

# Global environmental problems in Russia

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**Abstract.** Recycling of household waste and environmental pollution is currently one of the most serious environmental problems in Russia. During the year, about 400 kg of household solid waste is generated per inhabitant of Russia, and effective methods of inorganic waste disposal have not yet been developed. Human wastes also have a significant impact on the pollution of water bodies, since water used in cities for sewage system needs often goes directly to open water bodies, bypassing a system of treatment facilities that have poor quality: most of them are already almost unable to cope with their functions due to outdated and unusable equipment. The subject of the study is the national project “Ecology” developed in Russia. The purpose of the study is to create a set of additional measures to improve the environmental situation and reduce the emissions of pollutants into the atmosphere. To study the topic, the trends of the environment change and the scenario of the expected trends up to 2030 have been systematized. Reduction of expenditures on the national project “Ecology”. This project is mainly aimed at combating the effects of environmental pollution, rather than identifying the causes of degradation processes..

## 1 Introduction

Scientific and technological progress has brought to humanity a number of new, very complex problems, which it has not faced before, or the problems were not so big. A special place among them is occupied by relations between man and the environment. In the XX century, the load has been laid on nature, caused by a 4-fold increase in population and an 18-fold increase in world production. Scientists say that from about the 1960s to the 1970s, changes in the environment under human influence have become global, i.e. affecting everyone without exception in the world, so they were called global. The most relevant of them are:

- Earth's climate change;
- pollution of the air pool;
- ozone depletion;
- depletion of fresh water and pollution of the oceans;
- land pollution, destruction of soil cover;
- deficiency of biological diversity, etc.

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The environment (natural environment) is that part of nature with which human society directly interacts in its life and economic activities.

Although the second half of XX century is a time of unprecedented economic growth, but it has increasingly begun to be realized without due consideration of the opportunities of the environment, the permissible economic loads on it. As a result, environmental degradation occurs:

- 1) irrational use of nature;
- 2) pollution of the environment with waste;
- 3) genetic depletion

Irrational use of nature. Deforestation and depletion of land resources can be an example of environmental degradation as a result of unsustainable environmental management. The process of deforestation is expressed in the reduction of the area under natural vegetation, and above all - forest. According to some estimates, during the emergence of agriculture and livestock breeding, 62 million km<sup>2</sup> of land were covered by forests, and including shrubs and groves - 75 million km<sup>2</sup>, or 56% of its total surface area. As a result of the ongoing 10 thousand years of deforestation, their area has been reduced to 40 million km<sup>2</sup>, and average forest cover - to 30%. Nowadays, deforestation continues at an increasing rate: about 100,000 km<sup>2</sup> are destroyed annually. Forests disappear as land and pastures expand, and timber grows. Particularly threatening situation is in the tropical rainforest, especially in such countries as Brazil, Philippines, Indonesia, and Thailand.

As a result of soil degradation processes, about 7 million hectares of fertile land are annually removed from the global agricultural turnover. The main reasons for this process are growing urbanization, water and wind erosion, as well as chemical (pollution by heavy metals, chemical compounds) and physical (soil damage during mining, construction and other works) degradation. The process of soil degradation is particularly intensive in drylands, which occupy about 6 million km<sup>2</sup> and are most characteristic for Asia and Africa. The main desertification areas are located within the drylands, where, due to the high growth rates of the rural population, overgrazing, deforestation and irrational irrigated agriculture lead to anthropogenic desertification (60 thousand km<sup>2</sup> annually).

Environmental pollution with waste. Another reason for the degradation of the natural environment is the pollution with waste from production and non-production activities of man. This waste is divided into solid, liquid and gaseous.

The following calculations are meant to make an example. Nowadays, about 20 tons of raw materials are annually mined and grown per inhabitant of the Earth on average. In this case, only 50 km<sup>3</sup> of fossil rocks (more than 1,000 billion tons) are extracted from the subsoil, which are converted into 2 tons of the final product using an energy capacity of 2,500 W and 800 tons of water, of which 50% is thrown away immediately, the rest will go to waste later [2].

The structure of solid waste is dominated by industrial and mining waste. In general, and per capita, they are especially great in Russia, the USA, and Japan. The per capita indicator of municipal solid waste belongs to the United States with 800 kg of garbage per inhabitant per year (400 kg per Russian citizen).

Liquid waste primarily pollutes the hydrosphere, with the main pollutants being waste water and oil. The total volume of wastewater at the beginning of the XXI century amounted to about 1860 km<sup>3</sup>. To dilute a unit volume of contaminated wastewater to a level acceptable for use, an average of 10 to 100 or even 200 units of pure water is required. Asia, North America and Europe account for about 90% of total global wastewater discharges [2].

As a result, the degradation of the aquatic environment today has assumed a global character. Approximately 1.3 billion people use only contaminated water at home, and 2.5 billion experience a chronic shortage of fresh water, which causes many epidemic diseases. Due to pollution of rivers and seas, fishing opportunities are reduced.

About 60 million tons of solid particles are released into the Earth's atmosphere annually, which contribute to the formation of smog and reduce the transparency of the atmosphere. Sulfur dioxide (100 million tons) and nitrogen oxides (about 70 million tons) are the main sources of acid rain. A large and dangerous aspect of the ecological crisis is the impact of greenhouse gases, primarily carbon dioxide and methane, on the lower atmosphere. Carbon dioxide enters the atmosphere mainly as a result of the combustion of mineral fuels (2/3 of all emissions). Sources of methane emission to the atmosphere are biomass burning, some types of agricultural production, gas leakage from oil and gas wells. The international community decided to reduce carbon dioxide emissions by 20% by 2005 and by 50% by the middle of the 21st century. In developed countries, relevant laws and regulations have been adopted for this (for example, a special carbon tax) [2].

Genetic depletion. One aspect of environmental problems is the reduction of biological diversity. The biological diversity of the Earth is estimated at 10-20 million species, including 10-12% of the total in the territory of the former USSR. Damage in this field is already quite noticeable. This is due to the destruction of the habitat of plants and animals, excessive exploitation of agricultural resources, environmental pollution. According to American scientists, over 900 thousand species of plants and animals have disappeared on Earth over the past 200 years. In the second half of the XX century, the process of reducing the gene pool has accelerated sharply, and if current trends continue over the past quarter century, 1/5 of all species that inhabit our planet may disappear.

## **2 Materials and Methods**

The environmental situation in Russia is determined by two factors: a decrease in environmental protection costs, on the one hand, and smaller than before scale of economic activity, on the other.

So, for example, in 2000, there were almost 21 thousand enterprises in Russia with emissions into the atmosphere. These emissions amounted to (including automobiles) more than 85 million tons, of which almost 16 million - without any treatment. For comparison, in the USSR, emissions from stationary sources and automobile transport were 95 million tons in the mid-80s, in Russia in the early 90s - about 60 million tons. The largest air pollutants in modern conditions are the Siberian and Ural Federal Districts. They accounted for about 54% of total emissions from stationary sources.

According to the State Water Cadastre, in 2000, the total water withdrawal from natural objects will be 86 km<sup>3</sup> (of which more than 67 km<sup>3</sup> was used for production, household and drinking needs, irrigation and agricultural water supply). The total volume of polluted wastewater discharged into surface water exceeded 20 km<sup>3</sup>, of which 25% falls on the Central Federal District. In the USSR, this figure was 160 km<sup>3</sup>, in Russia in the 90s - 70 km<sup>3</sup> (40% of them are untreated or not sufficiently treated) [2].

In 2000, over 130 million tons of toxic waste were generated in Russia as a whole. Only 38% of the waste was fully utilized and detoxified. The largest number of them was formed in the Siberian Federal District (31% of the entire Russian Federation). If we talk about solid waste in general, then about 15 billion tons were generated annually in the USSR, in Russia in the early 90s - 7 billion tons [2].

Thus, although in Russia in the 90s, due to the economic crisis, there was a sharp decrease in emissions of all types of waste, subsequent economic growth leads to an increase in the amount of waste polluting the environment. Environmental changes in the 1970-1990s and forecast for 2030 are shown in table 1.

**Table 1.** Environmental changes and expected trends until 2030.

<b>Characteristic</b>	<b>Trend of 1970-1990s</b>	<b>Scenario for 2030</b>
Reduction of the area of natural ecosystems	Reduction at a rate of 0.5-1.0% per year on land; by the early 1990s, only about 40% survived	Persisting the trend, approaching almost complete elimination on land
Consumption of primary biological production	Consumption growth: 40% on land, 25% global (estimate as of 1985)	Consumption growth: 80-85% on land, 50-60% - global
Change in the concentration of greenhouse gases in the atmosphere	Increase in greenhouse gas concentrations from tenths of percent to few percent annually	Increase in concentration, acceleration of increase in the concentration of CO and CH <sub>4</sub> due to accelerated destruction of biota
Depletion of the ozone layer, growth of the ozone hole above Antarctica	Depletion of the ozone layer by 1-2% per year, increase in the area of ozone holes	Continued trend even when CFC emissions ceased by 2000
Reduction in forest area, especially tropical forests	Reduction at a speed of 117 (1980) to 180 ± 20 thousand km <sup>2</sup> (1989) per year; reforestation refers to deforestation as 1:10	Persisting the trend, reducing the forest area in the tropics from 18 (1990) to 9-11 million km <sup>2</sup> , reducing the area of temperate forests
Desertification	Expansion of the desert area (60 thousand km <sup>2</sup> per year), the growth of technogenic desertification of toxic deserts	Persisting the trend, an increase in rates is possible due to a decrease in moisture circulation on land and the accumulation of pollutants in soils
Land degradation	Erosion growth (24 billion tons annually), fertility decline, accumulation of pollutants, acidification, salinization	Persisting the trend, increased erosion and pollution, reduction of agricultural land per capita
Sea level rise	Sea level rise 1-2 mm per year	Persisting the trend, possible acceleration of the level rise to 7 mm per year
Extinction of species	Rapid extinction of species	Persisting the trend towards the destruction of the biosphere
Land-based water depletion	The growth of wastewater, point and areal sources of pollution, the number of pollutants and their concentration	Persisting and growing trends
Deterioration of the quality of life, growth of diseases associated with environmental pollution (including genetic), the emergence of new diseases	Rising poverty, food shortages, high child mortality, high morbidity, lack of clean drinking water in developing countries; an increase in genetic diseases, a high accident rate, an increase in drug consumption, an increase in allergic diseases in developed countries; AIDS pandemic in the world, lowering immune status	Persisting trends, growing food shortages, growing diseases associated with environmental disorders (including genetic), expanding the territory of infectious diseases, the emergence of new diseases

Economic damage from environmental pollution reaches 4-6% of the Gross Domestic Product (GDP), and taking into account the consequences for human health - 15% [1].

Among the most acute environmental problems in Russia are air pollution from factories (17%), landfills (15%) and the lack of river and lake cleaning (10%) [4].

Due to such problems, Russia developed the National project “Ecology”, which was approved by a decision of the Presidium of the Presidential Council for Strategic Development and National Projects on December 24, 2018. The project is being implemented under the decree of President Vladimir Putin on national goals and strategic objectives for the development of Russia for the period until 2024. There are many reasons for the emergence of the national project “Ecology of Russia”. It turned out to be necessary at least because environmental problems began to hamper the development of the Russian economy. The national project “Ecology” identifies two key problems (table 2).

**Table 2.** Key problems of the national project “Ecology”.

<b>Factors</b>	<b>Consequences</b>
High level of air pollution in large industrial centers Poor quality of drinking water	Significantly contribute to the increase in morbidity and mortality
Unauthorized landfills within the boundaries of cities	Promotes the growth of social tension in society

The national project “Ecology” includes eleven areas. The financial support of these areas is presented in table 3.

**Table 3.** Financial support for the areas of the national project “Ecology”.

<b>№</b>	<b>Federal project name</b>	<b>Financial support, million rubles</b>
1	“Clean country”	124 206.8
2	“Integrated solid waste management system”	296 223.8
3	“Infrastructure for waste management of I - II hazard classes”	36 353.3
4	“Fresh air”	500 139.8
5	“Pure water”	245 050.0
6	“Rehabilitation of the Volga”	205 378.9
7	“Preservation of Lake Baikal”	33 944.9
8	“Preservation of unique water bodies”	15 152.0
9	“Preservation of biological diversity and the development of ecological tourism”	6 282.8
10	“Forest conservation”	151 009.8
11	“Implementation of the best available technology”	2 427 300.0
	<b>Total</b>	<b>4 041 042.1</b>

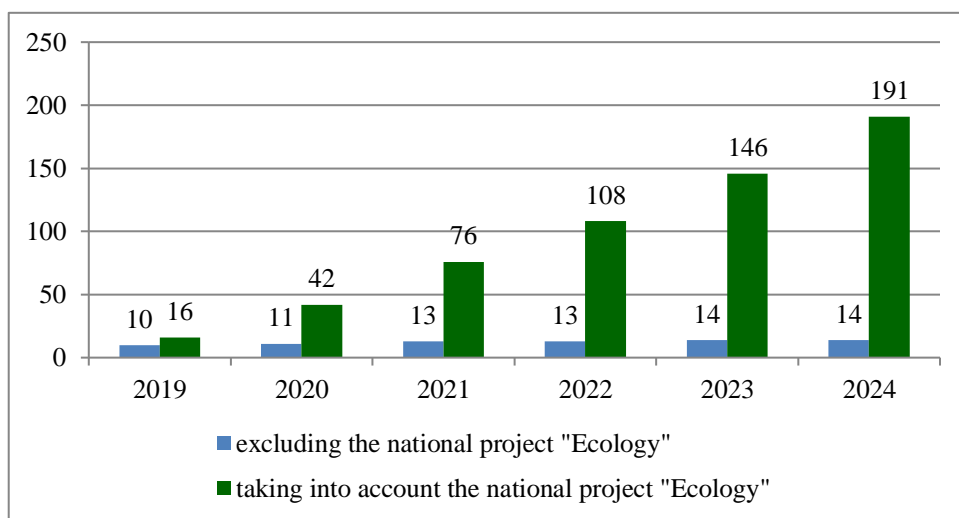
The national project “Ecology” is aimed at:

- efficient management of production and consumption waste, including the elimination of all unauthorized landfills identified on January 1, 2018 within the boundaries of cities;
- a drastic decrease in the level of air pollution in large industrial centers, including a decrease of at least 20% in the total volume of pollutant emissions into the air in the most polluted cities;
- improving the quality of drinking water for the population, including for residents of settlements that are not equipped with modern centralized water supply systems;
- ecological rehabilitation of water bodies, including the Volga River, and the preservation of unique water systems, including Lake Baikal and Lake Teletskoye;
- conservation of biological diversity, including through the creation of at least 24 new specially protected natural areas;
- ensuring the balance of deforestation and reproduction of forests in the ratio of 100% by 2024.

### 3 Results

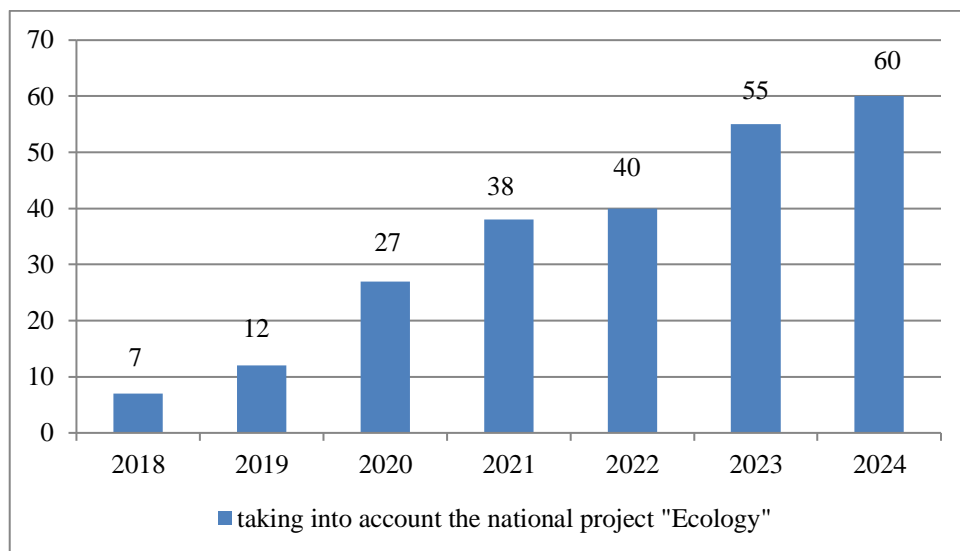
Given the large scale of the national project and the whole range of complex tasks for its implementation, the amount of planned subsidies will amount to 4,041 billion rubles. The most expensive part will be the “Implementation of the best available technologies” - 2,427.3 billion rubles (table 3). Significant financial support for the project should be provided by the largest enterprises of the country (the share of off-budget sources is 3,206.0 billion rubles), 701.2 billion rubles will be allocated from the federal budget, another 133.8 billion rubles - from the regional budget.

Let’s consider the federal program “Integrated solid waste management system” (Table 3, Fig. 1). 296.2 billion rubles are allocated for this program. When allocating funds from the budget, about 191 unauthorized landfills within the boundaries of cities will be destroyed for the period from 2019 to 2024, and without the allocation of funds - only 14. Is it worth considering not to allocate such large funds from the budget to eliminate unauthorized landfills, but to punish those organizations that create such landfills and to recover huge fines from them, thereby attracting money to the budget [3].



**Fig. 1** Elimination of identified unauthorized landfills within the boundaries of cities, pcs. (with cumulative total) (Source: Calculations of the Ministry of Natural Resources of Russia).

Since January 1, 2019, a new integrated system of solid municipal waste management began to work in Russia. This system will increase the country's environmental well-being, as in fact, a new branch of the economy and modern infrastructure in the field of garbage collection are being created. Within the framework of this system, new modern waste recycling complexes and landfills will be built that meet all standards, including global ones [4]. Besides, mass public work is planned, which will lead to the development of the country's population’s responsibility for their household waste, will allow people to better understand and evaluate the system of separate waste collection, as well as increase their respect for nature. This is a long-term program - the construction of facilities for processing, and so on, which will last about 5-6 years. In 2020, operators will start working who promise that they will make investments and everything that is necessary to make this process more environmentally friendly [5,6]. Already in 2024, about 60% of municipal solid waste will be directed to disposal (Fig. 2). Within the framework of this system, after 2024, the percentage of municipal solid waste processing will increase to 80%.



**Fig. 2.** The share of municipal solid waste aimed at disposal in the total volume of solid municipal waste generated, % (Source: Calculations of the Ministry of Natural Resources of Russia).

After analyzing the federal budget expenditures, the Ministry of Natural Resources of Russia decided to reduce the budget of the national project “Ecology” by 320 billion rubles (17.1%). The reductions mainly affected the allocation of funds from the budget, and extrabudgetary expenses increased slightly by 27.8 billion rubles. Most of all, they cut expenses for the “Pure water” project, which implies an increase in the provision of drinking water to 99% of Russians compared to 87.5% at the moment. In 2019–2024, half of this sum will be spent on this project. Planned costs of the “Pure water” project fell from 551 to 245.1 billion rubles (table 3). Other areas have been reduced less. Thus, the “Clean air” (reduction of atmospheric emissions in the metallurgical centers) and the “Rehabilitation of the Volga” projects will receive 5–5.5% less than originally planned and will receive 500.1 and 205.4 billion rubles, respectively (table 3). The “Pure air” project will reduce atmospheric emissions by 12% in 12 Russian cities - Bratsk, Krasnoyarsk, Lipetsk, Magnitogorsk, Mednogorsk, Nizhny Tagil, Novokuznetsk, Norilsk, Omsk, Chelyabinsk, Cherepovets, and Chita. The objective of the “Rehabilitation of the Volga” project is to reduce the volume of wastewater discharged into the Volga by three times from 3.2 km<sup>3</sup> to 1.1 km<sup>3</sup>. In addition, it is planned to begin the restoration of the banks, as well as to raise 95 vessels from the bottom, which harm the water area of the river [4-10].

## 4 Conclusions

For Russia, the national project “Ecology” is necessary and timely. Environmental issues reduce the potential for human development. On the other hand, satisfying the growing needs of the Russian economy requires environmental management. The national project “Ecology” is aimed at: the efficient management of production and consumption waste; drastic reduction in air pollution in large industrial centers; improving the quality of drinking water for the population; ecological improvement of water bodies; conservation of biological diversity. Implementation of 11 national projects during 2019-2024 is the first step towards a comprehensive solution of socio-economic and environmental problems, which is consistent with the principles and goals of sustainable development. But the results of the study showed that the implementation of the complex of measures of the national project

“Ecology” will not significantly change the environmental situation in Russia. The reason is that this project is mainly aimed at combating the consequences (to reduce air emissions and pollutant discharges into water bodies, to combat soil erosion, etc.), but not to identify the causes of degradation processes.

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