poverty and inequality in these countries have increased.

Another common feature of these countries is that they all fall into the group of middle-income countries. To specify, Armenia, Azerbaijan, Belarus, Georgia and Moldova are classified as upper middle income and only Ukraine is classified as a lower middle-income country. (World Bank, 2022a)

2. The issue of environmental burden as a result of communist regimes

This chapter will provide an overview of the environmental issues of the Soviet Union and will also attempt to identify the roots of the main problems caused to nature. During the 70 years of communist rule, the former Soviet Union was ready to sacrifice the well-being of the environment and the health of its citizens in the rush for military and economic power. A pursuit for economic growth has polluted the air and water, intoxicated the land with toxic waste and radioactive fallout and ruined the country's farms. All this time, the truth about what was happening to the environment remained a secret, which was overshadowed by the victories of Soviet development. *"For seven decades, the system held. Soviet leaders congratulated themselves on pushing their country to the forefront of the world's industrial and military powers. Because success was measured in terms of output, there was much to celebrate: The USSR boasted that it was the world's largest producer of crude oil, natural gas, iron, steel, nickel, rubber, fertilizer, and tractors. Moreover, tanks, warplanes, and rockets rolled off assembly lines by the thousands. Soviet physicists designed nuclear reactors to power their cities and a fleet of submarines and icebreakers. In an extraordinary effort to overcome the challenges of nature, engineers threw dams across the strongest rivers, cut irrigation canals through the desert, and forced railway lines across the frozen tundra."* (Peterson, 1993:16)

The government of the former Soviet Union was aware of the significance of power generation since the rise of the Soviet regime. The former regime strongly advocated the use of science and large-scale technology in order to transform nature. In spite of the significant damage caused by World War II, the former Soviet Union still tried to be a competitor with Western countries and build its economic system based on heavy industry. (Thomas et al., 2013) Enormous hydroelectric dams, such as the Dnieperstroi, helped to create "visible symbols of communist progress". Biologists who alerted authorities of the negative impacts of these projects on fisheries and other biotas, and engineers who claimed that smaller heat plants would be more cost-effective, were ignored or suppressed. (Weiner, 2017)

For several decades, the Soviet government has consistently devoted a huge share of its resources to building a large military-industrial complex in the country, ignoring the most important environmental problems and resisting the interventions of any environmental interests. As a result, excessive militarization and defence activities have proved to be one of the most harmful to the environment. Not only groundwater was contaminated by industrial solvents used in the aerospace industry, but also by radioactive and poisonous contamination due to hazardous storage and disposal of chemical, biological and nuclear weapons. (Peterson, 1993) In a continuous arms race, it was difficult to achieve both economic growth and sustainable development. (Thomas et al., 2013) Unfortunately, with this way of thinking, the environment has always been on the losing side. Other authors also admit that attitude towards nature was consumeristic. Josephson (2007:297) mentions that experts and planners considered nature as a "commodity machine" and applied large-scale practices to its modification in order to quickly and cheaply produce various goods. He also describes that as in most countries that have moved to large-scale industrialization, Soviet officials considered centralized technological systems to be the most effective way to

control natural resources. They firmly believed that in order to achieve a prosperous communist society with well-lit factories and cities, they would need coal, oil, steel, cement, and other products in huge amounts. "*A mindset of victory over nature and perceived human enemies predominated during the great industrialization drive*"(Josephson, 2007:301). Shelton (2003) mentions that the most frequent attitudes of the USSR were: to make everything big and keep everything secret, to comply with production quotas at all costs, to reward many for achievements and not blame anyone for failures. Moreover, even in the Constitution of the USSR, which was adopted in 1936, natural resources were considered exclusively as resources for improving the living standards of the population and developing the economic situation of the state, the environmental issue was not even taken into account (Yakovlev, 2020:26).

2.1. Air

Air pollution was at the top of the list of environmental problems in the Soviet Union. The Supreme Court of the USSR (1989) noted that the country was in an alarming and sometimes crisis-ridden environmental state and that, despite adopted measures, work on the country's ecological recovery was unsatisfactory. The Supreme Court also mentioned that the situation with air pollution was alarming: in 103 cities with a total population of about 50 million people, the concentrations of harmful substances in the air exceeded the maximum allowable limits by ten times or more, therefore damaging the human respiratory system and impeding plant growth.

Robinson (1988:359-360) reported that despite lower production in the USSR than in the United States, the USSR produced about the same amount of air pollution as its main competitor: "*the USA and USSR lead the world in carbon emissions from fossil fuels: in 1967 the USA released 1,224 million tons of carbon (2.28 tons/person; 276 grams per dollar GNP) and the USSR released 1,074 million tons of carbon (1.62 tons/person; 427 grams per dollar GNP)*". And according to Hill (1997:248), the European region of the former Soviet Union was the highest source of sulfur dioxide emissions on the European continent during 1980 and a significant emitter of nitrogen oxide emissions during 1987.

The size of the Soviet economy, as well as its focus on heavy industry and militarization, have influenced its considerable role in global environmental issues. In 1989, the Soviet Union was accountable for emitting 18% of the world's carbon emissions from energy production that year, ranking second in the world in terms of global pollutants. And their opponent, the USA, took first place, making 22% that year. (Peterson, 1993:36) The rapid industrialization of the USSR after World War II led to the emergence of large numbers of polluters, such as producers of steel and chemicals. Since then, industry has not been modernized and no effective means of pollution management have been established. (French, 1991) Considering the fact that the USSR had a tendency to allow ageing and the dilapidation of the industrial infrastructure, by the end of the 1980s most of the main elements were in poor condition, outdated, overburdened with taxes and badly maintained. Moreover, 40% of the economy's physical enterprises were depleted and almost unusable. As a consequence, reports of breakdowns or explosions came more and more often, such as derailed trains dumping dangerous goods; leaking of storage tanks, leading to escape of toxic waste; and failure of the sewage systems, pouring untreated waste into rivers and lakes. (Peterson, 1993:10)

According to Shahgedanova and Burt (1994), from 1988 to 1991, most of the electricity consumed in the USSR was produced by large central power plants, which were combined into regional networks and then into a single all-Union electric power system. In order to reduce transportation costs, Soviet planners tried to locate industries near the local natural resources they were going to make use of. This has resulted in several environmental pressures being crammed to a compact territory, which has led to the formation of large areas with catastrophic air quality. Regions with particularly poor air quality include Ukrainian industrial centres like Donetsk, Kryvyi Rih and

Dnepropetrovsk (now Dnipro), the Moscow region, the coast of the Sea of Azov, the northern coast of the Caspian Sea and the North Caucasus.

Table 1: Atmospheric pollution emissions for selected cities in 1987

City	Total (thousands of metric tons)	Source of Emissions in %	
		Transport	Stationary
Ashkhabad (Turkmenistan)	46	87	13
Vilnius (Lithuania)	97	62	38
Tallinn (Estonia)	108	62	38
Dushanbe (Tajikistan)	114	67	33
Kishinev (Moldova)	133	68	32
Riga (Latvia)	138	71	29
Bishkek (Kyrgyzstan)	163	46	54
Alma-Ata (Kazakhstan)	213	77	23
Minsk (Belarus)	235	53	47
Yerevan (Armenia)	248	71	29
Tbilisi (Georgia)	312	87	13
Kyiv (Ukraine)	327	71	29
Donetsk (Ukraine)	328	41	59
Tashkent (Uzbekistan)	362	86	14
Dnepropetrovsk (Ukraine)	444	28	72
Baku (Azerbaijan)	788	38	62
Novokuznetsk (Russia)	949	6	94
Temirtau (Kazakhstan)	1 018	2	98
Moscow (Russia)	1 211	70	30
Kryvyi Rih (Ukraine)	1 369	6	94
Norilsk (Russia)	2 426	1	99
Munich (1975)	213	27	73
Mexico City	5 027	80	20

Source: modified from Peterson, 1993

Note: highlighted cities are the cities in the selected countries

According to Peterson (1993), none of the major cities in the former Soviet Union have been able to avoid air pollution problems, as all of them were unsuccessful in acting in accordance with

standards for suspended particulate matter, nitrogen dioxide, ammonia, and phenol. Ukrainian cities Dniprodzerzhynsk (now Kamianske), Donetsk, Kommunarsk (now Alchevsk), Mariupol, Odesa and Zaporizhzhia, Georgian Rustavi and Zestafoni, and Armenian Yerevan are included in the list of the 30 cities that scored the worst air quality over the period 1985–1989 among the cities in the USSR. Also, in 1990, the annual level of three or more pollutants surpassed the daily norm in such cities as Yerevan, Kyiv, Kutaisi, Mogilev and others (Shahgedanova and Burt, 1994).

Table 2: Cities with the highest mean annual concentrations of major air pollutants in 1989

City	Factor by Which Standard Exceeded	Pollutant
Kutaisi (Georgia)	8.5	Dust
Nizhnevartovsk (Russia)	6.0	
Ararat (Armenia)	5.4	
Yerevan (Armenia)	2.0	Carbon monoxide
Zestafoni (Georgia)	1.6	
Tbilisi (Georgia)	1.4	
Yerevan (Armenia)	3.8	Nitrogen dioxide
Zyryanovsk (Kazakhstan)	3.6	
Yerevan (Armenia)	2.5	Ozone
Bekabad (Uzbekistan)	2.8	
Dzerzhinsk (Ukraine)	5.3	Phenol
Norilsk (Russia)	3.5	
Sumgait (Azerbaijan)	1.4	Chlorine
Yavan (Tajikistan)	1.6	
Severodonetsk (Ukraine)	7.1	Formaldehyde
Odesa (Ukraine)	7.1	
Lipetsk (Russia)	9.8	
Groznyi (Russia)	7.8	
Dniprodzerzhynsk (Ukraine)	5.1	Ammonia
Andizhan (Uzbekistan)	4.5	
Rustavi (Georgia)	3.7	

Source: modified from Peterson, 1993

Note: "Standards for individual pollutants in the atmosphere were expressed in terms of maximum permissible concentrations tolerated for human health. These standards were established by the USSR Ministry of Health and were derived from the minimum concentration of a substance that demonstrated an observable physiological effect." (Peterson, 1993)

As stated by Weiner (2017), during the entire Soviet period, one of the most ecologically friendly features was the lack of private cars and dependence on public transport and passenger railways. On the other hand, due to their older age and less efficient combustion, Soviet vehicles polluted the environment much more than Western ones.

By the late 1980s, the central government institutions of the USSR were becoming increasingly aware of the seriousness of air pollution. For instance, in 1984, the USSR Council of Ministers (1984) declared that the Ministries of Energy and Electrification, Oil Refining and Petrochemical Industries, Ministries of Ferrous and Nonferrous Metallurgy, Chemical Industries, and many others did not pay enough attention to air protection measures, which in turn led to pollution of soils, waters and other natural objects. It was also noted that the implementation of the tasks on reducing emissions of pollutants into the atmosphere, the development of production of gas cleaning and dust collection units were not provided. Low-waste technological processes were implemented slowly, and the level of equipment for sources of pollutant emissions did not meet modern requirements. Many treatment plants were damaged or inefficient. And the ministries that should carry out work on the construction of treatment facilities did not systematically complete the tasks for the construction of these facilities.

Despite the growing awareness of the pollution problem, efforts to improve air quality were insufficient. Peterson (1993:48) explains that one of the main reasons was the very low quality and productivity of the air pollution control equipment installed in the factories, therefore it did not always function as intended. The best air pollution control technologies for the chemical industry available to the Soviet Union lagged behind world standards by about 20 years. Also, the problem was that the staff was badly qualified in the proper management of the equipment. Sometimes the technologies were set up for assignments for which they were not intended, and in some cases, the filters were turned off at nights, as locals still could not see their action. Unfortunately, insufficient methods of controlling air pollution only exacerbated the problem of air pollution: the inability of Soviet devices to operate at their intended capacity led to the release of another 7 million tons of pollutants into the atmosphere in 1987. Given all of the problems above, before the collapse of the USSR in 1991, only 40% of Soviet industries were operating in accordance with emission standards.

2.2. Water

The situation with water pollution was no less critical than with air pollution, as many rivers have been affected by the uncontrolled disposal of petroleum products, phenols, heavy metals, wastewater and agricultural effluents (Peterson, 1993). The Supreme Court of the USSR (1989) reported that the condition of more than 60% of water sources did not meet standards and that there is dangerous groundwater pollution occurring.

The IUCN East European Programme Environmental Status Report of the USSR (1990:54) also confirmed that the water quality of most rivers, lakes and reservoirs remained poor. In 1989, the concentrations of organic matter, ammonia and nitrite nitrogen, phenols of petroleum products, metal-containing compounds and specific compounds in many water bodies exceeded the maximum permissible concentrations by several tens and sometimes hundreds of times. Water bodies received large amounts of these substances from fabrics, livestock farms, poultry farms, municipal sewage systems and overfertilized agricultural fields.

Moreover, as was stated by the Supreme Court of the USSR (1989), high-quality wastewater treatment was not provided in 600 cities, as water purification systems often failed due to poor design, incorrect maintenance and mechanic's errors.

As a result, the USSR's waterways received 153 billion cubic meters of wastewater, 21% of which was contaminated (IUCN East European Programme, 1990:41). Other authors like Winfrey (1992) also claim that too much sewage has been dumped into the country's waters. Peterson (1993) confirms that in 1988, about 13 million cubic meters of insufficiently treated wastewater was dumped into the country's national waters. The republics with the most overloaded municipal wastewater treatment systems were Belarus, Ukraine, Tajikistan, Latvia and Lithuania. And Azerbaijan's capital, Baku, was equipped with only a basic sewerage system, with upgrades delayed by a decade. In addition, it was reported that in 1989, a third of all industries and public utilities of the USSR did not perform in accordance with wastewater standards. In 1991, many regions still did not even have basic sewerage treatment facilities. (Peterson, 1993:64-65) According to French (1991:333-334), many industrial waste products were dumped into country waters in quantities almost unbelievable in western countries. Many lakes, rivers and coasts of the USSR were polluted by industrial discharges, untreated wastewater and agricultural effluents. In 1988, only 30% of Soviet wastewater was properly treated, 50% was improperly treated, and the remaining 20% was released into the environment without treatment. This led to a shortage of clean drinking water: in 1988, 18% of water samples across the country did not meet sanitary norms. The table below indicates wastewater treatment in the selected republics in 1989.

Table 3: Wastewater treatment by republics in 1989

Selected republics	Total Volume of Wastewater Requiring Treatment (millions of cubic meters)	% Treated in accordance with standards	% Treated not in accordance with standards	% Remaining Untreated
USSR average	43 564	25	51	24
Russia	30 633	11	61	28
Ukraine	6 706	57	36	7
Belarus	994	93	7	0
Uzbekistan	762	65	8	27
Georgia	626	49	9	42
Azerbaijan	597	51	12	37
Kazakhstan	591	43	48	9
Armenia	557	55	1	44
Moldova	298	37	48	15

Source: modified from Peterson, 1993

The country's polluted rivers eventually found their way to the seas. As stated by the IUCN East European Programme (1990:53), "*in 1989, 3.7 km³ of contaminated water were discharged by agricultural farms, 14.2 km³ by municipal services of urban and rural settlements, and 14.3 km³ by industrial enterprises. The heaviest water polluters were the wood, pulp and paper industry (2.66 km³), the petroleum processing and petrochemical industry (2.61 km³), the metal production industry (2.17 km³), the coal industry (0.85 km³), and the mineral fertilizer industry (1.0 km³)*". Partially treated and untreated sewage discharges were headed by the rivers mainly to the Caspian Sea, Sea of Azov, Black Sea, Baltic Sea and others. For example, the Ukrainian river Dnieper, before flowing into the Black Sea east of the large industrial centre of Odesa, passes through many industrial cities in Ukraine (like Kremenchuk, Dnepropetrovsk (now Dnipro) and Zaporizhzhia) collecting pollutants along its way. Due to this, the area in and around Odesa is considered to be the most polluted part of the Black Sea, the concentrations of pollutants in this area many times exceeded the permissible sanitary norms. Also, the Black Sea suffers from heavy pollution in the surroundings of the Georgian industrial port cities of Batumi and Sukhumi. (Peterson, 1993) According to Winfrey (1992:46-49), the main pollutants in USSR's coastal marine waters were chlorine, organic matter, nitrogen, wastewater and pesticide toxins. He also mentioned a concentration of hydrogen sulfide in the Black Sea.

Due to its nature and scale, agricultural activities posed the same high risk of pollution as industrial or municipal utilities, as large amounts of used pesticides and fertilizers enter the soil and groundwater. For example, in the 1980s, almost 50% of water pollution in Ukraine was generated by the agricultural sector. Severe cases of groundwater pollution have been identified around Ukrainian industrial cities such as Kryvyi Rih, Lysychansk and northern Crimea. (Peterson,

1993:71) Groundwater pollution also occurred because the government provided farmers with large stocks of agrochemicals almost free of charge and, in most cases, gave virtually no instructions on their use. As a result, *"the total annual load of pesticides in the Moldavian Republic exceeded the national average by 9-10 times and in the Armenian 20-25 times"* (Peterson, 1993: 3).

Another problem was that water use in the USSR was wasteful and inefficient by international standards. "*To produce one ton of steel, the average Soviet factory required 270 cubic meters of water; the average in West Germany was 180 cubic meters*." (Peterson, 1993:57) One of the explanations why performance remained low and consumption stood high was that water was often unwittingly diverted: 14% of the water pumped from groundwater and surface water in 1988 was lost in transfer between a primary source and final consumer - it was the amount comparable to the loss of almost all water flowing down the Dnieper in a year. More than 90% of water losses in the USSR happened in the agricultural sector. In order to increase agricultural production, the expansion of irrigation systems was used. But they were often of poor quality and also poorly maintained. For example, in Georgia water losses were somewhere between 40-60%. Furthermore, it was reported that half of the agricultural land in Ukraine was overwatered, which in turn led to erosion. Inadequate work of the irrigation systems could be the reason for that. (Peterson, 1993:57-58)

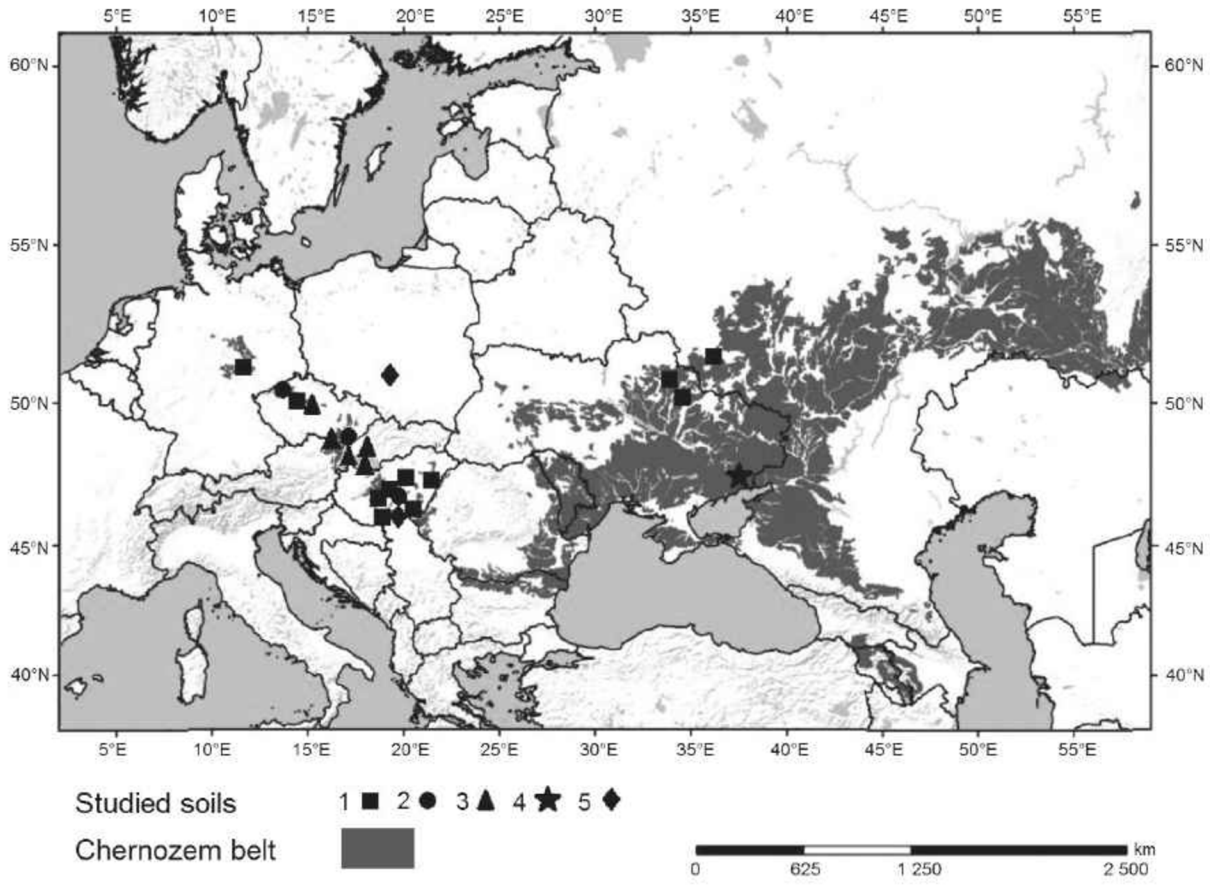
Moreover, due to the fact that many areas experienced regular energy shortages, especially during the winter heating season, the authorities usually had to use hydropower to cover supply gaps. Thus, water supplies were depleted in winter and could be filled up only in spring, when rivers rose due to showers and melting snow. As a result, the unnatural cycle of water flow damaged water systems and damaged fish reproduction and migration, as many of the dams in the USSR were built without fish passages and those in which they were present were inefficient. (Peterson, 1993)

2.3. Land

The state lands of the USSR occupied the largest territory in the world - 2,231 million hectares, but 72% of them were unfit for cultivation due to lack of warmth and/or humidity (IUCN East European Programme, 1990:10). Because of these limitations, only 28% of the land resources were suitable for cultivation, which slowly degraded due to overuse.

The main harms to agricultural lands were caused by excessive grazing, intensive tillage and continuous logging. Such activities disturbed the chemical balance of the soil, contributed to erosion, desertification and caused a significant reduction in land productivity in the central chernozem regions. (Peterson, 1993) According to Fraindová (2020), chernozems are one of the most fertile soils. Their characteristic vegetation is steppe and forest steppe. Because of their high fertility, the black soil areas were considered the breadbasket of the world and were used as arable land.

Figure 1: Distribution of chernozems



Source: Strouhalová et al., 2019

As stated by the IUCN East European Programme (1990:62), active anthropogenic activities caused the growth of land degradation and pollution processes. Over the last 15 years, the eroded area of agricultural land has increased by 54,7 million hectares, and the total area of gullies has overreached 10 million hectares. Soil erosion causes damage to agriculture, which is estimated annually at 18-25 billion rubles, and this number has doubled in the last 20 years. French (1991:335) confirms that land degradation has severely hampered agricultural productivity and notes that no less than 1,5 billion tons of topsoil were eroded annually in the USSR and production losses due to soil erosion cost the Soviet economy around $ 33 billion a year.

By the end of the 1980s, many of the region's agricultural lands had been injured by ravines and erosion, which affected half of the farming land. Of all the regions, Moldova was affected the most, also the Caucasus, Central Asia and the central chernozem zone. Due to erosion, a large amount of fertilizer was lost, and agricultural production was below its potential by an average of 15-60% in 1988. In Ukraine, erosion has stricken almost a third of all arable land, leading to the production losses of large quantities of wheat in 1990. As a result, billions of rubles were lost in vain. (Peterson, 1993:97) Erosion is the main mechanism of soil humus loss (IUCN East European Programme, 1990:62), and in some parts of the chernozem, up to a third of this organic material is already gone (Peterson, 1993:97). The IUCN East European Programme Environmental Status Report of the USSR (1990:62) also mentioned that of the country's 173 million hectares of arable lands studied, 20% contained less than 2% humus. Soil erosion was often the result of poor land-use planning, which led to increased droughts and desertification.

One of the examples of such poor land-use practices can be also seen after 1928, when the collectivization of agricultural production was promoted in order to achieve central management, which, of course, provided political control. Between 1917 and 1928, 97% of all farming land was cultivated individually, but rapid collectivization after 1928 practically eradicated separate farming, and by 1940, 97% of all farms were working collectively. The remains of the individual farms were solely the homestead plots, which allowed collective farmers to have near their homes for individual farming. (Csáki and Lerman, 1992:8) The fundamental structure of Soviet agriculture was based on two types of collective enterprises: 1) the state-owned farm (sovkhoz), where production output and all purchases were owned by the state, and which functions like any rural factory with employed supervisors and employees; 2) the collective farm (kolkhoz), which is comparable to a production cooperative, where production output and all purchases are owned jointly by the collective and farmers participate in the net income of the farm. (Batra, 1974)

The state-farm system had a weak administration and organization. The Soviet government has traditionally ignored the needs of agriculture - the shortage of trucks, electrification and tractors, and lack of paved routes directly affected the ability of farms to provide crops and livestock with the necessary care. Most importantly, there were few agricultural experts qualified for managing such farms. Also, low wages and lack of bonuses for quality work have led to an overall carelessness and an absence of incentives to work well among state-farm workers: there were combines that rusted right in the snow whereas the farm director complained about the lack of these machines, some workers finished the harvest and hurriedly left their combines in the closest

suitable place and forgot where they left them, also workers built fences from metal, stolen from still functional tractors, around their private properties. (Ballard, 1966) On the Soviet collective farm (kolkhoz) it was considered that members were interested in maximizing per capita income from cultivating the stock of land provided by the state for a fixed amount of rent. But after the crops were produced, not the forces of supply and demand, but the planners of the Soviet planning hierarchy defined prices at which the crops farmed at kolkhoz were to be sold. (Batra, 1974) Along with state ownership of land and collective agriculture, the widespread use of agrochemicals has been represented as an undoubted benefit, the assumption that fertilizers and pesticides can improve productivity indefinitely has led to the direct spending of the soil's reserves and the stagnation in agricultural science. In general, the unproductive nature of collective farming and public land ownership were not efficient, as many of the support programs that were supposed to help were designed poorly and only contributed to further food supply problems and the deterioration of land in regions. (Peterson, 1993) Collectivization was also associated with ecologically controversial agricultural practices. For example, due to the lack of soil protection measures, Nikita Khrushchev's Virgin Lands Program in 1954 resulted in substantial topsoil erosion. (Weiner, 2017) All in all, poor farm projects and the fact that the workers were not the owners of the land and did not have incentives for quality work led to further negative consequences for the land.

According to IUCN East European Programme (1990:10), the overall state of the USSR's land resources was unsatisfactory: about 250 million hectares, almost half of the agricultural lands, were subjected to erosion or were in danger. Over the last 25 years, the share of humus in soils has decreased by 0,4%. Irrational use of pesticides led to their accumulation in soils, waters and, accordingly, food. In addition, more than 10 000 hectares of farming land contained residual amounts of DDT (a commonly used pesticide for insect control) in quantities exceeding the maximum allowable concentrations. According to Fedorov (1997), in 1970 the Soviet government removed DDT from the official government list of pesticides permitted for use. Nevertheless, even after this measure was taken and the pesticide was declared "banned", soil and food contamination of DDT in the Soviet Union worsened. Even after the so-called ban in 1970, Soviet production and use of DDT has secretly continued, and in some cases even increased.

Despite the fact that the use of DDT was banned, half of the analyzed samples contained traces of the pesticide, and 14% exceeded the norm (IUCN East European Programme, 1990:64). Furthermore, Peterson (1993) reported that about a quarter of all agricultural land was treated with chemical pesticides. However, same as with fertilizers, farmers were taught little about the proper use of pesticides, technical support was weak, and farmers often didn't have enough of the required equipment to use pesticides correctly. As a result, improper use of these chemicals has caused significant damage to crops, the environment and agricultural workers. Agricultural land was heavily contaminated with pesticides in Azerbaijan, Armenia, Moldova and other countries. (Peterson, 1993:104-106)

Also, food supply problems were noticed in the region. They occurred due to inadequateness of collective agriculture, unrealistic prices, weak and wasteful food processing and allocation systems. Productive lands, such as the rich chernozem zone, were used the most by Soviet agriculture. Due to excessive use, the degradation of chernozems began to occur, which was of particular concern, as this area accounted for 60% of arable land and produced 80% of the USSR's sellable grain. (Peterson, 1993:97) In addition, the Supreme Court of the USSR (1989) stated that some food products were dangerous to consume because of their saturation with pesticides, nitrates and radionuclides. Analyses of food products conducted in 1988 in the USSR showed that 10% of goods did not meet state sanitary norms (Peterson, 1993). It was reported that in Moldova 25% of crop production was contaminated with nitrates, in Belarus and Russia it was 17%, in Azerbaijan, Armenia and Georgia - 12%; and the cleanest crops (0,7-7%) were supplied by Uzbekistan, Tajikistan and Ukraine (IUCN East European Programme, 1990:65). Nevertheless, analyses of Kyiv's foods in 1989 revealed an excess of nitrates in 25% of products (Peterson, 1993:104-106).
Air pollution has also damaged land resources. The concentration of industrial pollutants was greatest near metallurgical centres, for example, in the Donetsk basin of Ukraine, as well as in some Georgian cities, such as Tbilisi, Rustavi and Batumi. In these places, the concentrations of pollutants in the soil were significantly higher than the permitted levels. (Peterson, 1993)
The Supreme Court of the USSR (1989) stated that millions of hectares of once-fertile lands have been withdrawn from agricultural use due to mining activities, erosion, flooding, salinization and desertification. As much of the fertile lands were polluted by industry - agriculture was pushed into more insufficient soils. As a result, attempts of agronomists to force the land to produce through the abundant use of chemical pesticides, herbicides and fertilizers have done more harm than good. (Josephson, 2007)

2.4. Hazardous waste

Hazardous industrial waste was also one of the most acute problems threatening land, groundwater and consequently human health. In 1989, the Supreme Court of the USSR (1989) noted that the volume of toxic industrial waste, most of which was taken to landfills of municipal solid waste, was rapidly growing. Despite the fact that the USSR has achieved great success in the production of many high-tech goods, planners have not been able to develop appropriate and environmentally friendly ways to dispose of by-products. Metallurgical industries, the biggest producers of hazardous waste, have succeeded to recycle or properly bury only 10% of the waste they produced. Due to the lack of environmentally friendly methods of disposal, waste was dumped practically anywhere. Moreover, data on waste generated by the military-industrial complex have always been classified, as has all Soviet defence activities. The Soviet government controlled about 6 000 landfills across the country, but it is unknown how many landfills remain unregistered, as there are no reports of illegal landfills, but there are probably thousands. (Peterson, 1993:135)
Most dumps and solid waste landfills in the USSR did not meet environmental and sanitary norms, and the masses of waste accumulated in landfills heavily contaminated soils, surface and ground waters and air basins (IUCN East European Programme, 1990).
French (1991:334) confirms that more than 50% of the USSR's 6 000 official landfills did not work in accordance with sanitary standards. In Georgia and Moldova, more than 75% of landfills did not meet standards. Improperly disposed, often hazardous waste was detected weekly. Due to weak officials' control, many companies dumped their waste wherever and however it suited them. Despite the fact that data on waste generated by the military-industrial complex have been confidential, French (1991) considers that the military sector is also accountable for some major cases of waste mismanagement, mainly from nuclear weapons complexes with radioactive waste.

2.5. Chornobyl's legacy

Weiner (2017) claims that Chornobyl was related to the energy dilemmas of the USSR. The Soviet Union had energy obligations to Eastern Europe and Cuba and had to export big amounts of oil in order to pay for food imports. But the Soviet economy had overall energy inefficiency and wasteful mining and transportation of fossil fuels. This has resulted in the use of nuclear energy to cover its own energy demands. As a result, for example, the Chornobyl's reactors operated without a backup emergency cooling system.

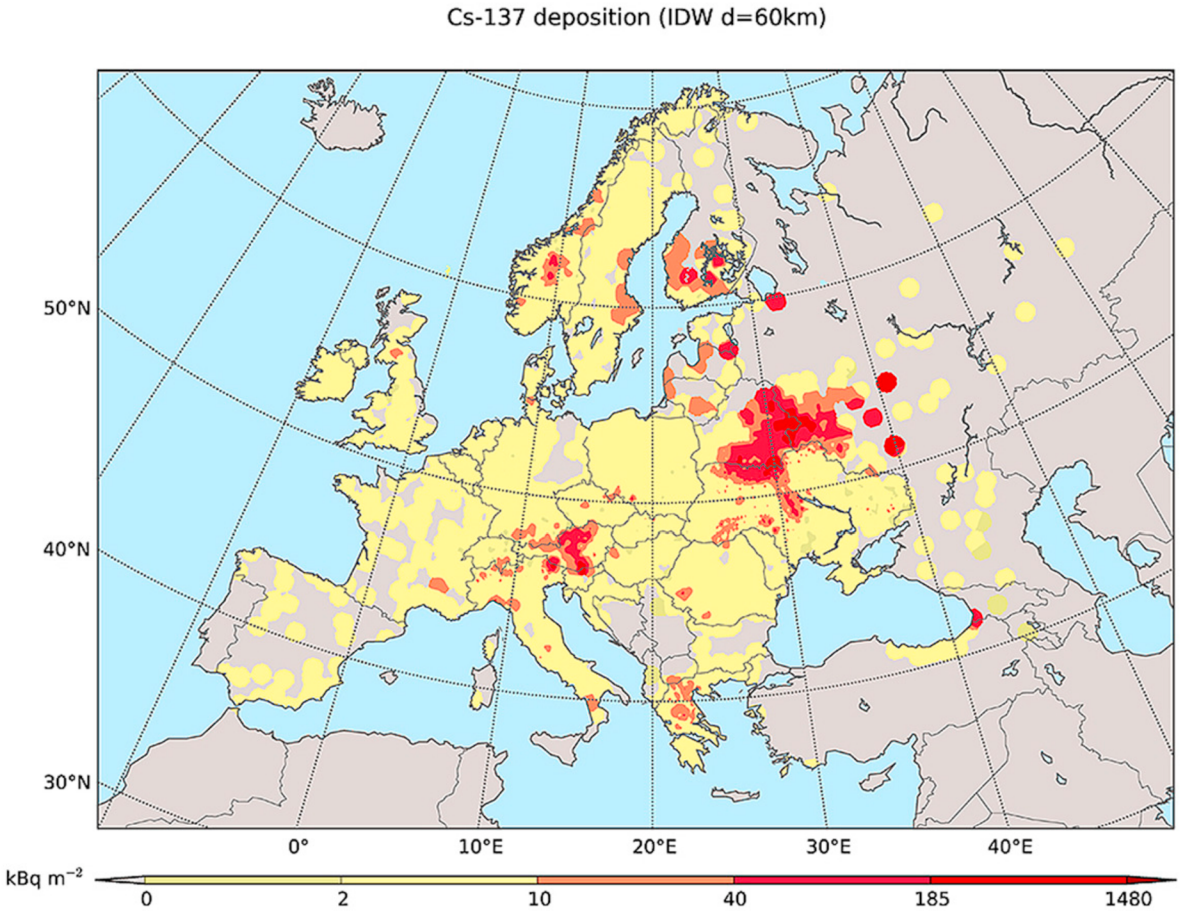
The accident at reactor number 4 of the Chornobyl nuclear power plant occurred on April 26, 1986. The negative consequences of this man-made disaster are characterized by the release of a significant number of radioactive substances into the environment, the presence of a destroyed nuclear reactor and numerous victims. Unfortunately, information about the accident and the resulting spread of radioactive materials was not originally available to the public. The disaster was not covered at all by the Soviet media during the first two days, because the authorities wanted to try to hide the truth about the Chornobyl accident. The first to raise the alarm were the workers of the Forsmark nuclear power plant in Sweden. The Swedes tried to find out about the incident through diplomatic channels, but this did not give any results. Only when they threatened to submit an official request to the International Atomic Energy Agency, the USSR was forced to report the accident. (Ukraine Crisis Media Centre, 2021)

For a certain part of the population, it was no longer just an environmental crisis, but a health crisis, as millions of people in Belarus, Ukraine and the Russian Federation still lived in Chornobyl-contaminated areas in 1990. (Peterson, 1993:238) This catastrophe resulted in the pollution of more than 145 thousand square kilometres of the territory of Ukraine, the Republic of Belarus and the Russian Federation. As a result of the Chornobyl disaster, about 5 million people suffered, since almost 5 thousand settlements are located in the contaminated areas. Only on the territory of Ukraine, there were 2 293 affected villages, towns and cities, in which the population in the early nineties exceeded 2,6 million people. (Ivanyuta, 2021:1)

According to Ukraine Crisis Media Centre (2021), Ukraine ranked first in terms of the number of victims of the accident among the former republics of the Soviet Union. In addition, Belarus accounted for about 60% of harmful emissions and Russia also suffered greatly from radiation pollution. The cloud from the reactor spread many radioactive materials to most of Europe: a powerful cyclone carried radioactive substances through the territories of Lithuania, Latvia, Poland, Sweden, Norway, Austria, Finland, Great Britain, and later Germany, the Netherlands, and Belgium. Therefore, the man-made disaster has become a global accident not only in terms of the number of deaths and economic losses but also in terms of radiological pollution of the environment and damage to the population. The explosion of the reactor released about 450 types of radionuclides into the atmosphere. The Chornobyl disaster led to the pollution of the water resources of the Dnieper, Pripyat and Kyiv reservoirs, at the bottom of which about 60 million tons of radioactive sludge have accumulated. (Kiselev et al., 2014:32)

According to Ivanyuta (2021:2), the total economic damage from this catastrophe for Ukraine amounted to about 180 billion US dollars, including the amount of indirect losses due to the inability to use contaminated agricultural land, water and forest resources, reduced electricity production and reduced production of goods. Many rural areas, where the main source of income before the accident was agriculture, both for domestic consumption and local sales, were affected. A total of 784 320 hectares of agricultural land were removed from the exploitation in the three countries, and timber production on a total area of 694 200 hectares of forest was stopped. (IAEA, 2006:34) According to Soukhikh (1991:180), 3,5 million hectares of forests in Ukraine, Belarus and Russia were polluted to varying degrees after the Chornobyl accident. As a result, incomes from agricultural activities and certain types of production decreased. The impact on agriculture affected the entire economy of Belarus, where some of the best arable lands were withdrawn from production. (IAEA, 2006:34)

Figure 2: Gridded map of the updated Cs-137 deposition database for the Chornobyl accident



Source: Evangeliou et al., 2016

According to Prokhorov (2021:16), about 70% of the radioactive fallout that fell into the atmosphere fell on the territory of the Republic of Belarus. More than 46 thousand square kilometres of land (23% of the total area of the republic) with a population of 2,1 million people, were under long-term radioactive contamination. Moreover, 2,64 thousand square kilometres of agricultural land were removed from agricultural use due to radionuclide contamination. As a result, there was a sharp decline in cultivated areas, livestock was reduced, and forestry was severely damaged. About a quarter of Belarus' forest resources (17,3 thousand square kilometres of forest) have been contaminated. Also, termination of economic activities in contaminated areas has led to the uncontrolled penetration and spread of invasive species.

Another source says that 5 years after the Chornobyl's reactor number 4 accident, millions of people still lived in the area contaminated with radioactive fallout and 2,2 million people still lived on one-third of the territory of the Republic of Belarus, which was polluted. Even where agricultural land was heavily contaminated, it continued to be cultivated due to the lack of an alternative source of income or food. In Minsk, the Red Cross regularly inspected city shops and markets to make sure the products did not contain radioactive substances. (Peterson, 1993:4)

Moreover, the accident caused different health problems among the affected population. One of the main health consequences of the accident was thyroid cancer which had the biggest effect on children. It was caused by radioactive iodine fallout and had the greatest impact on those who drank milk high in radioactive iodine. By 2002, more than 4 000 cases of thyroid cancer had been diagnosed, and most of these cases were likely to be related to unaware radioactive iodine consumption. There has also been an increase in fatal leukaemia, circulatory system diseases and solid cancers, caused by radiation, among emergency workers. (IAEA, 2006:7)

Also, particularly high concentrations of radioactive substances were found in mushrooms, berries and game. Thus, high levels of contamination of forest food products in some countries may still exceed acceptable levels. Contamination of milk and meat with radioactive caesium is one of the biggest long-term problems, as it may cause health problems as stated above. Due to the high content of radionuclides in crop and livestock products, forestry restrictions have been applied, such as a limited collection of berries and mushrooms, to help reduce internal radiation doses; restrictions on the collection of firewood to prevent exposures in homes and backyards when firewood is burned, and ash is disposed of or used as fertilizer; and a change in hunting methods to avoid eating meat with high levels of radiocaesium. (IAEA, 2006:28)

It can be assumed that the Chornobyl accident not only gave an important lesson to the Soviet governance about the need for honesty and transparency but also warned the population about the alarming state of the environment in the USSR (Peterson, 1993). The concealment by the authorities of the truth about the fact of the catastrophe and its consequences, the lack of information about security measures and insufficient assistance to the victims shook faith in the values of the communist idea. Thus, the Chornobyl disaster became one of the reasons for the collapse of the USSR. (Ukraine Crisis Media Centre, 2021)

2.6. Before the collapse

For several decades, an environmental issue was secondary in the USSR. Many people were aware of the poor state of the environment, but, unfortunately, there were no channels through which they could influence administration's policies. Administrative approaches to the environment were deficient, as law enforcement agencies were generally much weaker politically and financially than the polluters they sought to combat. Moreover, all environmental agencies were significantly underfunded. (Peterson, 1993)

According to Thomas and Orlova (2001), all data during the Soviet period were surrounded by secrecy. The lack of reliable information about the environment was a well-known fact in the Soviet Union. Moreover, until 1987, there was virtually no official information available on the ecological status and morbidity of the population. Also, Soviet institutions tried to ensure environmental censorship. The Central Committee decree of 1957 banned reports of "forest fires, industrial accidents, military accidents, infant death rates or information about radioactive contamination", and therefore the information which was provided was not always trustworthy. After all, the Chornobyl-scale disaster was needed to remove much of the environmental censorship. (Weiner, 2017)

As for medical workers in the Soviet Union – they were poorly trained, overworked, and low-paid. They seldomly kept precise records of their patients, and in cities where the health of the population was extremely poor, the authorities often prohibited collecting data and keeping health records to avoid difficulties and public indignation. By the end of the 1980s, only 23% of Soviet children under the age of seven were considered "almost healthy," doctors had virtually no detailed medical records, and officials often faked data to hide this unpleasant part of Soviet history. (Peterson, 1993:6)

Alexey Yablokov, a well-known Soviet and Russian biologist, environmentalist, and opposition politician who founded the Greenpeace of the USSR in 1988 and led it until the collapse of the Soviet Union in 1991 (Radio Free Europe, 2017), mentioned that the territory of the USSR loses several species of animals and plants every year, and the most dangerous was that it was not known exactly how many species was lost (Peterson, 1993:17). The course taken for industrialization in the late 1920s was primarily aimed at increasing industrial production in a short period of time, establishing the production of various materials and construction of enterprises. All this happened without taking into account the harmful effects on the environment. In general, until the mid-1980s, the Soviet government's attitude towards nature remained consumeristic, as the main goal was always to implement state plans and achieve the established indicators, which, in turn, contributed to the deterioration of the environmental situation. The main trigger for changes in the state's awareness of the role of the environment was the accident at the Chornobyl nuclear power plant in 1986. (Peterson, 1993)

The total cost of environmental projects from 1976 to 1988 exceeded 100 billion rubles. Regardless of the increase of capital investment in environmental protection, there has been no significant advancement in the methods used for its protection nor the significant restoration of the natural

environment. Of all the scheduled environmental projects, about 53-60% were implemented. (IUCN East European Programme, 1990:23) In the late 1980s, at the 19th party conference, Fyodor Morgun, chairman of the Soviet State Committee for Environmental Protection said: "*For a whole era our party and professional propaganda and science have been intolerably passive as far as ecology is concerned. For many decades, the environment has been undergoing catastrophic pollution*" (Sun, 1988:1033). Nevertheless, since the 1960s, the network of protected areas of the USSR has expanded, including inviolable reserves created under Lenin but devastated under Stalin and Khrushchev, reserves, created to protect certain biotic resources, and natural monuments, as well as national parks for tourists. (Weiner, 2017)

In 1988, acknowledging the flaws of the regime's environmental activities, the Soviet government created an institution that deals entirely with environmental protection: the USSR State Committee for the Protection of Nature, or Goskompriroda. The agency has been entrusted with several tasks related to environmental protection. One of the main tasks was to draft a detailed program of environmental clean-up and economic development for the thirteenth five-year plan (1991-1995) and up to 2005. The agency created this document, known as the Ecological Program. Despite the fact that the Ecological Program was approved, it was never implemented due to the collapse of the Soviet regime. (Peterson, 1993:161) During its existence, the State Committee for the Protection of Nature remained financially poor, institutionally powerless and constantly involved in the bureaucratic struggle. Up until the collapse, the Committee for the Protection of Nature had not been able to accomplish any of the new important environmental programs. After all, few were bothered about the agency's end. Shelton (2003) believes that Soviet environmental legislation did not work either because it was too complicated or because economic production has always been more important than protecting the environment. Nevertheless, the former Soviet states inherited environmental bureaucracies, detailed environmental and sanitary regulations, research institutes, and a system of national parks and reserves. Although these institutions were underdeveloped, they offered the new states a temporary basis for prospective environmental policies. (Peterson, 1993)

All in all, threats and consequences of the Chornobyl nuclear disaster and other attacks on the environment, false and insufficient informing of the public about the circumstances have led to the collapse of the Soviet Union (Makhno, 2015). Now that the USSR is in the past, the new independent successor states must struggle with the "*legacy of destruction*" (Peterson, 1993).

2.7. Conclusion

To conclude, the period of the existence of the Soviet Union caused great damage to the environment of its member states through its huge militarization, industrialization, insufficient methods of controlling pollution and ignorance of important environmental problems. As a result, there were lots of cities with alarming air pollution, poor condition of the industrial infrastructure, escape of toxic waste and failures of the sewage systems, poor quality of lakes and polluted rivers which come into the seas, lands injured by ravines and erosion and poisoned by fertilizers, dumps and solid waste landfills which did not meet environmental and sanitary norms and many more. All in all, the former countries of the Soviet Union have faced a challenging situation: environmental recovery was crucial for economic recovery, but economic recovery required investment capital to improve the environment (French, 1991).

According to Agyeman et al. (2009), the transition from Communist rule to the independence of the Soviet Union countries and their market economies led to a period of economic and political upheaval within the countries, as well as tensions between them. A severe economic downturn in the mid-1990s was followed by a gradual recovery and associated difficulties. Societies have been ravaged by the disruption of social and health systems, the decentralization and establishment of national political power, and the increasingly obvious ecological, environmental, and public health crises. The consequences of the deeds of the Soviet Union and its collapse persist to this day. Although when the market economies of the countries of the former Soviet Union are established, the improvement of the quality of life of the population, the regulation of environmental risks, and the other benefits will follow.

The economic depression in the Soviet and post-Soviet eras was further exacerbated by the republics' attempts to increase trade barriers in an attempt to protect their economies. As a consequence, uncertainty, unpredictability and recession have swept across the region, depriving managers of the opportunity to take the necessary measures to protect the environment. The collapse of the USSR intensified political tensions between the former Soviet states. As states sought to strengthen their strategic position, the conflict was most acute in the military and economic sectors, as well as tensions over environmental issues. After the collapse of the Soviet Union, each individual republic became in charge of financing its own environmental and social programs. The governments faced difficult challenges - not only devising ways to dispose of toxic waste and arranging a plan to combat the effects of Chornobyl but also finding vast resources for basic utilities such as garbage collection and wastewater treatment. (Peterson, 1993)

The total cost of eliminating the consequences of the Chornobyl disaster for Belarus in early 1992 was estimated at more than half of the republic's annual national income. Most of Moldova and significant parts of the chernozem region were in crisis due to over-cultivation and chemical contamination of the soils, the North Caucasus region contained considerable amounts of agrochemicals; and almost everywhere in Ukraine, from north to south, the situation was bad as the country has struggled with the effects of Chornobyl, the devastation in the Donetsk basin and the pollution of rivers and the seaside. Due to economic problems, all the new republics sought

outside assistance. Authorities in Ukraine and Belarus have been forced to seek help from the United Nations and the international community, acknowledging that millions of their citizens are still living in polluted areas with no expectation of evacuation or sufficient medical care. (Peterson, 1993)

After the collapse, the environmental situation in these countries required not only assistance from developed countries, but also the involvement of the general public in solving environmental problems, working closely with environmental NGOs, supporting their initiatives and concrete proposals, which is in line with and provided by environmental legislation. It was also necessary for these states to increase the ecological culture of their communities and improve the professional training of specialists in general compulsory education in the field of environmental protection.

3. Overview of the environmental situation in each country

This chapter is going to provide a general overview of Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine and address the environmental situation in each of these countries after the collapse of the USSR. A brief general overview will be provided for understanding the countries' sizes, locations, physical geography, population amounts, GDP, and environmental problems. This, in turn, will help to evaluate the country's environmental situation, the amount of affected population and the need for aid.

Also, in order to compare each country - environmental performance index will be included. "*The 2020 Environmental Performance Index (EPI) provides a data-driven summary of the state of sustainability around the world. Using 32 performance indicators across 11 issue categories, the EPI ranks 180 countries on environmental health and ecosystem vitality. EPI indicators provide a way to spot problems, set targets, track trends, understand outcomes, and identify best policy practices. Overall EPI rankings indicate which countries are best addressing the environmental challenges that every nation faces.*" (Wendling et al., 2020)

In accordance with Wendling et al. (2020), the 11 issue categories of EPI are: air quality, sanitation & drinking water, heavy metals, and waste management – the subcategories of environmental health objective, which evaluates how well a country protects its population from environmental health risks; and biodiversity & habitat, ecosystem services, fisheries, climate change, pollution emissions, agriculture, water resources – the subcategories of ecosystem vitality, which measures how well countries maintain, protect and improve the ecosystems and the services they provide. The EPI score is set from 0 to 100, with the worst - 0 and the best – 100. Among all 180 countries, in 2020 Denmark ranks the first place with the score of 82.5 and Liberia ranks the last place with the score of 22.6.

Table 4: EPI rank and score by countries in 2020

Country	Rank	EPI Score
Belarus	49	53
Armenia	53	52.3
Ukraine	60	49.5
Azerbaijan	72	46.5
Moldova	87	44.4
Georgia	102	41.3

Source: modified from 2020 EPI results (Wendling et al., 2020)

3.1. Armenia

Figure 3: Armenia

Source: United Nations, 2008

General overview

The Republic of Armenia is a landlocked country in the Lesser Caucasus Mountains with a highland continental climate; located between Eastern Europe and Western Asia. It borders Turkey to the west, Georgia to the north, Azerbaijan to the east and Iran to the south. The country occupies a total area of 29 743 km² (land and water) and has a population of 3 million people . The capital is Yerevan. The major freshwater lake is lake Sevan which occupies a territory of 1 360 km². Agricultural land occupies 59,7% and forests occupy 9,1% of the country's territory. Armenia gained its independence from the Soviet Union on 21 September 1991. (CIA, 2022a) Armenia belongs to the group of "Upper middle income" countries. According to the World Bank (2022b), its GDP in 2020 was 12,641 billion US dollars in contrast to 2,07 billion in 1991.

Environmental challenges

According to CIA (2022a), among major Armenia's environmental issues are soil contamination from toxic chemicals, deforestation, drying out of Lake Sevan, pollution of rivers, droughts and occasional earthquakes. On the report of The Policy Forum Armenia "The State of Armenia's Environment" (2010), deforestation in Armenia has now increased to an abnormal level. The Policy Forum Armenia (2010:15) also mentions the survey which demonstrates that Armenians recognise illegal logging as a fundamental part of the problem of environmental degradation. Since a significant part of the forest is degrading, and only about 8% of the country's territory is covered with forest (compared to 35% two centuries ago), Armenians are becoming more worried.

Gharabegian and Saryan (1992) confirm that Armenia has problems with water resources caused by economic development during the USSR period. They note that country's water resources are scarce, and most of its freshwater reserves are contained in Lake Sevan, which is slowly becoming polluted. Moreover, it's been reported, that untreated or partially treated industrial waste and wastewater have been discharged into receiving water bodies, which is also very damaging to the country's already fragile water reserves. Also, outdated and corroded sewage and water distribution systems pose a significant danger to human health and therefore need urgent attention. Due to deteriorating infrastructure, cross-contamination occurs between sewer and freshwater drinking water pipes and therefore water supplies are regularly being polluted. (Policy Forum Armenia, 2010) The State of Armenia's Environment (2010) report that most water pollution in the Ararat Valley is caused by pesticide pollution and other urban and agricultural effluents. Moreover, pesticides such as DDT are still used in crop production and are sold with virtually no instructions for use. They are washed into drainage water during irrigation and enter rivers and seep into the soil. (Policy Forum Armenia, 2010)

As for Lake Sevan, Hovhanissian and Gabrielyan (2000) state that due to excessive exploitation of water resources and pollution, large-scale transformations have taken place in the entire basin of the lake. The Armenian Environmental Network (2022) notes that for decades, the lake has been drained to supply Ararat Valley farmers with irrigation water. Uncontrolled water abstraction from the lake has led to a sharp drop in water levels, which in turn has led to eutrophication and deteriorating water quality (Hovhanissian and Gabrielyan, 2000). Organic agricultural effluents and untreated wastewater facilitated the saturation of the lake with nutrients, as a result of which some species are threatened with extinction. The fishing industry has also seen an annual drop in catches. (Armenian Environmental Network, 2022) Moreover, of the 167 endemic and migratory birds that previously populated the surrounding swamps of Lake Sevan, only 18 species remain, and mammalian fauna is also declining in the area (Hovhanissian and Gabrielyan, 2000:178).

According to Environmental Performance Index 2020, out of 180 countries studied, Armenia ranks 53d place with a score of 52.3. To specify, the country scored 91st place in the Environmental Health policy objective and 36th place in the Ecosystem Vitality policy objective. (Wendling et al., 2020)

3.2. Azerbaijan

Figure 4: Azerbaijan

Source: UN Cartographic Section, 2007

General overview

The Republic of Azerbaijan is a landlocked country situated in southwestern Asia with the Great Caucasus Mountains to the north and has a dry, subtropical climate. The country borders Armenia to the west, Georgia and Russia to the north, the Caspian Sea to the east and Iran to the south. The Nakhchivan Autonomous Republic is a landlocked exclave of the Republic of Azerbaijan, which, borders Armenia to the east and north, Iran to the south and west, and a little part of Turkey to the west. The country occupies a total area of 86 600 km² (land, water, exclave) and has a population of 10 million people (2021). The capital is Baku. The major saltwater lake is the Caspian Sea which has 374 000 km², other countries like Russia, Turkmenistan, Kazakhstan and Iran also have

access to this lake. Agricultural land occupies 57,6% and forests occupy 11,3% of the country's territory. Azerbaijan gained its independence from the Soviet Union on 18 October 1991 (CIA, 2022b) and belongs to the group of "Upper middle income" countries. According to the World Bank (2022c), its GDP in 2020 was 42,607 billion US dollars in contrast to 1,57 billion in 1993.

Environmental challenges

According to CIA (2022b), among major Azerbaijan's environmental problems are droughts, soil contamination due to oil spills, the use of DDT pesticides and toxic defoliants used in cotton production, and pollution of surface and groundwater by untreated domestic, industrial and agricultural effluents. In addition, the Absheron Peninsula, including Baku, and the Caspian Sea are considered to be the most ecologically ruined areas due to severe pollution.

Shelton (2003) also expresses his concerns about the environmental situation in the country. He mentions heavy pollution of air, water and soil in the industrial city of Sumgait, north of Baku, on the Absheron Peninsula, built by the Soviet Union in the late 1950s as a center for the chemical, petrochemical and metallurgical industries. Pollution from Sumgait's chemical plants, the oil refineries of Baku and poor-quality wastewater treatment in both cities cause these parts of the coast to be the most polluted. The World Bank (2011) also highlights serious pollution in Sumgait and Baku caused by heavy industry, oil and energy production. Pointing out that the main reasons are outdated technologies, malfunction or shortage of equipment to combat pollution, as well as the use of low-quality raw materials, which lead to high emissions of pollutants.

Water resources are crucial for the country's economy. According to Shelton (2003:303-304), Azerbaijan has problems in both supply and quality of water resources. The main source of water are rivers, but 70% of river flow originates outside the country (for example, in Turkey, Georgia, Armenia, Iran and Russia), which significantly complicates water control and negatively affects water quality. Moreover, the pollution of the Caspian waters of Azerbaijan is increasing due to discharges from other countries (for example, the Volga river provides almost 80% of pollutants entering the Caspian Sea). Caspian Sea fish are in serious danger due to water pollution, spawning floods and illegal fishing, and Caspian seals are dying and being washed up on Azerbaijan's beaches in alarming quantities. Also, the water in the Kura-Araz river system is much polluted from different sources inside and outside Azerbaijan. There is a deficiency of drinking water in many areas, 80% of the population of Azerbaijan lives in areas without modern water supply and sewerage networks. And according to the World Bank (2011), over 50% of the population does not have access to tap potable water. Moreover, the deterioration of water quality in rural and urban areas is leading to an increase in water-borne diseases.

Shelton (2003:304) also notes that the country's soil resources have long been subject to waterlogging and salinization, overuse of fertilizers and pesticides, industrial waste and other pollutants and damaged by wind and water erosion. Almost half of the country's total land area is classified as eroded. The use of fertilizers, herbicides and pesticides was particularly intense during the Soviet era, especially in cotton production. The long-lasting consequences of these approaches

are noticed in the south-eastern part of the Kura-Araz lowland, where the amount of residual DDT exceeded the permissible norms by 9 times. Despite the fact that the use of these pesticides decreased after the collapse of the USSR, the number of residual chemicals in the soil still remains high.

According to Environmental Performance Index (2020a), out of 180 countries studied, Azerbaijan ranks 72nd place with a score of 46.5. To specify, the country scored 113th place in the Environmental Health policy objective and 44th place in the Ecosystem Vitality policy objective. In addition, Azerbaijan shares 1st place with 21 other countries in the Pollution Emissions issue category, which "measures progress on managing the emissions of two primary air pollutants, and is composed of two indicators, adjusted emission growth rates for SO_2 and NO_X" (Environmental Performance Index, 2020b).

3.3. Belarus

Figure 5: Belarus

Source: United Nations, 2004

General overview

The Republic of Belarus is a landlocked middle-income country in Eastern Europe, bordered by Ukraine to the south, Poland to the west, Lithuania and Latvia to the northwest and Russia to the northeast. The country occupies a total area of 207 600 km² (land and water), which makes it the largest landlocked country in Europe. Belarus has a population of 9,5 million people. The population is predominantly urban. The capital city is Minsk. The major river is the Dnieper. Agricultural land occupies 43,7% and forests occupy 42,7% of the country's territory. Belarus gained its independence from the Soviet Union on 25 August 1991. (CIA, 2022c)

Belarus belongs to the group of "Upper middle income" countries. According to the World Bank (2022d), its GDP in 2020 was 60,258 billion US dollars in contrast to 17,793 billion in 1994.

Environmental challenges

According to Yasoveyev et al. (2017), the current agro-industrial structure of the economy of Belarus has largely inherited the features of irrational development of the second half of the twentieth century: outdated technologies, industry imbalances and environmentally unsafe mining have a negative impact on all components of the environment.

According to the CIA (2022c), among major Belarus' environmental problems are soil pollution from the use of pesticides, and radioactive contamination of the southern part of the country because of the nuclear reactor accident at Chornobyl.

Vlasenko (2018) also notes that one of the biggest environmental problems in Belarus is the radioactive contamination of forests, agricultural lands and settlements. And Peterson (1993) points out that the total cost of eliminating the consequences of the Chornobyl disaster for Belarus in early 1992 was estimated at more than half of the republic's annual national income. Vlasenko (2018) also mentions air pollution from industrial emissions and exhaust fumes from vehicles, noting that the worst state of the atmosphere in the city of Mogilev. And according to the United Nations (2005), poor air quality was in such cities as Novopolotsk, Polotsk, Gomel, Svetlogorsk and Vitebsk. The biggest air pollutants in these cities are chemical factories, power plants, and manufacturing industries.

In accordance with Yasoveyev et al. (2017), there is also the problem of drinking water quality and surface water pollution in the country. The quality of surface waters is affected by the influx of pollutants as a result of their washout from agricultural and urban areas, livestock farms, and discharged wastewaters. Moreover, he points out that some of the existing purification facilities are worn out and need to be reconstructed. Also, Vlasenko (2018) argues that the state of water in the lakes and rivers of the country is moderately polluted. He points out that due to industrial effluents, water bodies are polluted with elements such as manganese, copper, iron, petroleum products, zinc and other industrial wastes. Yasoveyev et al. (2017) also mentions the problem of waste, specifically the category of hazardous waste that poses the greatest threat of pollution. He also notes that among all waste storage and disposal facilities, the greatest danger is posed by facilities built during the Soviet period, when environmental requirements were not as strict as they are now.

According to Environmental Performance Index (2020c), Belarus ranks 49th place with a score of 53. To specify, the country scored 48th place in the Environmental Health policy objective and 61st place in the Ecosystem Vitality policy objective.

3.4. Georgia

Figure 6: Georgia

Source: United Nations, 2015

General overview

Georgia is a predominantly mountainous country with the Great Caucasus Mountains in the north and Lesser Caucasus Mountains in the south, located between Western Asia and Eastern Europe. It is bordered by Azerbaijan on the east, Armenia on the south, Turkey on the southwest, Russia on the north and northeast and washed by the Black Sea on the west. Georgia has a total area of 69 700 km² and a population of 3,7 million inhabitants. Approximately 18% of Georgia's area is occupied by Russia; it includes Abkhazia and South Ossetia regions. The capital city is Tbilisi. Georgia has a strategic location east of the Black Sea and also controls most of the Caucasus Mountains and the routes through them. Agricultural land occupies 35,5% and forests occupy 39,4% of the country's territory. (CIA, 2022d)

It is a small country with lots of valuable natural resources, diverse landscapes, habitats, and ecosystems that are of regional and global importance. The country also has rich water resources, which are located mainly in the west, whereas the eastern parts often experience water deficiencies (Ministry of Environment Protection of Georgia, 2012). Many areas need attention and environmental actions. Georgia gained its independence from the Soviet Union on 9 April 1991 (CIA, 2022d) and now belongs to the group of "Upper middle income" countries. According to the World Bank (2022e), its GDP in 2020 was 15,846 billion US dollars in contrast to 2,688 billion in 1993.

Environmental challenges

According to CIA (2022d), among major Georgian environmental problems are degradation of lands and forests; air pollution; soil contamination with pesticides; earthquakes; biodiversity loss; and waste management problems.

Ministry of Environment Protection of Georgia (2012) states that almost all city-wide landfills in Georgia do not meet today's environmental standards, as they were built during the Soviet times. Thus, improperly constructed municipal landfills have polluted air and large amounts of water, as most of them do not have groundwater protection barriers and treatment systems. As for water, CIA (2022d) specified that there are issues with severe pollution of rivers and the Black Sea and an insufficient supply of drinking water. According to the Ministry of Environment Protection of Georgia (2012), untreated urban effluents account for 67% of surface water pollution. Industries that have a substantial impact on surface water quality are mainly mining, oil and food, as well as illegal landfills and farming.

The World Bank (2015:xi-xii), also states that Georgia faces problems with the loss of land productivity, as two-thirds of agricultural land is subject to erosion or degradation; floods and erosion, particularly from landslides and mudflows, resulted in economic losses of 650 million US dollars between 1995 and 2012. The other issue is the loss of forest cover, over the past 12 years, the forest area has decreased by 7 800 hectares, and Georgia has received 4 900 hectares of forest of other quality. Moreover, about 75% of Georgia's population is exposed to considerable amounts of particulate matter in cities, which puts them at an increased chance of cardiovascular diseases, chronic obstructive pulmonary diseases and lung cancer. According to the Ministry of Environment Protection of Georgia (2012), other common challenges include the negative effects of climate change on natural ecosystems and biodiversity such as declining species populations and habitat deterioration, as well as desertification and melting of glaciers. There are also problems with inefficient control of protected areas, lack of an adequate database on biodiversity conservation and sustainable management of biological resources, and lack of sustainable forest management practices.

According to Environmental Performance Index (2020d), Georgia ranks 102nd place with a score of 41.3. To specify, the country scored 102nd place in the Environmental Health policy objective and 104th place in the Ecosystem Vitality policy objective.

3.5. Moldova

Figure 7: Moldova

Source: United Nations, 2013

General overview

The Republic of Moldova is a landlocked country in Eastern Europe that borders Ukraine to the north, east, and south, and Romania to the west. The country occupies a total area of 33 851km^2 (land and water) and has a population of 2,6 million people. The capital city is Chisinau. The major rivers are Danube and Dniester. Agricultural land occupies 74,9% and forests occupy 11,9% of the country's territory. Moldova gained its independence from the Soviet Union on 27 August 1991. (CIA, 2022e)

Moldova belongs to the group of "Upper middle income" countries. According to the World Bank (2022f), its GDP in 2020 was 11,916 billion US dollars in contrast to 1,753 billion in 1995.

Environmental challenges

According to CIA (2022e), Moldova's main environmental problems include soil and groundwater pollution due to the massive use of agricultural chemicals, as well as significant soil erosion and reduced soil fertility due to inadequate farming methods.

Moreover, the United Nations (2014a:12) mention that a lot of agricultural lands are located on slopes which makes them vulnerable to degradation. In 2011, 35% of agricultural land was eroded and new land is affected every year. Furthermore, according to the Embassy of the Czech Republic in Chisinau (2016), during the Soviet era, a huge number of pesticides were used in Moldova to control pests of agricultural crops, and a large amount of expired or banned pesticides were still stored in the warehouses of former collective farms in inappropriate conditions and without appropriate accounting. The high level of expansion of agricultural production with the usage of pesticides and mineral fertilizers and the inattention to environmental needs has resulted in pollution of water, soil and plants with toxic chemicals and fertilizers and contributed not only to a sharp worsening of the environmental situation but also to a deterioration in the quality of people's life (IUCN East European Programme, 1990).

The United Nations (2014a:11) claim that the country also has problems with deteriorating water quality. In 2005, half of the water samples did not meet sanitary standards, and in 2011 the share increased to 72%. The main sources of surface water pollution are discharges of polluted municipal wastewater, leakages from agriculture and solid waste disposal facilities.

Problem with waste management is also critical, as the existing waste management infrastructure does not meet international standards and needs to be significantly improved to ensure safe waste disposal. Currently, waste is disposed of mainly in landfills. In most cases, these are small uncontrolled landfills operating without legal permits. Despite the fact that there are more than a thousand landfills in the country, only 12 have been issued a national level permit. (United Nations, 2014a:127-129)

According to Environmental Performance Index (2020e), Moldova ranks 87th place with a score of 44.4. To specify, the country scored 82nd place in the Environmental Health policy objective and 99th place in the Ecosystem Vitality policy objective.

3.6. Ukraine

Figure 8: Ukraine

Source: United Nations, 2014b

General overview

Ukraine is a country in Eastern Europe, which borders Belarus in the northwest, Poland, and Slovakia in the west, Hungary, Romania, and Moldova to the southwest and Russia to the northeast and east. It is also washed by the Black Sea and the Sea of Azov in the south. The country occupies a total area of 603 550 km² (land and water) and has a population of 44 million people. The capital city is Kyiv.

As of February 23, 2022, approximately 7,1% of Ukraine's area was occupied by Russia; it included the Crimean Peninsula and parts of Luhansk and Donetsk oblasts. (CIA, 2022f) With the Russian invasion on February 24, 2022, the situation is changing rapidly, and it is difficult to estimate the exact share of the occupied territories.

The landscape of Ukraine is formed mainly by plains and plateaus, in the west are the Carpathian Mountains, which reach a height of 2 061 m on Mount Hoverla, which is the highest peak. The major rivers are Dnieper, Southern Bug, Dniester, Siverskyi Donets and Desna. Agricultural land occupies 71,2% and forests occupy 16,8% of the country's territory. (CIA, 2022f)
Ukraine gained its independence from the Soviet Union on 24 August 1991 (CIA, 2022f). The country belongs to the group of "Lower middle income" countries. According to the World Bank (2022g), its GDP in 2020 was 155,499 billion US dollars in contrast to 71,9 billion in 1992.

Environmental challenges

According to CIA (2022f), among Ukraine's main environmental problems are air and water pollution, land degradation, biodiversity loss, deforestation, occasional floods and occasional droughts, issues with the management of solid waste and radiation contamination from the accident at Chornobyl Nuclear Power Plant.
As stated in the National Environment Strategy of Ukraine for the period up to 2030 one of the most critical environmental problems is air pollution. Almost two-thirds of the country's population live in areas where air quality does not fulfil hygienic standards. Despite a certain decline in production, the level of air pollution in big cities and industrial areas remains high. The main air pollutants in Ukraine are mining and processing industries, heat energy industries and transport. (Verkhovna Rada of Ukraine, 2019) Furthermore, Ukraine tops the list of countries by the number of deaths from air pollution in relation to the total population. According to a study by the World Health Organization (2018), 54 932 people died due to air pollution in Ukraine in 2016, which is 123,6 deaths per 100 000 population. Also, the leaders in this ranking were Bulgaria (120,8), Georgia (118,8), Belarus (104,4), Bosnia and Herzegovina (86,75) and Moldova (86,06).
The rivers and territorial waters of the Black and Azov Seas are also in a poor state, which is deteriorating due to toxic, microbiological and biogenic pollution. Due to anthropogenic pollution, groundwater does not meet the sanitary standards for water sources in many regions. The major sources of water pollution are poor drainage infrastructure and purification equipment, leaching of poisonous substances from farmlands and discharges from industrial facilities. (Verkhovna Rada of Ukraine, 2019)
The National Environment Strategy of Ukraine for the period up to 2030 also mentions that the state of Ukraine's land resources is close to critical: about 20% of Ukraine's lands are polluted, more than 12% of the territory is subject to occasional flooding and about 57% of the territory is affected by erosion. The main reasons are that the current use of land resources does not meet the requirements of rational nature management, as well as excessive ploughing and use of poor technologies in agriculture, industry, energy and other sectors of the economy. Also, the environmental situation is worsened by considerable amounts of accumulated waste and the absence of effective measures of recycling and environmentally friendly disposal. Lack of effective control leads to the mass formations of uncertified landfills and multiple rules violations with hazardous waste management. (Verkhovna Rada of Ukraine, 2019)

Moreover, in the 30-km exclusion zone of the Chornobyl Nuclear Power Plant, plants, fungi, animals, microorganisms and viruses are permanently exposed to ionizing radiation. To overcome the consequences of the Chornobyl disaster, it is important to create and develop a radioactive waste management system, strengthen the barrier function of the exclusion zone and also maintain the post-Chornobyl disaster management facilities in a safe state. (Ivanyuta, 2021) According to Ivanyuta (2021:2), the total economic damage from this catastrophe for Ukraine amounted to about 180 billion US dollars, including the amount of indirect losses due to the inability to use contaminated agricultural land, water and forest resources, reduced electricity production and reduced production of goods.

Furthermore, due to military actions and the destruction of ecologically dangerous enterprises, the ecological balance was disturbed in the temporarily occupied territories of Donetsk and Luhansk oblasts. The biggest threats are air and soil pollution due to ammunition explosions; penetration of poisonous mine waters into the surface and ground waters due to their flooding; destruction of toxic and radioactive waste storage facilities; the devastation of forests, landscapes and vegetation due to the use of military equipment and fires caused by military actions. (Verkhovna Rada of Ukraine, 2019)

The recent invasion, which happened on February 24, 2022, has caused even more problems. The consequences of Russia's full-scale military invasion of Ukraine are not only human casualties, economic deterioration, the complete destruction of cities and the destruction of infrastructure, but also a negative impact on the environment, destruction of ecosystems, pollution of soils and waters, and reduction of biodiversity. According to Perha (2022), numerous cases of shelling and airstrikes on gas pumping stations, enterprises or warehouses where chemical, pharmaceutical or paint materials have been stored have resulted in damage to storage tanks for oil, kerosene, propane and diesel fuel, leading to air and groundwater pollution. The destruction of sewage pumping stations led to the fact that water from settlements enters the Dnieper without any treatment. Untreated effluents contain large amounts of organic matter, pathogenic bacteria, sulfates, chlorides, etc. Also, the detonation of missiles and artillery shells oxidizes the surrounding soil, wood, and turf, as well as formats a number of chemical compounds and a large number of toxic organic substances. During an explosion, all substances undergo complete oxidation, and the products of the chemical reaction are released into the atmosphere. Furthermore, the movement of heavy machinery, the construction of fortifications and fightings damage the soil cover - this leads to degradation of vegetation and increases wind and water erosion. About 2,9 million hectares of the network of protected areas, created to preserve thousands of species of plants and animals, are at risk of destruction. (Perha, 2022)

The UNDP (2022) also notes that the effects of war on the environment are often large-scale and devastating. For example, the use of explosive ordnance in cities creates large amounts of debris, which can cause air, water and soil pollution. People's Deputy of Ukraine Eduard Proshchuk (2022) stated that since February 24, Russia has not only fired heavy artillery at cities but has also struck almost 2000 cruise missiles across Ukraine. Fires caused by fightings and shellings have polluted the air, soil and water resources. The deputy also notes that especially dangerous are fires

in the Chornobyl Exclusion Zone, in the forests of which a significant amount of radionuclides are accumulated. In just one month of the Russian invasion and occupation of the Kyiv region, more than 30 outbreaks of large fires were detected in the Chornobyl zone, which in its turn led to an increase in the radiation background. Also, Kersten (2022) mentions the threat of an ammonia leak from a factory in Sumy that was caused by shelling and the danger of the Russian direct attack on Europe's largest nuclear power plant, Zaporizhzhia. Although it is currently impossible to estimate the exact environmental damage in Ukraine caused by the war, it is clear that the costs continue to increase with each passing day.

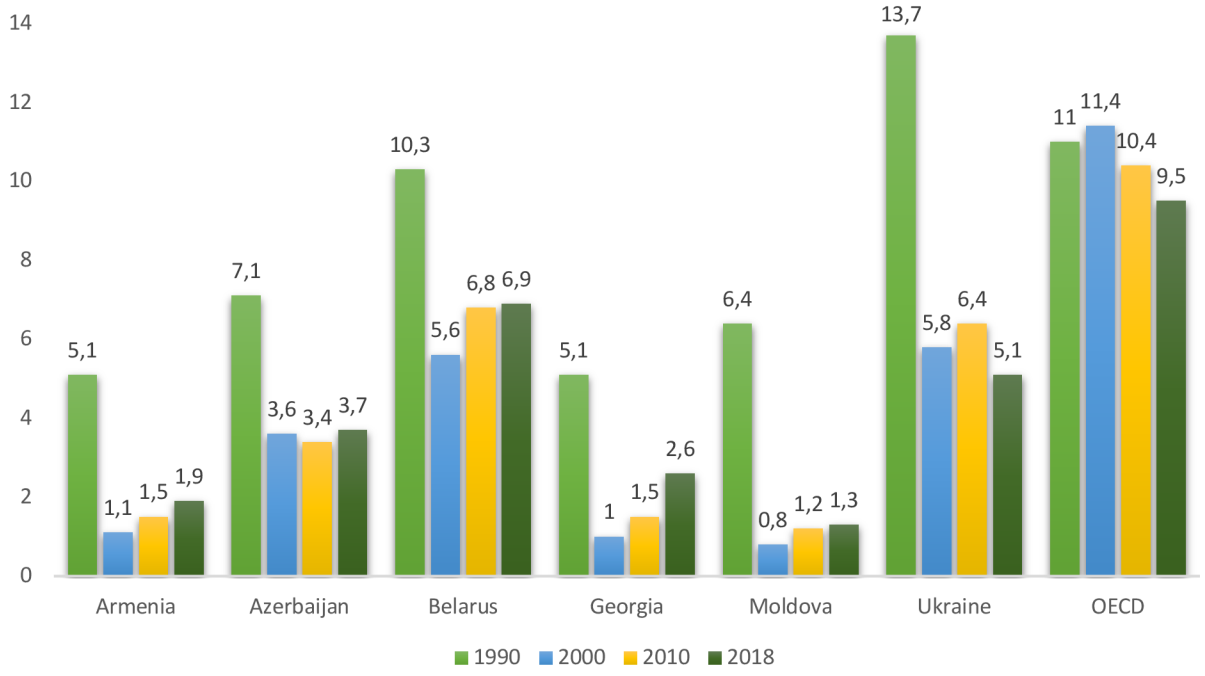
According to Environmental Performance Index (2020f), Ukraine ranks 60th place with a score of 49.5. To specify, the country scored 69th place in the Environmental Health policy objective and 66th place in the Ecosystem Vitality policy objective. In addition, Ukraine ranks 1st place among all countries in the agriculture issue category, which *"measures efforts to support healthy populations while minimizing the threats of agriculture to the environment, and is based on one indicator, the Sustainable Nitrogen Management Index"*.

3.7. Comparison of indicators

The addition of artificial greenhouse gases to the atmosphere affects the Earth's radiative balance and results in the planet's surface temperature growth, as well as sea level rise and negative effects on climate and global agriculture. The impact of carbon dioxide (CO_2) on the environment is especially important, as carbon dioxide makes up the biggest share of greenhouse gases contributing to global warming and climate change. However, the CO_2 emissions of a country are only one indicator of greenhouse gases. Gases such as methane and nitrous oxide should also be considered in order to better understand how the country is contributing to climate change. (World Bank, 2022h)

In some charts, OECD data will be added to compare the performance of the selected countries with the members of the organization. The Organisation for Economic Co-operation and Development is an international economic organisation that facilitates policies to enhance the economic and social well-being of the world population. There are 38 member countries, specifically: Austria, Australia, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. (OECD, 2021)

Figure 9: Carbon dioxide emissions, production emissions per capita (tones)



Source: Prepared by the author with data from UNDP, 2020

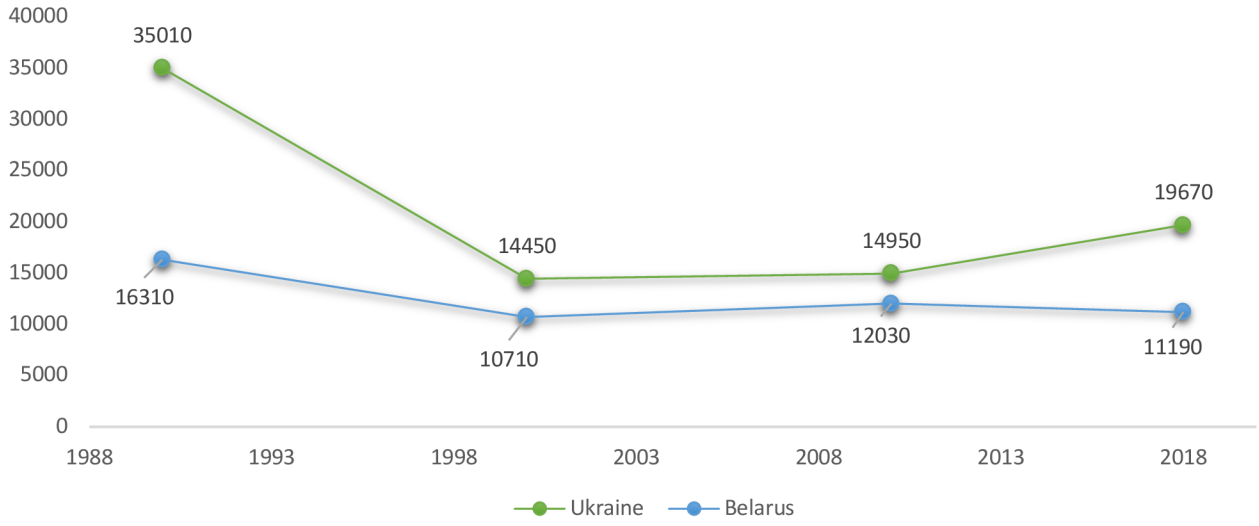
The figure 9 shows total carbon dioxide emissions from human activities (e.g., use of coal, oil and gas for combustion and industrial processes, combustion of associated gas and cement production), divided by the average annual population. It can be seen that the amount of carbon dioxide emissions significantly decreased since the collapse of the Soviet Union in each observed country. The biggest decrease per capita since 1990 happened in Ukraine. The smallest – in OECD.

Table 5: Agricultural nitrous oxide emissions (thousand metric tons of CO_2 equivalent)

Country	Year			
	1990	2000	2010	2018
Armenia	770	460	680	1 070
Azerbaijan	2 580	1 840	2 680	3 480
Belarus	16 310	10 710	12 030	11 190
Georgia	1 620	1 220	900	1 030
Moldova	1 910	960	660	1 020
Ukraine	35 010	14 450	14 950	19 670

Source: Prepared by the author with data from the World Bank, 2022h
Note: Agricultural nitrous oxide emissions are emissions produced through fertilizer use (synthetic and animal manure), animal waste management, agricultural waste burning and savanna burning (World Bank, 2022h).

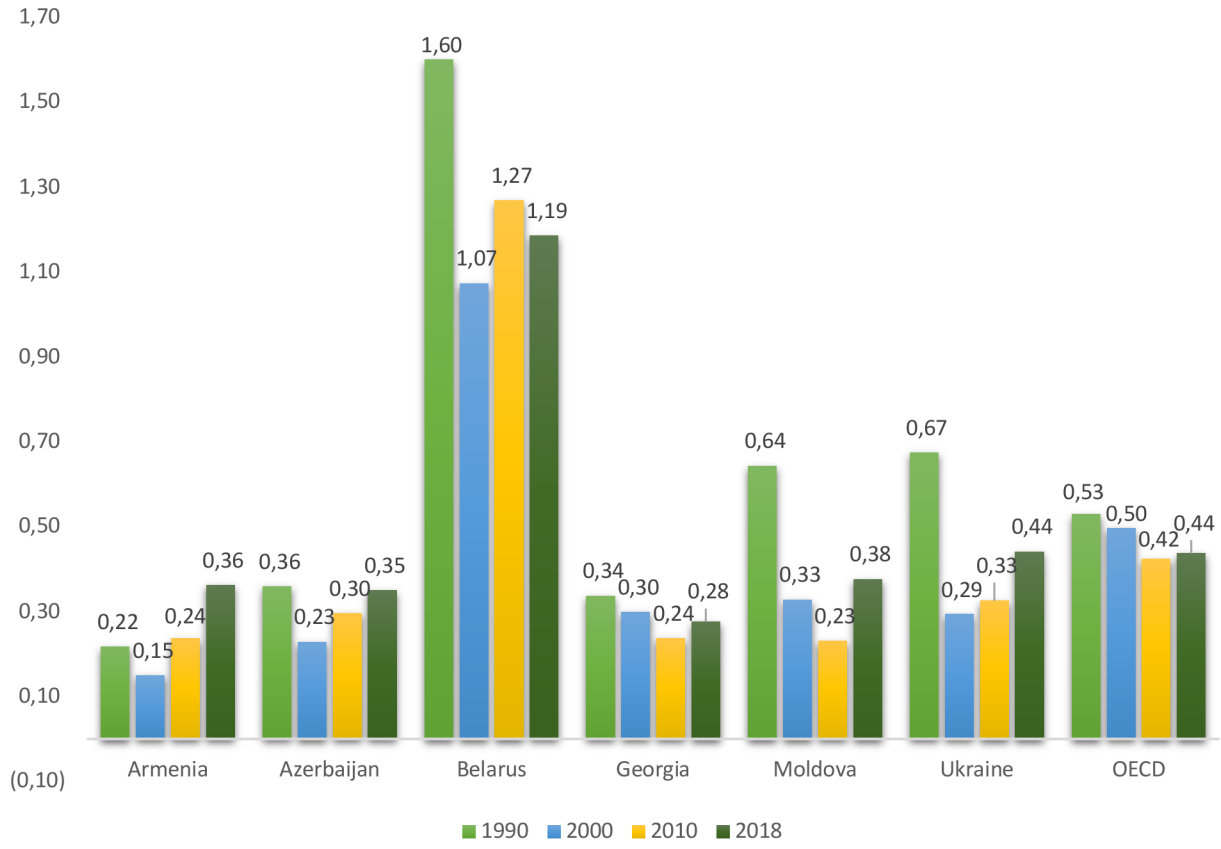
Figure 10: Agricultural nitrous oxide emissions (thousand metric tons of CO_2 equivalent) - Ukraine and Belarus



Source: Prepared by the author with data from the World Bank, 2022h
Note: The biggest changes in agricultural nitrous oxide emissions

The biggest changes between the years 1990 and 2018 are observed in Ukraine and in Belarus. There can be seen a strong decrease in agricultural nitrous oxide emissions since 1990. In Ukraine, the quantity of agricultural nitrous oxide emissions decreased from 35 010 thousand metric tons of CO_2 in 1990 to 19 670 thousand metric tons of CO_2 in 2018. In Belarus, there was a decrease from 16 310 thousand metric tons of CO_2 in 1990 to 11 190 thousand metric tons of CO_2 in 2018. Armenia and Azerbaijan, on the other hand, increased their agricultural nitrous oxide emissions since 1990.

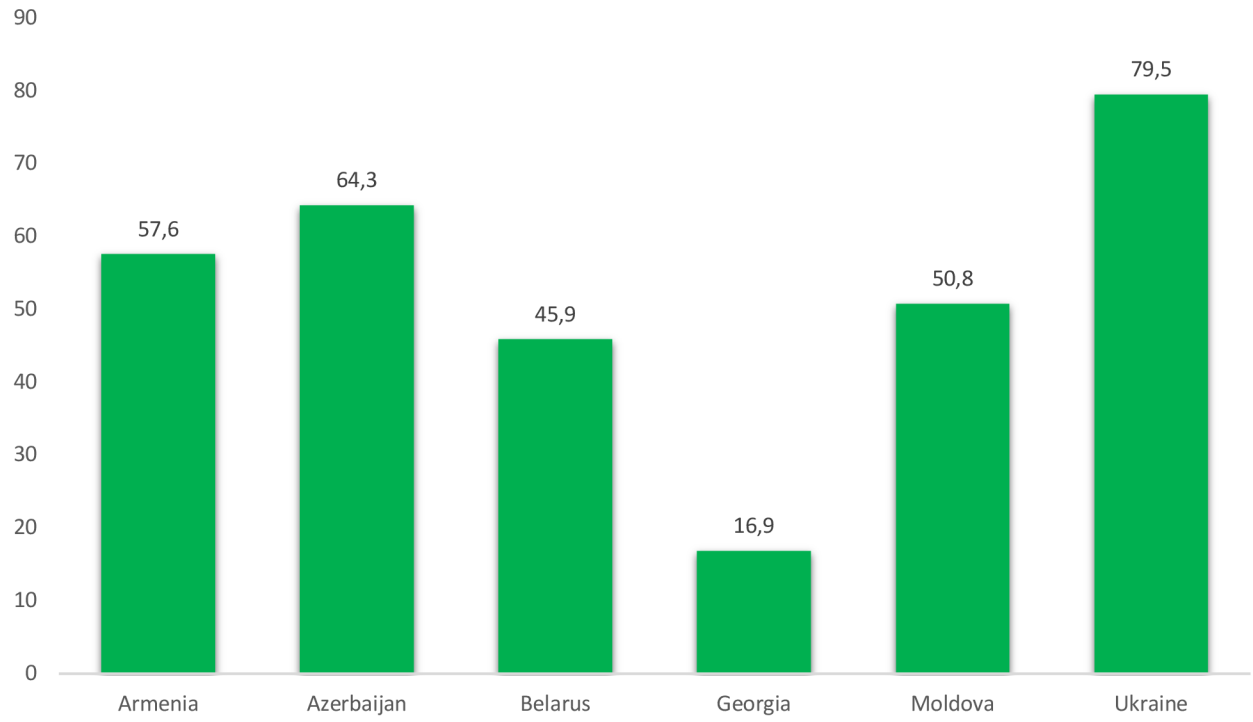
Figure 11: Agricultural nitrous oxide emissions (metric tons of CO_2 equivalent) per capita



Source: Prepared by the author with data from the World Bank, 2022h and World Bank, 2022j

Although emissions per capita in Belarus have been reduced, they are still high in comparison with other five countries in the region and OECD. Moreover, Belarus has one of the highest agricultural nitrous oxide emissions per capita in the world, ranking in 2018 10th place after Mongolia (1st), New Zeland (2nd), Australia, Uruguay, South Sudan, Ireland, Central African Republic, Chad and Paraguay (Our World in Data, 2022). If in absolute terms Azerbaijan increased its nitrous oxide emissions since 1990, in per capita there was a slight decrease from 0,36 to 0,35.

Figure 12: Sustainable Nitrogen Management Index



Source: Prepared by the author with data from the Environmental Performance Index, 2020h

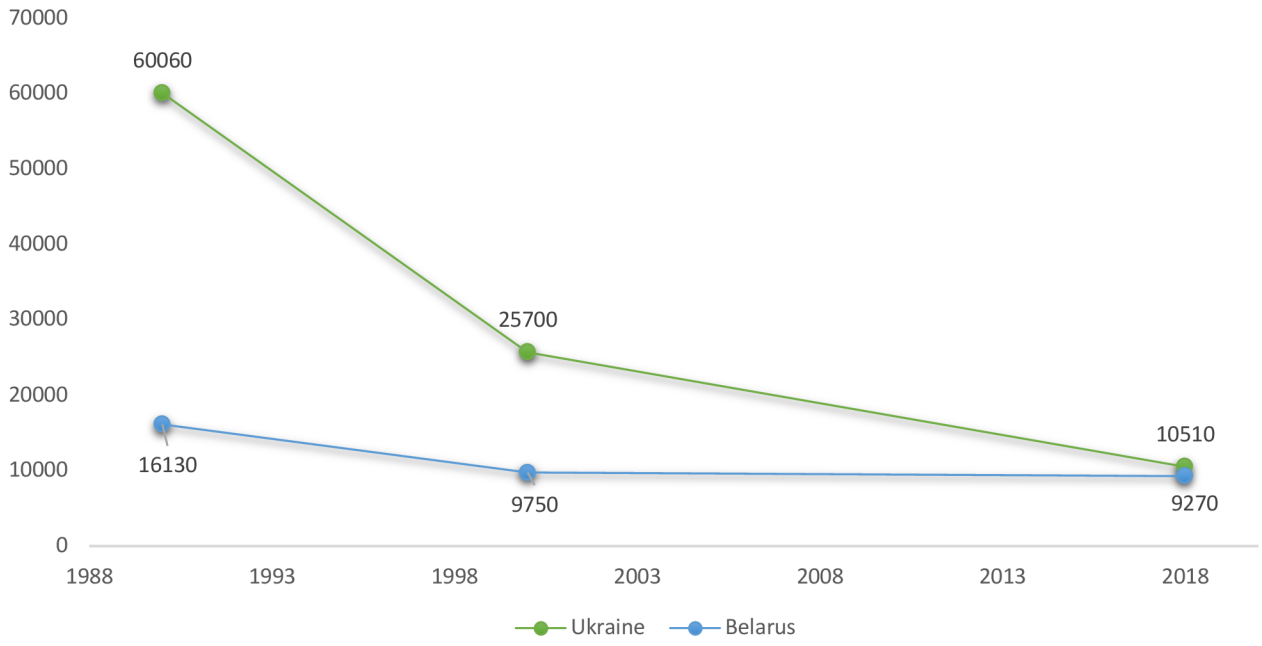
"The Sustainable Nitrogen Management Index (SNMI) seeks to balance the efficient application of nitrogen fertilizer with maximum crop yields as a measure of the environmental performance of agricultural production. The 2020 EPI uses the SNMI as a proxy for agricultural drivers of environmental damage. A score of 100 indicates that a country is optimizing both crop yields and fertilizer application, and a score of 0 indicates a country has among the worst performance on the SNMI." In Sustainable Nitrogen Management Index for the year 2020, Ukraine has the best score not only among the six countries studied but among 180 countries on the EPI list. Georgia, on the other hand, has the worst score among the studied countries and also ranks almost the lowest among all regions - 163rd place. Azerbaijan, for example, ranks 18th, Armenia - 30th, Moldova - 49th, and Belarus - 62nd. Czech Republic, for comparison, ranks 29th. (Environmental Performance Index, 2020h)

Table 6: Agricultural methane emissions (thousand metric tons of CO_2 equivalent)

Country	Year			
	1990	2000	2010	2018
Armenia	810	570	660	680
Azerbaijan	3 180	2 920	3 960	3 930
Belarus	16 130	9 750	8 990	9 270
Georgia	1 510	1 350	1 210	1 100
Moldova	2 730	1 350	860	700
Ukraine	60 060	25 700	13 670	10 510

Source: Prepared by the author with data from the World Bank, 2022i
Note: Agricultural methane emissions are emissions from animals, animal waste, rice production, agricultural waste burning, and savanna burning (World Bank, 2022i)

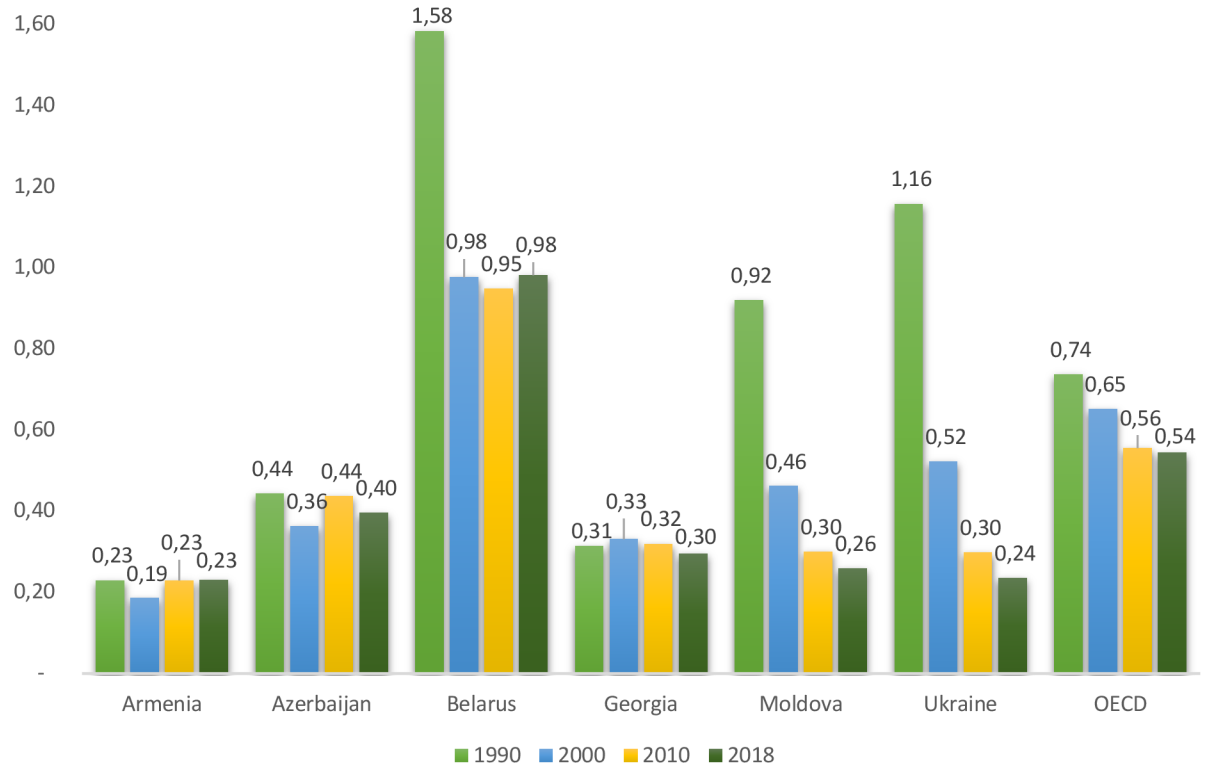
Figure 13: Agricultural methane emissions (thousand metric tons of CO_2 equivalent) - Ukraine and Belarus



Source: Prepared by the author with data from the World Bank, 2022i
Note: The biggest changes in agricultural methane emissions

Here, also, the biggest changes in agricultural methane emissions are observed in Ukraine, Belarus and Moldova. The most significant change between 1990 and 2018 can be seen in Ukraine, in 1990 there were 60 060 thousand metric tons of CO_2 and it decreased to 10 510 thousand metric tons of CO_2 in 2018 (the change of 49 550 thousand metric tons of CO_2 in 28 years). In Belarus, there was a decrease from 16 130 in 1990 to 9 270 thousand metric tons of CO_2 in 2018. Azerbaijan, unlike all the other observed states, had an increase in agricultural methane emissions – 750 thousand metric tons more than at the beginning of the observed period.

Figure 14: Agricultural methane emissions (metric tons of CO_2 equivalent) per capita



Source: Prepared by the author with data from the World Bank, 2022i and World Bank, 2022j

In per capita terms, Armenia did not have any changes in 2018, in comparison with 1990, Azerbaijan had a small decrease of 0,04, Belarus had a decrease of 0,6, and Georgia had a small decline of 0,01. Moldova reduced its emissions by 0,66, and Ukraine made the biggest drop - the country reduced its agricultural methane emissions per capita by 0,92 since 1990. Also, among the observed countries, only Belarus has more emissions per capita than OECD.

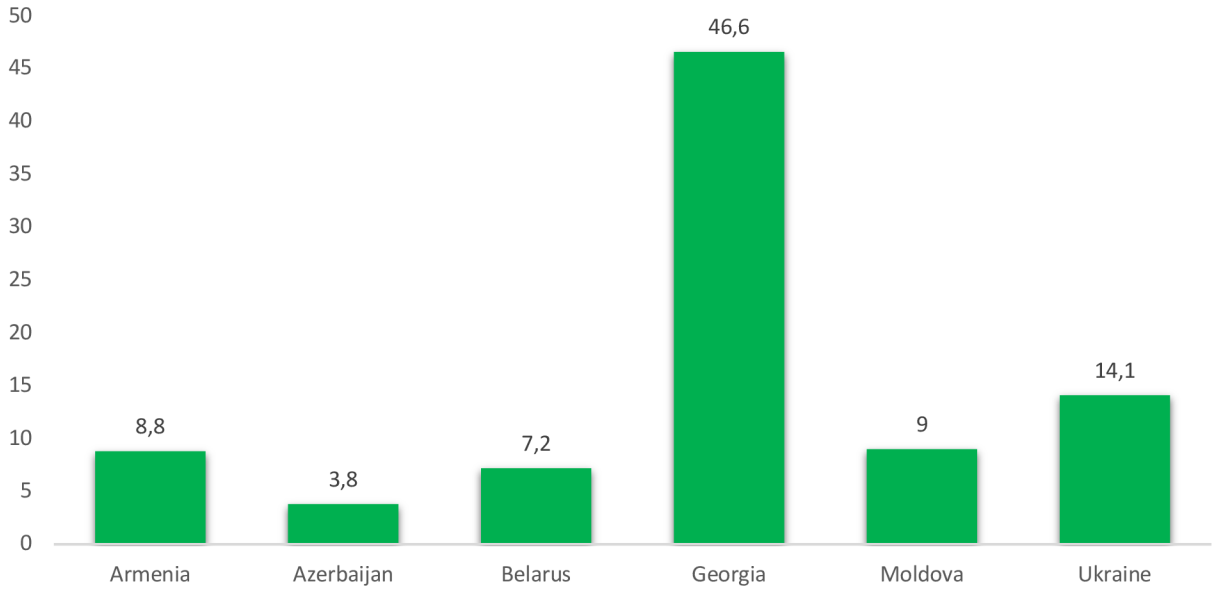
Table 7: Proportion of population using safely managed drinking water services (%)

Country	Year		
	2000	2010	2017
Armenia	29.59%	61.7%	86.47%
Azerbaijan	49.67%	68.7%	73.56%
Belarus	80.6%	90%	94.5%
Georgia	74.58%	78.5%	79.99%
Moldova	40.4%	62.17%	72.87%
Ukraine	65.75%	84.59%	92%

Source: Prepared by the author with data from the United Nations, 2022a,b,c,d,e,f

The aim of the Sustainable Development Goal 6 is to provide the accessibility and sustainable management of clean water and sanitation for all. In 2017, 86.5% of the population of Armenia, 73.6% of the population of Azerbaijan, 94.5% of the population of Belarus, 80.0% of the population of Georgia, 72.9% of the population of Moldova, and 92.0% of the population of Ukraine used a safely managed drinking water service – an improved public source free from pollution or infection. The biggest changes between 2000 and 2017 are observed in Armenia, Moldova and Ukraine.

Figure 15: Wastewater treatment EPI Score



Source: Prepared by the author with data from the Environmental Performance Index, 2020i

Environmental Performance Index (2020i) measures "*wastewater treatment as the proportion of wastewater that undergoes at least primary treatment in each country, multiplied by the proportion of the population connected to a wastewater collection system. A score of 100 indicates that a country has 100% of its population connected to a sewer system and 100% of household wastewater is treated; a score of 0 indicates that no wastewater is reported as treated within a country.*"

Table 8: Proportion of household wastewater safely treated

Country	Total household wastewater generated (millions of cubic meters)	Proportion of household wastewater safely treated (%)
Armenia	103,542	40,1%
Azerbaijan	234,972	57,4%
Belarus	262,589	56,5%
Georgia	185,438	46%
Moldova	110,808	38,5%
Ukraine	1432,001	34,3%

Source: Prepared by the author with data from the UN Habitat and WHO, 2021

According to UN Habitat and WHO (2021), estimates of the total volume of wastewater generated by households in 2020 show that the biggest proportions of safely treated household wastewater are in Azerbaijan (57,4%) and in Belarus (56,5%). The smallest, on the other hand, are in Ukraine (34,3%) and in Moldova (38,5%).

Table 9: Hazardous waste generated, per capita (kilograms)

Country	Year		
	2000	2010	2017
Armenia	124	151	184,5
Azerbaijan	3	15,5	27
Belarus	7	97	176,5
Moldova	0,7	0,2	2
Ukraine	53,5	36	13,6

Source: Prepared by the author with data from United Nations, 2022a,b,c,e,f
Note: data for Georgia was not available

The aim of the Sustainable Development Goal 12 is to ensure sustainable ways of consumption and production. Hazardous waste, for example, falls under that goal. According to EPA (2021), hazardous waste means waste that has dangerous qualities or has the ability to harm human health or the environment. Hazardous waste comes from multiple sources, varying from industrial waste to batteries, and can take a variety of forms, such as liquids, solid gases and sludge.
For the time period from the year 2000 to 2017 In Armenia, the quantity of hazardous waste generated per capita increased from 124,3 kg to 184,5 kg; in Azerbaijan, the quantity of hazardous waste generated per capita increased from 3,3 kg to 27 kg; Belarus had the biggest increase among the studied countries - the quantity increased from 7,4 kg to 176,5 kg; Moldova has the smallest amount of hazardous waste generated per capita, but the quantity has also increased from 0,7 kg to 2,1 kg; only in Ukraine, the quantity of hazardous waste generated per capita decreased from 53,5 kg in 2000 to 13,6 kg in 2017.

4. Identification and assessment of suitable indicators of environmental aid

Environmental aid can provide significant improvements for developing countries. It can improve biodiversity, economic, social and political conditions. Better environment can positively affect people's health, boost tourism, improve living conditions, preserve ecosystems and contribute to sustainable development of developing countries. The objective of this chapter is to identify and compare the volume of environmental aid to the selected countries, to learn which projects were implemented in the selected time periods and to compare the aid per capita.

For achieving that purpose, OECD.stat - Creditor Reporting System was selected. According to OECD (2021a), *"the objective of the CRS Aid Activity database is to provide a set of readily available basic data that enables analysis on where aid goes, what purposes it serves and what policies it aims to implement, on a comparable basis for all DAC members. Data are collected on individual projects and programmes. Focus is on financial data, but some descriptive information is also made available"*.

As the main source, the general environmental protection sector was selected because it comprises resources that are primarily directed to environmental protection. The OECD - CRS database can also identify other flows that are undoubtedly related to the environment, but are not included in the "environmental protection" sector. For example, some subcategories of the Water Supply & Sanitation sector, such as Water resources conservation, Basic drinking water supply, River basins development and Waste management/disposal. Energy generation and renewable sources sector, and also different subcategories of Agriculture, Forestry and Fishing sector may also be appropriate.

The figure 16 shows data regarding the flows of Official Development Assistance (ODA) to the selected countries. OECD (2021b) defines ODA as "*those flows to countries and territories on the DAC List of ODA Recipients and to multilateral development institutions which are: i. provided by official agencies, including state and local governments, or by their executing agencies; and ii. each transaction of which: a) is administered with the promotion of the economic development and welfare of developing countries as its main objective; and b) is concessional in character and conveys a grant element of at least 25% (calculated at a discount rate of 10 per cent).*" The type of flow chosen is "gross disbursements", which is defined by OECD (2021c) as *"the placement of resources at the disposal of a recipient country or agency, or in the case of internal development-related expenditures, the outlay of funds by the official sector."*

The table on the figure 16 was customized by the author to show the flows of all types of aid from the DAC (development assistance committee) countries to the General Environmental Protection sector of the chosen countries through all channels till the latest year with available data. For Belarus and Ukraine, data was available only since 2005 and for Moldova, Armenia, Azerbaijan and Georgia since 2002. Unfortunately, data for the previous years were not available. Also, for Belarus, data for 2017 were not available.

Figure 16: General environmental protection flows to Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine

Creditor Reporting System (CRS) : *Creditor Reporting System (CRS)*

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Donor	DAC Countries, Total
Sector	410: IV.1. General Environment Protection, Total
Flow	Official Development Assistance
Channel	All Channels
Amount type	Constant Prices
Flow type	Gross Disbursements
Type of aid	All Types, Total
Unit	US Dollar, Millions, 2019

Year / Recipient	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Belarus	..	..	..	0.096	0.017	0.344	0.696	0.345	2.944	3.016	0.282	0.084	0.761	0.570	0.429	..	0.032	0.497
Moldova	0.773	0.690	0.612	0.174	0.418	0.223	0.287	0.159	0.248	0.925	0.918	1.630	0.220	0.561	1.613	0.916	0.680	1.560
Ukraine	..	..	..	5.211	2.681	2.408	1.147	14.054	31.634	13.799	24.547	24.249	6.051	2.822	4.478	1.973	6.711	9.108
Armenia	0.527	0.251	1.108	8.107	12.820	8.449	3.686	2.287	1.845	2.045	0.516	0.859	1.652	0.619	1.162	1.943	0.713	47.880
Azerbaijan	0.185	0.262	0.200	0.522	0.938	0.467	0.420	0.777	0.840	0.796	0.291	0.819	1.310	0.449	0.238	0.562	0.228	0.324
Georgia	1.503	1.172	2.017	1.458	1.222	0.960	8.004	1.775	2.616	1.585	1.555	5.115	5.296	3.911	5.303	6.267	5.022	5.255

Source: OECD, 2021d

The General Environmental Protection sector includes:

- Environmental policy and administrative management
- Biosphere protection
- Biodiversity
- Site preservation
- Environment education/training
- Environmental research

The flows were monitored through all channels, such as:

- Public sector
- NGOs and Civil Society
- Public-Private Partnerships (PPP)
- Multilateral organisations
- Teaching institutions, research institutes or think-tanks
- Private Sector Institutions

All types of aid comprise:

- Budget support
  - ➢ General budget support
  - ➢ Sector budget support
- Core contributions and pooled programmes and funds
  - ➢ Core support to NGOs, other private bodies, PPPs and research institutes
  - ➢ Contributions to specific-purpose programmes and funds managed by implementing partners
  - ➢ Basket funds/pooled funding
- Project-type interventions
- Experts and other technical assistance
  - ➢ Donor country personnel
  - ➢ Other technical assistance
- Scholarships and student costs in donor countries
  - ➢ Scholarships/training in donor country
  - ➢ Imputed student costs
- Debt relief
- Administrative costs not included elsewhere
- Other in-donor expenditures
  - ➢ Development awareness
  - ➢ Refugees/asylum seekers in donor countries
  - ➢ Asylum-seekers ultimately accepted
  - ➢ Asylum-seekers ultimately rejected
  - ➢ Recognised refugees

Amount type: constant prices. Unit: US Dollar, Millions, 2019

Comparison of the general environmental protection flows during the selected period

The tables below are designed to show the general environmental protection flows in the available years, the total amount of flows and for the period of assistance and aid per capita.

Table 10: General environmental protection flows

Year	Recipient (US Dollar, Millions, 2019)					
	Armenia	Azerbaijan	Belarus	Georgia	Moldova	Ukraine
2002	0,527	0,185	..	1,503	0,773	..
2003	0,251	0,262	..	1,172	0,690	..
2004	1,108	0,200	..	2,017	0,612	..
2005	8,107	0,522	0,096	1,458	0,174	5,211
2006	12,820	0,938	0,017	1,222	0,418	2,681
2007	8,449	0,467	0,344	0,960	0,223	2,408
2008	3,686	0,420	0,696	8,004	0,287	1,147
2009	2,287	0,777	0,345	1,775	0,159	14,054
2010	1,845	0,840	2,944	2,616	0,248	31,634
2011	2,045	0,796	3,016	1,585	0,925	13,799
2012	0,516	0,291	0,282	1,555	0,918	24,547
2013	0,859	0,819	0,084	5,115	1,630	24,249
2014	1,652	1,310	0,761	5,296	0,220	6,051
2015	0,619	0,449	0,570	3,911	0,561	2,822
2016	1,162	0,238	0,429	5,303	1,613	4,478
2017	1,943	0,562	..	6,267	0,916	1,973
2018	0,713	0,228	0,032	5,022	0,680	6,711
2019	47,880	0,324	0,497	5,255	1,560	9,108
Total	96,468	9,627	10,113	60,034	12,606	150,872

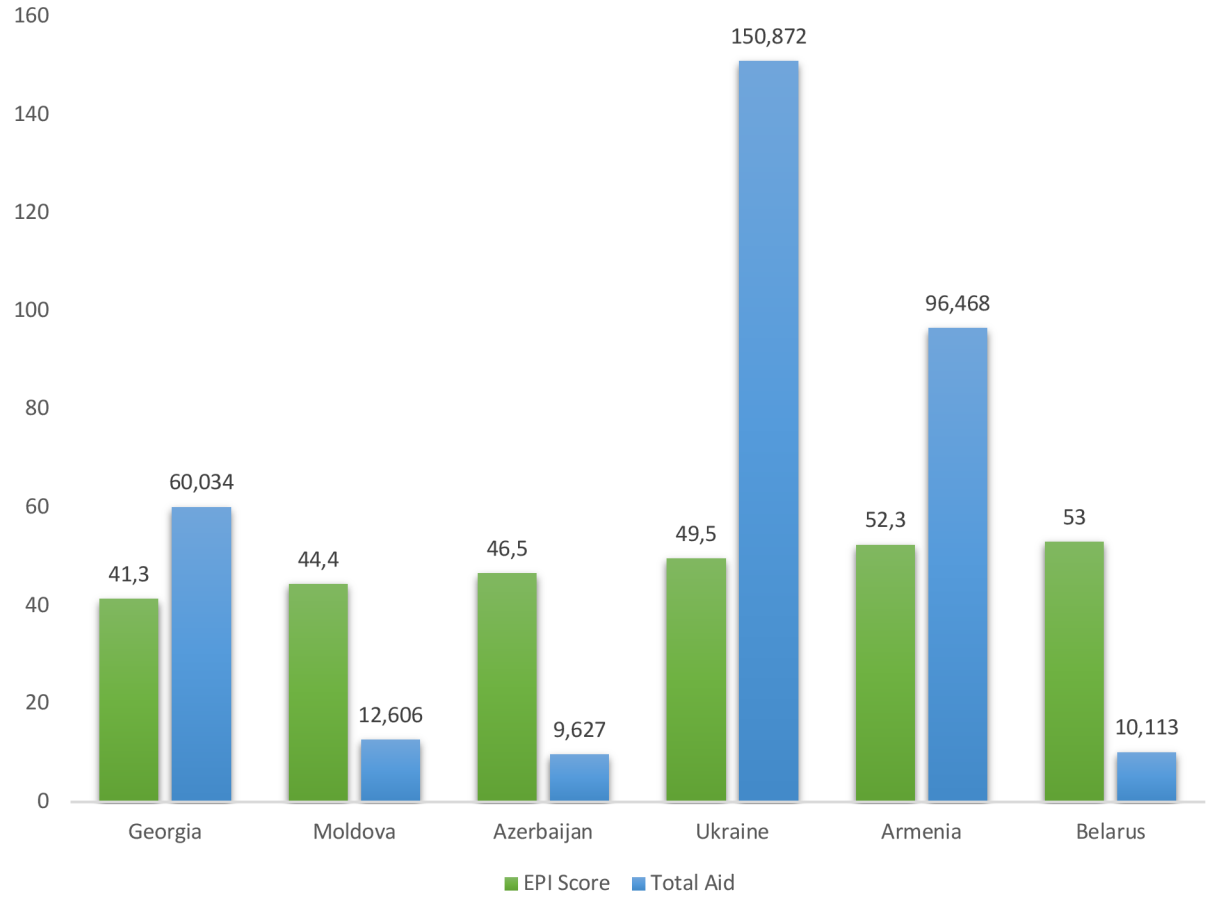
Source: Prepared by the author with data from the OECD, 2021d

Table 11: Total aid and Aid per capita

Recipient	Total aid (US $)	Aid per capita
Ukraine	150 872 000	3,4
Armenia	96 468 000	32,62
Georgia	60 034 000	16,14
Moldova	12 606 000	4,73
Belarus	10 113 000	1,07
Azerbaijan	9 627 000	0,96

Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

Figure 17: EPI Score vs Total Aid



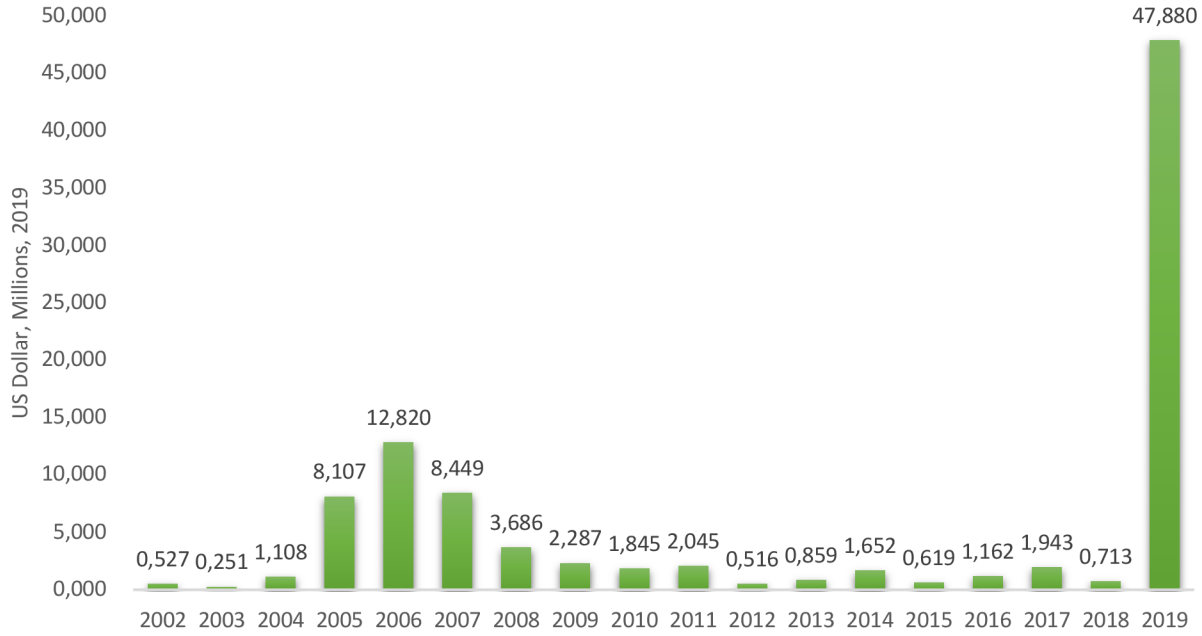
Source: Prepared by the author with data from the OECD, 2021d and Wendling et al., 2020

The image above shows the difference between the volume of aid and the Environmental performance index score of the countries. It can be seen that there is no relation between the two of them. The smallest score didn't have the smallest amount of aid, and the highest score didn't have the biggest amount or vice versa.

Georgia, with the lowest score (41,3) among the studied countries, between the years 2002 and 2019 received 60,034 millions of US dollars; Azerbaijan, on the other hand, has a higher score (46,5) than Georgia, but between 2002 and 2019 received a smaller amount of environmental aid – 9,627 millions of US dollars. Ukraine has a higher score (49,5) than Georgia, Moldova and Azerbaijan and between 2005 and 2019 the country received 150,872 million US dollars - the highest amount. But Belarus has the highest EPI score and at the same time received almost the smallest amount among the studied countries.

Recipient Armenia

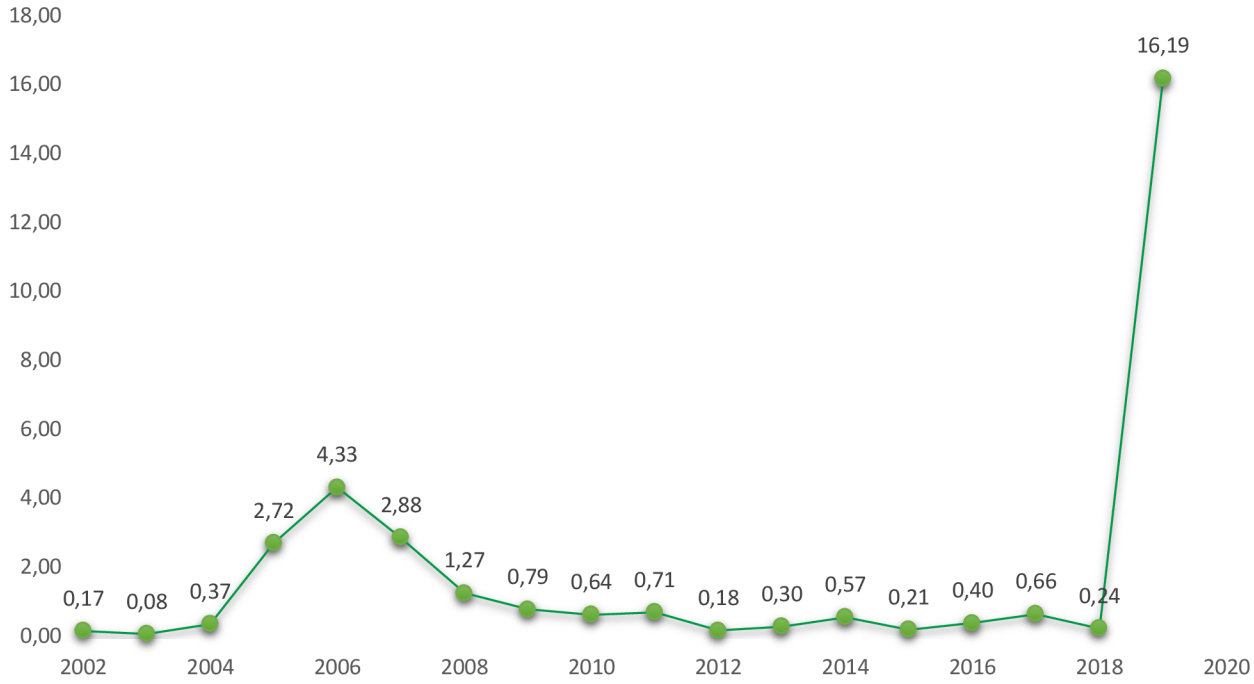
Figure 18: Flows to Armenia



Source: Prepared by the author with data from the OECD, 2021d

For the 2002 – 2019 time period Armenia received 96,468 million dollars with the biggest flow in 2019 when country received 47,880 million dollars. The main donors in 2019 were Austria, Czech Republic, France, Germany, Japan and United States. Donors' projects were focusing on youth and communities take action on climate change mitigation, adaptation, impact reduction and early warning through education, local governance, human and institutional capacity development; empowering civil society in towns Alaverdi and Akhtala in addressing problems with industrial pollution; promoting civil participation in solving the environmental problems; study of the distribution data for selected Caucasian plants; ecoregional conservation; improvement of equipment for restoration and conservation of archaeological artifacts for the Scientific-Research Centre of the Historical and Cultural Heritage. (OECD, 2019a) Also, in 2006, there were projects from the United States aimed at safe and sustained access to energy and water resources (OECD, 2006).

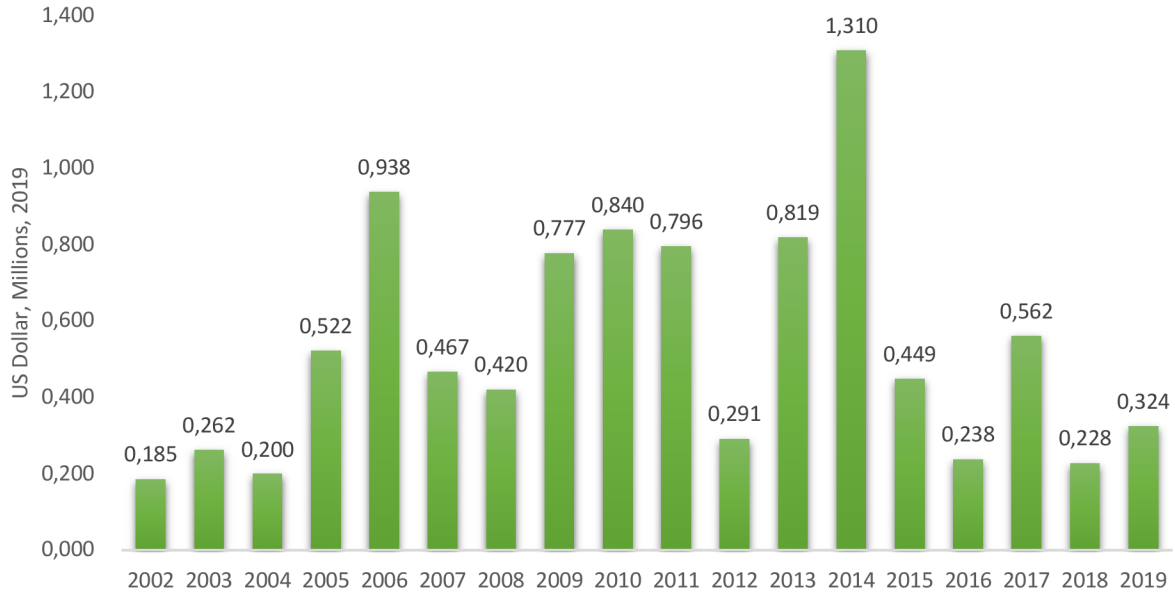
Figure 19: Aid per capita Armenia



Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

Recipient Azerbaijan

Figure 20: Flows to Azerbaijan



Source: Prepared by the author with data from the OECD, 2021d

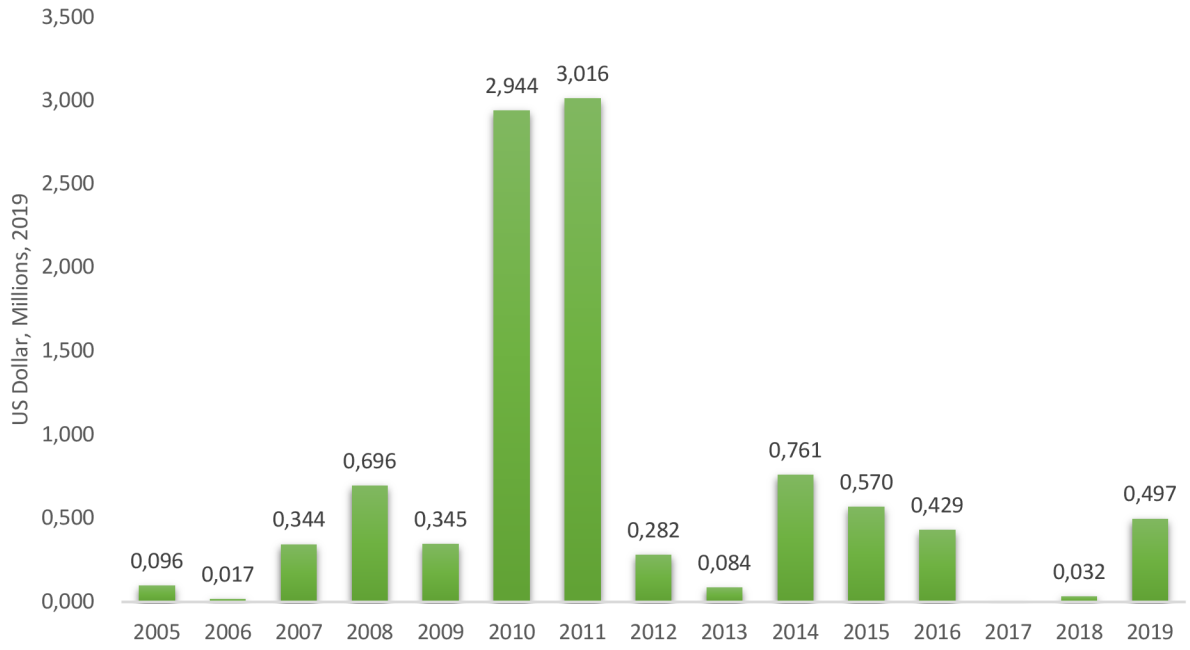
For the 2002 – 2019 time period Azerbaijan received 9,627 million dollars with the biggest flow in 2014 when country received 1,310 million dollars. In 2014, the main Azerbaijan's donors were France, Germany, Japan, Korea, Norway and United States. The main purposes of the projects were to secure biodiversity and reduce conflict potential in the region of the Southern Caucasus; to improve ecosystem biodiversity; capacity building in environment and water management; improving governance and management of protected areas; and site preservation. (OECD, 2014a)
In 2009, there were projects to support the development and implementation of an administration strategy for the national parks; a program of activities for reducing greenhouse gas emissions; analysis and development of the cadaster of polluted areas and employee training at the department of urban planning; and training of environmental inspectors of Azerbaijan (OECD, 2009).
In 2010, one of the projects focused on biosphere protection and aimed to establish a European Monitoring and Evaluation Programme rural air quality monitoring station in Azerbaijan (OECD, 2010a). In 2013, there was a financial contribution in order to secure biodiversity and lower conflict potential in the region of the Southern Kaukasus; also, there was a transfer of know-how in the area of managing contaminated lands, and the development of a decision support system as the basic planning tool for rural areas threatened by erosion in north-western part of Azerbaijan; the other project aimed to improve the management of protected areas (OECD, 2013a).

Figure 21: Aid per capita Azerbaijan

Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

Recipient Belarus

Figure 22: Flows to Belarus



Source: Prepared by the author with data from the OECD, 2021d

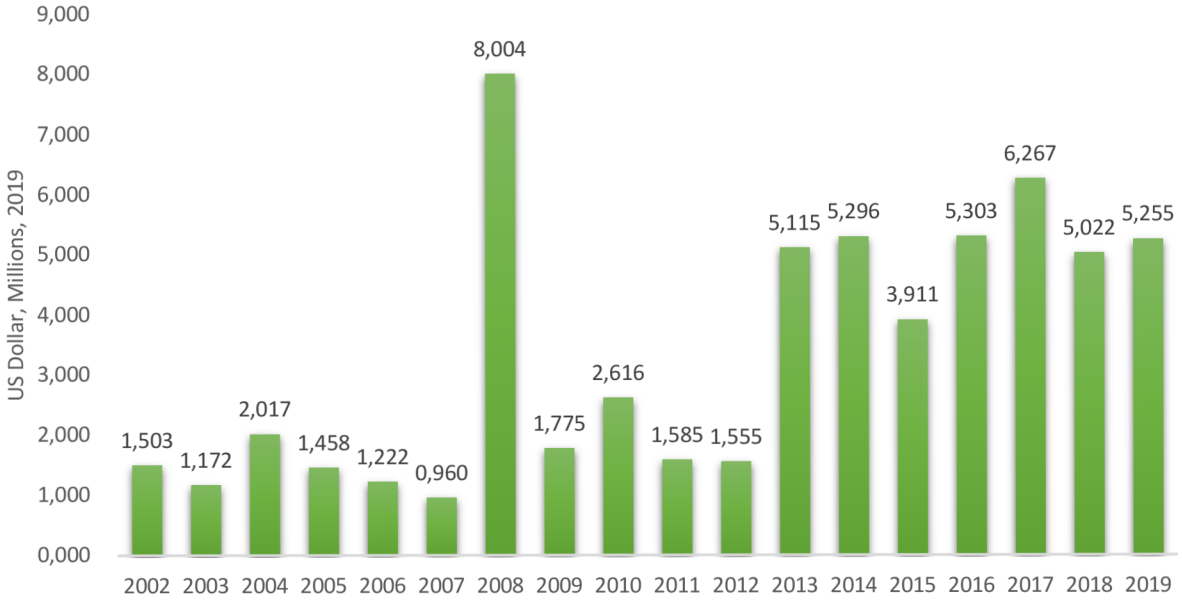
For the 2005 – 2019 time period Belarus received 10,113 million dollars.
The biggest flows were in 2010 and 2011, country received 2,944 million and 3,016 million dollars. The main donors in the year 2010 were Germany, Norway and Sweden. Projects were focused on renewable energies, development of renaturation methods, development and implementation of a comparative wetland monitoring system, strengthening civil society organizations working in the field of environment, building competence within energy efficiency and promoting environmental protection (OECD, 2010b)
In 2011 there were two main donors - Norway and Sweden. Major goals of the projects were: improvement of environmental education on energy and climate in Belarus, energy efficiency, investigation of the effect of forest fires on the behaviour of radionuclides, strengthening civil society organizations operating in the field of environment and increasing of environmental security (OECD, 2011). Also, in 2014, in close cooperation with Ukrainian partners, a long-term programme for industrial energy efficiency and cleaner production in Belarus was implemented. The other project's goal was to apply open-source software and methods for territorial analysis and sustainable use of natural resources in Belarus. (OECD, 2014b)

Figure 23: Aid per capita Belarus

Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

Recipient Georgia

Figure 24: Flows to Georgia



Source: Prepared by the author with data from the OECD, 2021d

For the 2002 – 2019 time period Georgia received 60,034 million dollars with the biggest flow in 2008 when country received 8,004 million dollars. In 2008 main Georgia's donors were France, Germany, Norway, Sweden and United States. They implemented projects, which were focusing on biosphere protection; rehabilitation of degraded areas in the context of climate change; regional environmental policy in the Southern Caucasus; supporting the Ministry of environmental protection; contributing to the development of a biodiversity monitoring system; protection of the biodiversity in the South Caucasus and development of environmental NGOs; strengthening the natural resources management; and archaeological activities. (OECD, 2008)

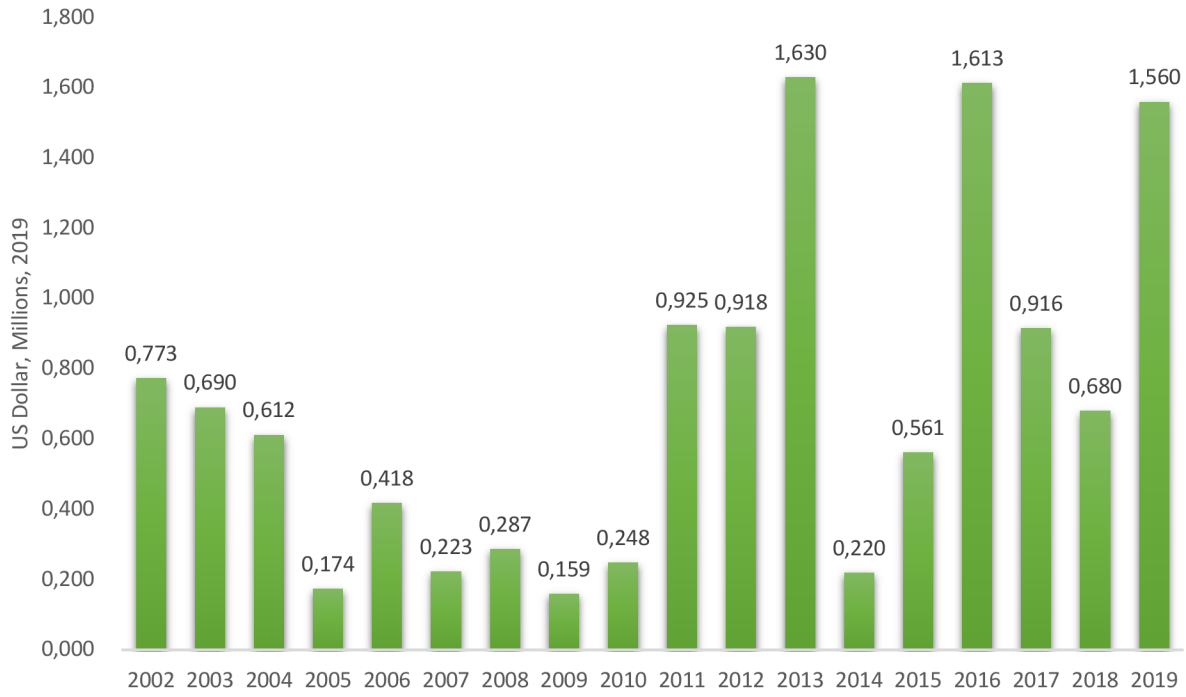
The next significant year was 2017 when the projects aimed at the preservation of unique forests in Georgia by creating new protected areas; grants and technical assistance in the agriculture sector; waste management support; actions to protect drinking water from contamination; measures to mitigate the effects of droughts, and boosting environmental and social responsibility in the mining sector in the Caucasus (OECD, 2017).

Figure 25: Aid per capita Georgia

Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

Recipient Moldova

Figure 26: Flows to Moldova

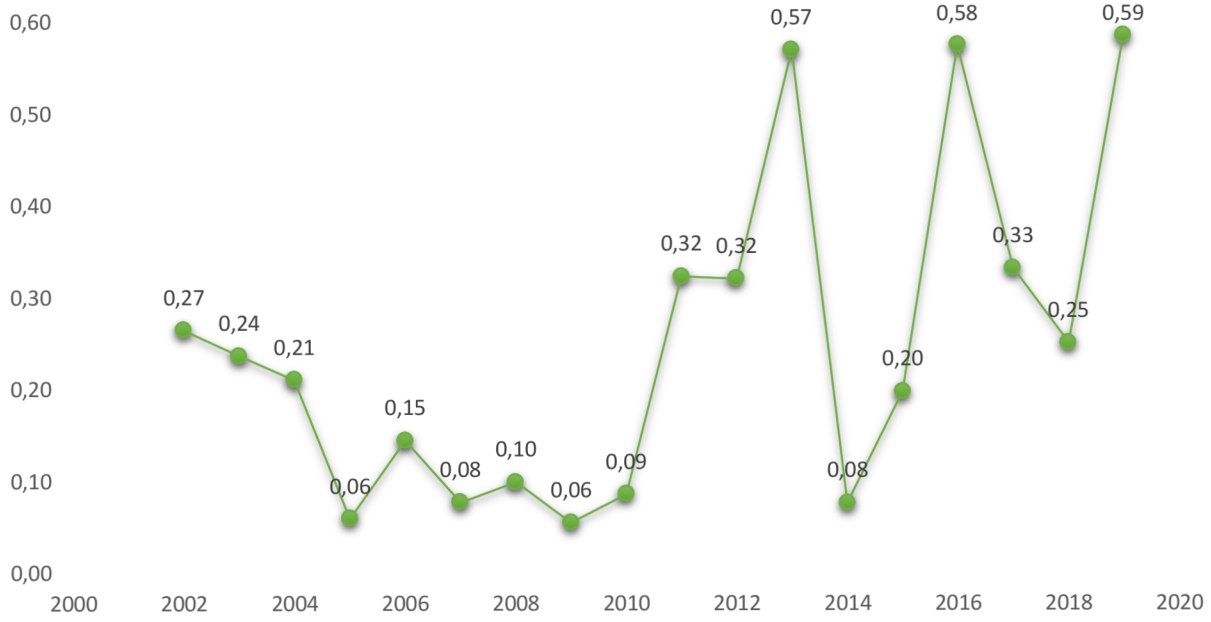


Source: Prepared by the author with data from the OECD, 2021d

For the 2002 – 2019 time period Moldova received 12,606 million dollars. The biggest flows were in 2013, 2016 and 2019, country received 1,630 million, 1,613 million and 1,560 million dollars. In 2013 the main donors were Austria, Czech Republic, Finland, Germany, Poland, Slovak Republic, Sweden and United States. The projects were aiming at support of Moldova's National Climate Change Adaptation Planning Process, increase of education and awareness of the young generation in the field of sustainable development, supporting local and regional authorities with the implementation of an integrated local management system and waste management. (OECD, 2013b) In 2016 the donors were Austria, France, Germany, Poland, Sweden and United States. The donors were aiming at supporting Moldova's National Climate Change Adaptation Planning Process; promoting sustainable development; supporting national, regional and local administration in planning and implementation of improved services in four priority sectors - water supply and sanitation, solid waste management and energy efficiency in public buildings; and others. (OECD, 2016) In 2019 the donors were Austria, Czech Republic, France, Germany, Slovak Republic, Sweden and United States. Goals of the projects were: enhancing climate resilience in the Biosphere Reserve; ecosystem-based adaptation, climate-resilience measures and institutional development; environmental research for the development of the tourism sector; capacity building

in the field of education and research; biosphere protection, removal of pesticides; supporting sustainable development; environmental education and training; and site preservation (OECD, 2019b)

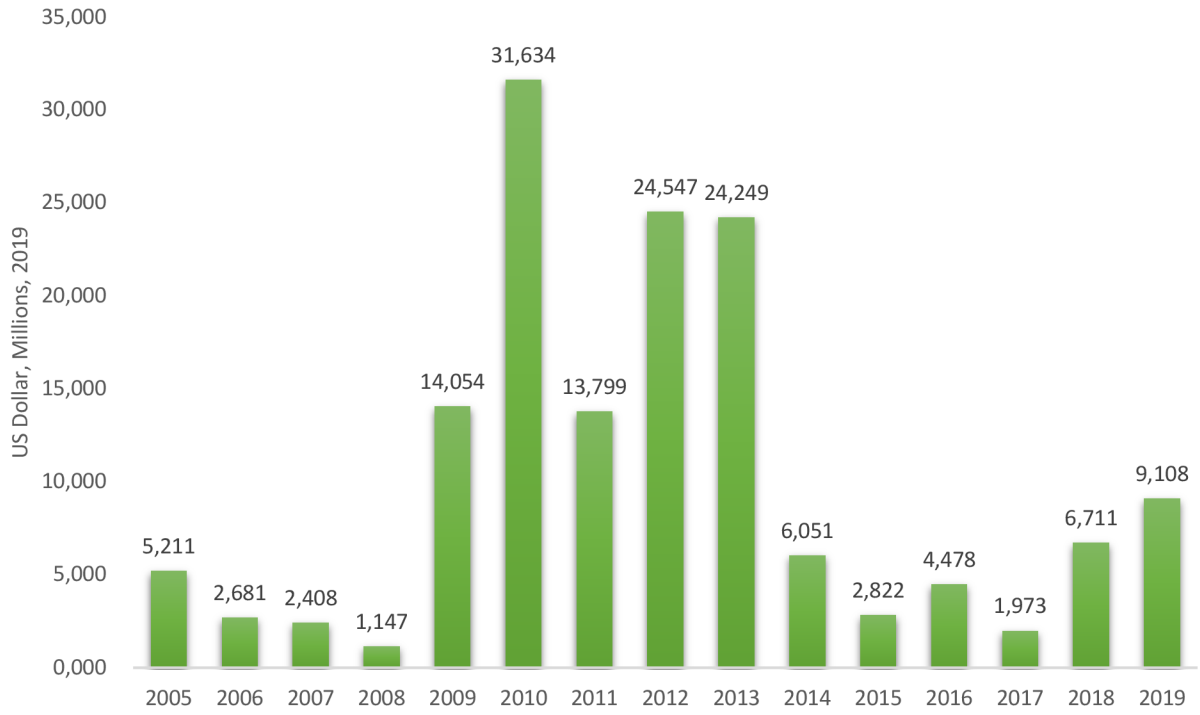
Figure 27: Aid per capita Moldova



Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

Recipient Ukraine

Figure 28: Flows to Ukraine



Source: Prepared by the author with data from the OECD, 2021d

For the 2005 – 2019 time period Ukraine received 150,872 million dollars.
The biggest flows were in 2010, 2012 and 2013, country received 31,634 million, 24,547 million and 24,249 million dollars. In 2010, major donors in Ukraine were Canada, Germany, Norway, Sweden and United States. Canada's projects were focused on engaging youth volunteers in development projects attempting to make better health outcomes and advance environmental sustainability; supporting partner organizations working on health and environment-related initiatives through projects in the following sectors: (1) primary health care; (2) family planning and reproductive health care; (3) food and nutrition; (4) environmental conservation, pollution prevention, and capacity building in environmental management; and (5) equality between women and men. Germany was focusing on landscape planning; improving the management of buffer zones in conservation areas of the Carpathians; capacity building of the administration department for nature and environment; climate-smart sustainable mobility strategy. Norway focused on capacity building for environmental NGOs in order to promote sustainable energy policy; creating a network of climate activists all over the country to raise public awareness about climate change; improving the ecological situation; organising a summer school which trains creating conditions for ecotourism and sustainable development of the local community; providing schooling for the

forestry administration, tourism actors, local administration and NGOs for promoting the sustainable management of the natural resources in the Ukrainian Carpathians; capacity building within the field of energy efficiency and climate change; environmental education. Sweden's projects were aimed at cooperation between the Swedish Chemicals Agency and part in Ukraine (Ministry of Industry); area of civil radiation protection; development of regulation and reforms in the area of solid waste management, water management, environmental protection, transboundary cooperation; introducing sustainable development lessons into school curriculum in the selected oblasts of Ukraine, including Crimea; eliminating the rocket fuel Melange. US projects focused on international capacity building; The Chornobyl Shelter Fund worked on stabilizing and replacing the deteriorating sarcophagus which entombs the highly radioactive remains of the destroyed Chornobyl 4th reactor. (OECD, 2010c)

In 2012, major donors in Ukraine were Germany, Sweden and United States. Germany's projects were focused on capacity building on protected areas and their management; realization of the Ukrainian National Park programme; communication structures between Slovak, Ukrainian and German UNESCO beech forest sites; training for improving the management of buffer zones in conservation areas of the transnational World Natural Heritage Site Primeval Beech Forests of the Carpathians in Slovakia and Ukraine; strengthening the capacity of Ukraine's educational establishments and raising awareness of environmental issues; monitoring air pollutants from aircraft emissions near an airport. Sweden's projects aimed at support to Pripyat-Stokhid Natural Park; education for sustainable development; radiation protection; chemical management; education about sustainable development. US was focused mainly on the Chornobyl Shelter Fund. (OECD, 2012)

In 2013, Canada, France, Germany, Sweden and United States were among the main donors. Canada's projects were primarily focused on the Volunteer Cooperation Program (2009-2014) and supporting partner organizations working on health and environment-related initiatives through projects in the following sectors: (1) primary health care; (2) family planning and reproductive health care; (3) food and nutrition; (4) environmental conservation, pollution prevention, and capacity building in environmental management; and (5) equality between women and men. Germany's projects were aiming at improvement of air in and around the city of Mariupol; implementation of the Ukrainian National Park programme; landscape planning; German-Ukrainian innovation partnership in sustainable environmental technologies; Climate-Smart Sustainable Mobility Strategy - developing of mobility management during and after the European Football Championship 2012. Sweden's projects were about the Environment Programme Review; events with the topic of facing the climate and future; support to the environment movement; capacity development and dialogue at national level and development of regulation and reforms in the area of solid waste management, water management, environmental protection and transboundary cooperation; radiation protection; environment education. US major projects were focused on site preservation; the Chornobyl Shelter Fund; technical assistance to fulfil requirements of environmental regulations regarding environmental impacts of U.S. funded activities overseas. (OECD, 2013c)

Figure 29: Aid per capita Ukraine

Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

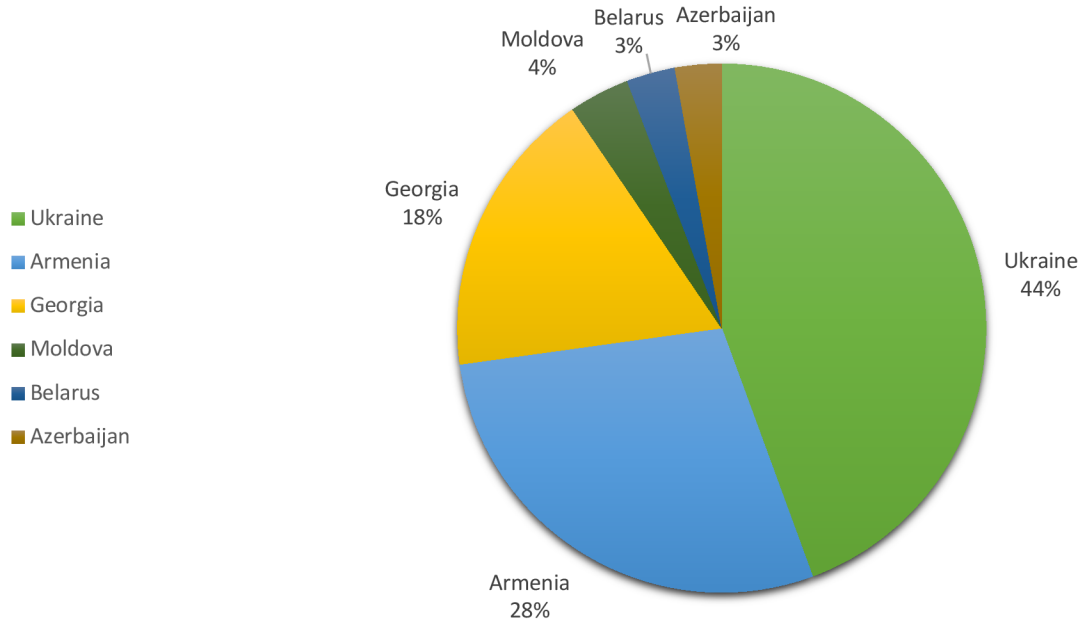
Table 12: Total aid vs Aid per capita

Recipient	Total aid (US $)	Aid per capita
Ukraine	150 872 000	3,4
Armenia	96 468 000	32,62
Georgia	60 034 000	16,14
Moldova	12 606 000	4,73
Belarus	10 113 000	1,07
Azerbaijan	9 627 000	0,96

Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

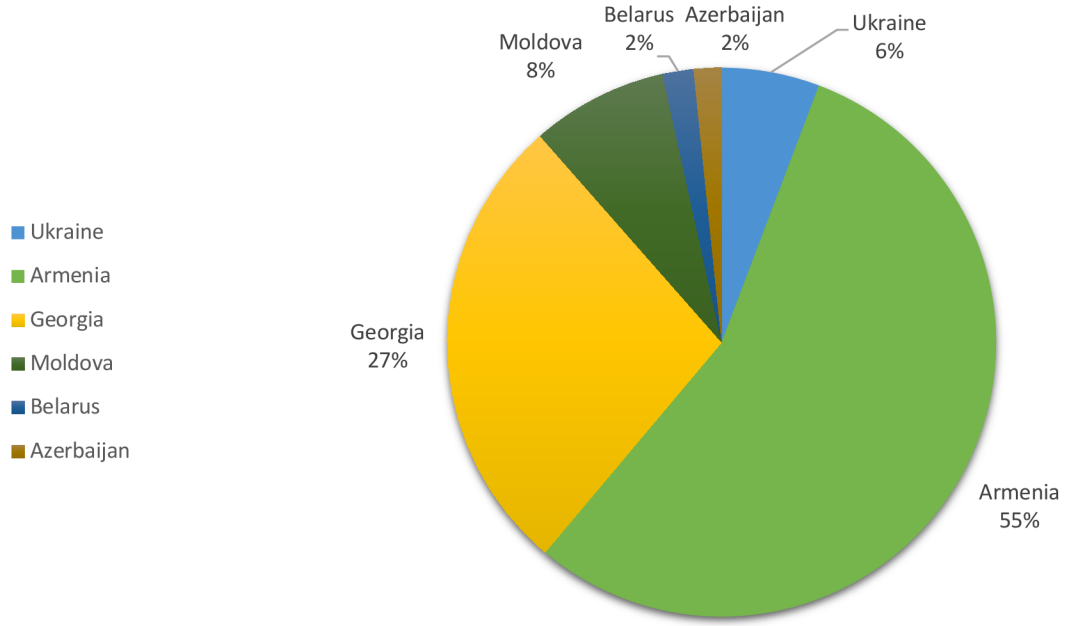
Overall, the biggest amount of flows went to Ukraine (150,872 million dollars) and the smallest to Azerbaijan (9,627 million dollars). But in per capita terms, the situation looks different. According to the chart below, the largest aid per capita was in Armenia (32,62) and the smallest one in Azerbaijan (0,96).

Figure 30: Total aid (US $)



Source: Prepared by the author with data from the OECD, 2021d

Figure 31: Aid per capita



Source: Prepared by the author with data from the OECD, 2021d and World Bank, 2022j

Conclusion

All in all, it can be said that the attitude towards nature in USSR was consumeristic and caused significant damage to the environment of its member states. The Soviet government has consistently devoted a huge share of its resources to creating a large military-industrial complex in the country, neglecting the most important environmental problems and resisting the interventions of any environmental interests. As a result, excessive industrialization, militarization and defence activities have proved to be one of the most damaging to the environment. Because of the fact that the best air pollution control technologies available to the Soviet Union lagged behind world standards by about 20 years, air quality was one of the greatest issues. Areas with especially poor air quality included Ukrainian industrial centres like Donetsk, Kryvyi Rih and Dnipro, the Moscow region, the coast of the Sea of Azov, the northern coast of the Caspian Sea and the North Caucasus. Also, many rivers have been affected by the uncontrolled disposal of petroleum products, phenols, heavy metals, wastewater and agricultural effluents. The republics with the most overloaded municipal wastewater treatment systems were Belarus, Ukraine, Tajikistan, Latvia and Lithuania. And Azerbaijan's capital, Baku, was equipped with only a basic sewerage system, with upgrades delayed by a decade.

Excessive grazing, intensive tillage and continuous logging disturbed the chemical balance of the soil, contributed to erosion, and desertification and caused a substantial reduction in land productivity in the central chernozem regions. Irrational use of pesticides led to their accumulation in soils and waters. In addition, more than 10 000 hectares of farming land contained residual amounts of DDT in quantities surpassing the maximum permissible concentrations. About a quarter of all agricultural land was treated with chemical pesticides. The fact that farmers were taught little about the proper use of pesticides, technical support was inefficient, and farmers often didn't have enough of the required equipment to use pesticides correctly resulted in significant damage to crops and the environment. Moreover, millions of hectares of once-fertile lands have been withdrawn from agricultural use due to mining activities, erosion, flooding, salinization and desertification.

Furthermore, in USSR, due to the lack of environmentally friendly methods of disposal, waste was dumped virtually anywhere – the amount of toxic industrial waste, most of which was taken to landfills of municipal solid waste, was rapidly growing and planners have not been able to develop appropriate and environmentally friendly ways to dispose of by-products. As a result, the masses of waste accumulated in landfills, contaminated soils, surface and ground waters and air basins. In addition, the negative effects of Chornobyl resulted in large amounts of harmful emissions and radiation pollution of air, waters, soils and forests.

After the collapse of the Soviet Union, the former member countries had a lot of environmental challenges on their way. Armenia's main environmental issues were soil contamination from toxic chemicals, deforestation, problems with water resources caused by economic development during the USSR period like pollution, drying out of Lake Sevan and contamination of rivers. Azerbaijan faced challenges like droughts, soil contamination due to oil spills, waterlogging and salinization, overuse of fertilizers and pesticides, industrial waste and other pollutants, the use of DDT pesticides and toxic defoliants, and pollution of surface and groundwater by untreated domestic, industrial and agricultural effluents, and problems in both supply and quality of water resources. Belarus faced problems with soil pollution from the use of pesticides, air pollution from industrial emissions and exhaust fumes from automobiles, hazardous waste, and radioactive contamination of the southern part of the country because of the accident at Chornobyl. Among major

environmental problems in Georgia, there were degradation of lands and forests, air pollution, soil contamination with pesticides, biodiversity loss, severe pollution of rivers and the Black Sea, an insufficient supply of drinking water, and waste management problems, as almost all city-wide landfills in Georgia did not meet today's environmental standards, as they were built during the Soviet times and have polluted air and water, as most of them did not have groundwater protection barriers and treatment systems. Moldova's main environmental problems included deteriorating water quality, soil and groundwater pollution due to the massive use of agricultural chemicals, as well as significant soil erosion and reduced soil fertility due to inadequate farming methods. Among Ukraine's main environmental problems there were air and water pollution, land degradation, biodiversity loss, deforestation, issues with the management of solid waste and radiation contamination from the accident at the Chornobyl Nuclear Power Plant. Furthermore, there is a large-scale and devastating effect of war on the environment. The ecological balance is disturbed because of military actions and the destruction of ecologically dangerous enterprises.

The volume of the total and per capita amounts of the general environmental protection flows differed for the observed countries. For the 2002 – 2019 time period Armenia received 96,468 million dollars (32,62 per capita). Implemented projects were mainly focusing on climate change mitigation, adaptation, impact reduction and early warning through education, local governance, human and institutional capacity development; empowering civil society in addressing problems with industrial pollution; promoting civil participation in solving the environmental problems; ecoregional conservation; and safe and sustained access to energy and water resources.

For the 2002 – 2019 time period Azerbaijan received 9,627 million dollars (0,96 per capita). The main goals of the implemented projects were to secure biodiversity and reduce conflict potential in the region of the Southern Caucasus; to improve ecosystem biodiversity; capacity building in environment and water management; to improve governance and management of protected areas; site preservation; a program of activities for reducing greenhouse gas emissions; analysis and development of the cadaster of polluted areas and employee training at the department of urban planning; training of environmental inspectors and a transfer of know-how in the area of managing contaminated lands.

For the 2005 – 2019 time period Belarus received 10,113 million dollars (1,07 per capita). Projects on which the funds were allocated focused on renewable energies, development of renaturation methods, development and implementation of a comparative wetland monitoring system, strengthening civil society organizations working in the field of environment, building competence within energy efficiency and promoting environmental protection; improving environmental education on energy and climate, energy efficiency and investigation of the effect of forest fires on the behaviour of radionuclides.

For the 2002 – 2019 time period Georgia received 60,034 million dollars (16,14 per capita). Implemented projects were focusing on biosphere protection; restoration of degraded areas in the context of climate change; contributing to the development of a biodiversity monitoring system; protection of the biodiversity in the South Caucasus, the development of environmental NGOs; preservation of unique forests by creating new protected areas; technical assistance in the agriculture sector; waste management support and protecting drinking water from contamination.

For the 2002 – 2019 time period Moldova received 12,606 million dollars (4,73 per capita). The projects aimed to support Moldova's National Climate Change Adaptation Planning Process, support local and regional authorities with the implementation of an integrated local management system and waste management, promote sustainable development, support national, regional and

local administration in planning and implementation of improved services in water supply and sanitation, solid waste management and energy efficiency in public buildings.
For the 2005 – 2019 time period Ukraine received 150,872 million dollars (3,4 per capita). The goals of the implemented projects focused on environmental sustainability, landscape planning, improving the management of buffer zones in conservation areas of the Carpathians, capacity building of the administration department for nature and environment, area of civil radiation protection, development of regulation and reforms in the area of solid waste management, water management, environmental protection, introducing sustainable development lessons into the school curriculum in the selected oblasts of Ukraine, including Crimea, stabilizing and replacing the deteriorating sarcophagus with the radioactive remains of the destroyed Chornobyl 4th reactor, chemical management, education about sustainable development, improvement of air in and around the city of Mariupol, implementation of the Ukrainian National Park programme, environmental education and many more.
In general, despite all the implemented projects, there are still a lot of environmental challenges these countries ought to face. For example, improving the wastewater treatment technologies and safely managed drinking water services, the issue of waste management and landfills, the problem of soil contamination and land degradation, air pollution, and, last but not least, the devastation of Ukraine's environment due to the current war.

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