

CLIMATE RISK ASSESSMENT TO DEVELOP SECTOR CLIMATE CHANGE ADAPTATION PLAN

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Abstract

The article provides an analysis of emergency situations caused by natural hazardous processes with a climatic factor on the territory of the Russian Federation. There is an increase in economic damage from emergencies. The constituent entities of the Russian Federation that are most vulnerable to climate change have been identified. The analysis was carried out as part of the development of a sectoral action plan for the first phase of adaptation to climate change for the period up to 2022.

Keywords: dangerous natural process, emergencies, climate change, sectoral adaptation plan

I. Introduction

Since the 60s of the 20th century, climatologists from most countries of the world have noted an increase in anomalous surface temperature, global changes in the direction of changes in atmospheric flows, long periods of high temperature increase and a decrease in pressure over the territory. All these phenomena have received a common name – global climate change. The origin of this phenomenon has caused controversy between the export of natural climate variability and the export of human impact on allergic climate change. But regardless of the causes that caused climate change, the climate changes that have occurred have already led to an increase in the number of dangerous natural phenomena that lead to loss of life and damage to human health, direct and indirect material losses. The combination of climatic hazards affecting the population and leading to material damage makes it possible to distinguish the concept of climate risk from the general set of natural risks.

The study of the impact of climate change on the socio-economic development of the Russian Federation and individual sectors of the economy in terms of taking measures to mitigate the impact of climate risks, the so-called adaptation measures, makes the study of emerging phenomena and adaptation measures very relevant [1].

Decree of the Government of the Russian Federation of December 25, 2019 No. 3183-r approved the National Action Plan for the first stage of adaptation to climate change for the period up to 2022 [2], paragraph 26 of which provides for the development of a sectoral plan for adaptation to climate change in the field of civil defense, protection population and territories from natural and man-made emergencies.

The legal basis for taking measures to adapt the EMERCOM of Russia system to climate change is the Constitution of the Russian Federation, the Federal Law “On the protection of the population and territories from natural and man-made emergencies” [3], the Fundamentals of state

policy in the field of ensuring the protection of the population and territories from emergencies for the period up to 2030 [4], the Strategy for the Development of Civil Defense, the Protection of the Population and Territories from Emergencies, Ensuring Fire Safety and the Safety of People at Water Bodies [5], the Climate Doctrine of the Russian Federation [6] and the National Action Plan mentioned above the first stage of adaptation [2].

To develop a national action plan, the Ministry of Economic Development of Russia developed and approved guidelines for climate risk assessment, for the formation of sectoral, regional and corporate climate change adaptation plans, as well as guidelines for ranking adaptation measures according to their priority [7]. Climate risk analysis is necessary to assess the exposure of territories to hazardous natural processes (hazardous geological, hydrological, meteorological phenomena and processes, as well as space hazards and natural fires), which can be sources of emergencies. Therefore, the analysis of emergency situations in the constituent entities of the Russian Federation, caused by natural processes with a climatic factor, with an assessment of damage from large-scale emergencies, is an important point for developing adaptation measures.

II. Analysis of emergency situations caused by natural processes with a climatic factor

Based on the data of state reports on the protection of the population and territories from natural and man-made threats [8], a comparative assessment of the large-scale emergency situations that occurred due to hazardous natural processes with a climatic factor was performed. Below are diagrams of the number of emergencies caused by some natural processes with a climatic factor, obtained on the basis of an analysis of state reports and works of employees of the All-Russian Scientific Research Institute of Civil Defense and Emergencies of the EMERCOM of Russia (the Federal Science and High Technology Center) [9-11]. The number of emergencies associated with dangerous meteorological phenomena (storms, hurricanes, tornadoes, squalls, strong snowstorms) registered in the constituent entities of the Russian Federation for the period 01.01.2013-12.31.2020 is shown in Figure 1.

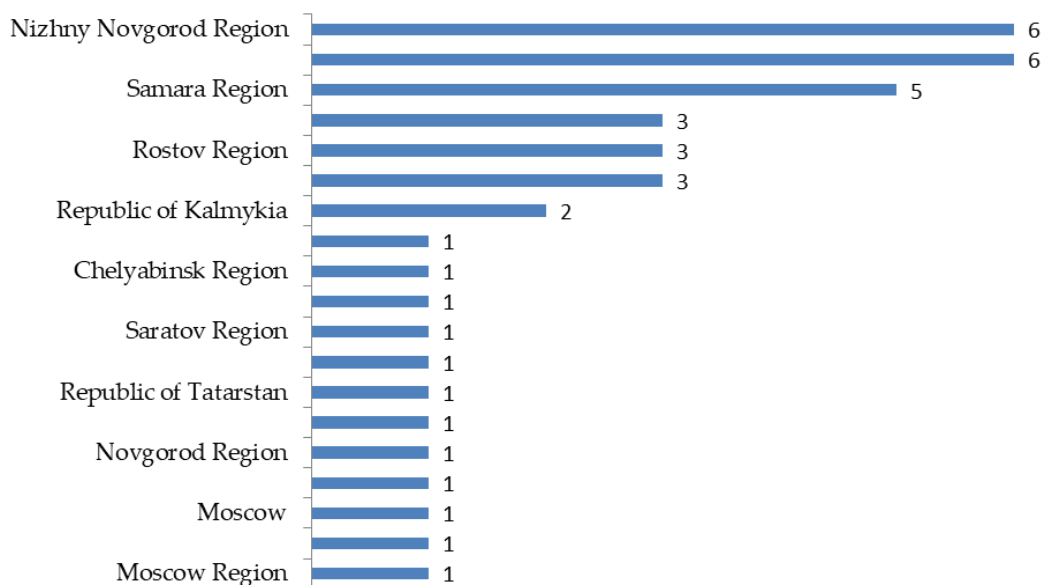


Figure 1: The number of emergencies for 2013-2020 associated with storms, hurricanes, tornadoes, squalls, heavy snowstorms recorded in the constituent entities of the Russian Federation.

The number of emergencies associated with dangerous meteorological phenomena (frost, drought, dust storms) registered in the constituent entities of the Russian Federation for the period 01.01.2013-12.31.2020 is shown in Figure 2.

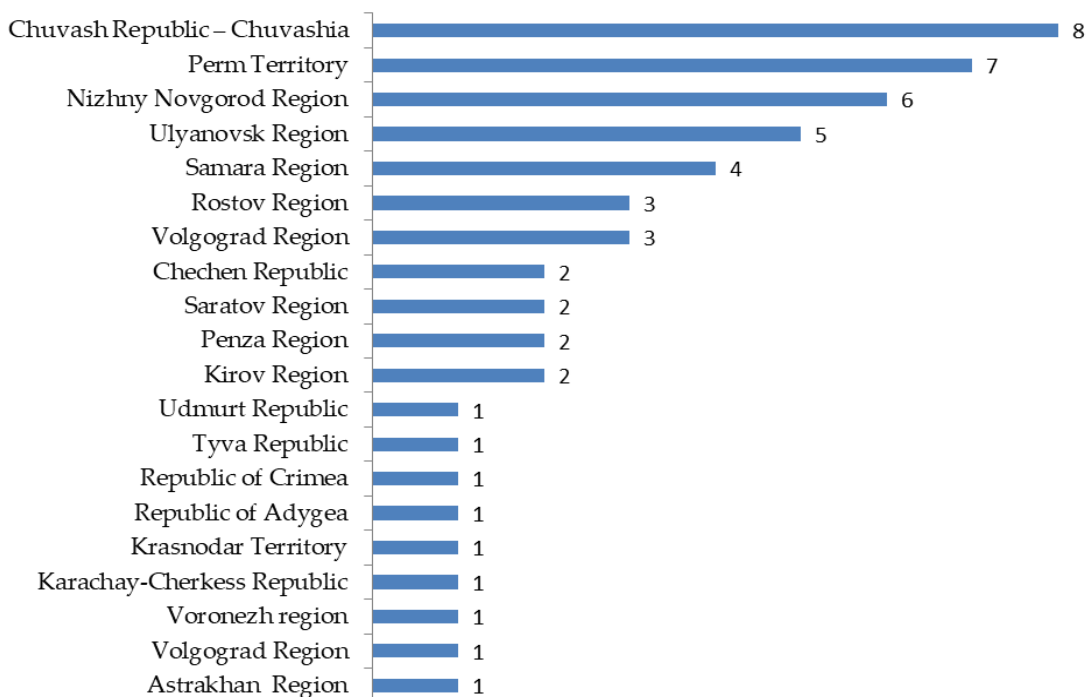


Figure 2: Frosts, droughts, dust storms recorded in the constituent entities of the Russian Federation in 2013-2020.

Large natural fires include large uncontrolled fires in the area: for ground protection of forests – 25 hectares or more; for aviation protection of forests – 200 hectares and more. The number of emergencies of this type registered in the constituent entities of the Russian Federation for the period 01.01.2013-12.31.2020 is shown in Figure 3.

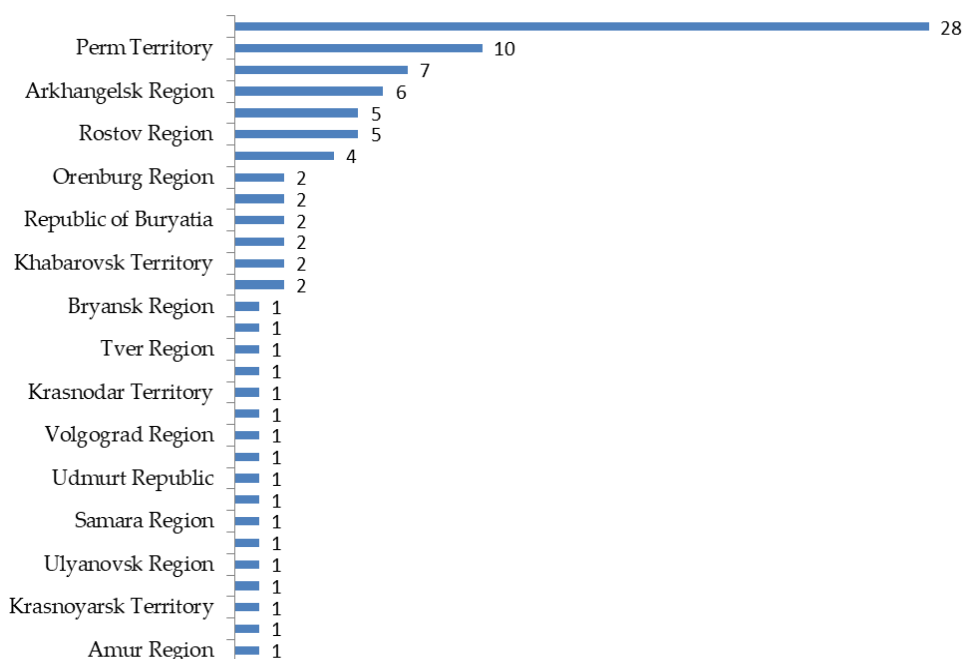


Figure 3: Large natural fires recorded in the constituent entities of the Russian Federation in 2013-2020.

An analysis was made of damages from large-scale emergencies [9,10] caused by natural hazardous processes and phenomena with a climatic factor. Direct economic losses from climate emergencies in the Russian Federation for 2014-2020 are shown in Figure 4.

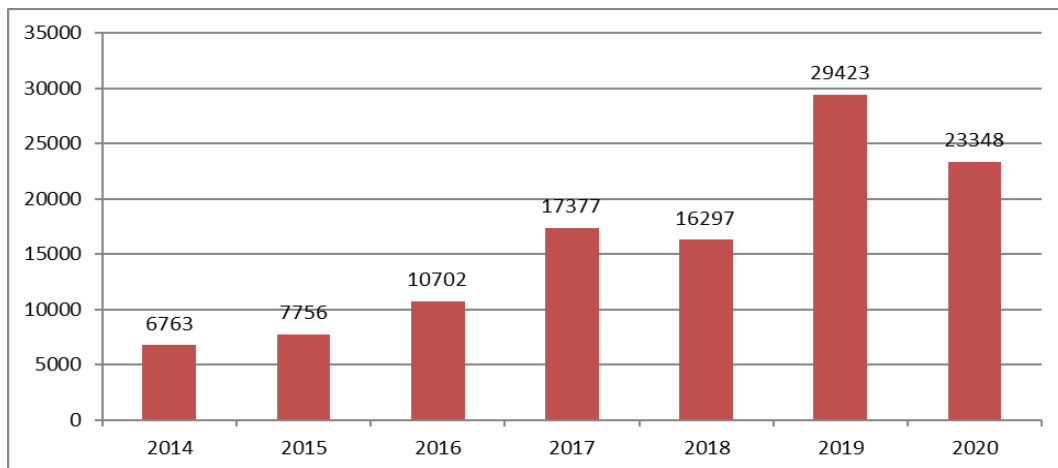


Figure 4: Direct economic losses from natural emergencies caused by the climatic factor in 2014-2020, million rubles.

The growth of direct economic losses from natural emergencies is associated with an increase in the exposure of the regions of the Russian Federation to climate risks, an increase in the scale and frequency of natural hazards associated with climate change [12]. Based on the data on exposure to climate risks of the constituent entities of the Russian Federation and data on the number of large-scale emergencies caused by natural processes with a climatic factor, a table was formed containing a list of constituent entities of the Russian Federation in which the most emergencies were recorded due to natural hazards with a climatic factor, and measures on adaptation (see table) [10, 11].

Table: Constituent entities of the Russian Federation in which large-scale emergencies occurred due to hazardous natural processes with a climatic factor for the period 2013-2020 and exemplary adaptation activities

№	Constituent entity/entities	Dangerous natural process	Adaptation activities
1.	Krasnodar Region, Nizhny Novgorod Region, Samara Region	Storms, hurricanes, tornadoes, squalls, strong snowstorms	Forecasting and early warning of the population about dangerous meteorological phenomena; strengthening industrial and residential buildings; dismantling of fragile buildings and structures; cutting down old trees
2.	Chuvash Republic - Chuvashia, Perm Territory	Freeze, drought, dust storms	Development of water management infrastructure; rehabilitation of river systems to increase water storage capacity; hardening of linear structures, monitoring of their icing; use of drought-resistant and frost-resistant crops
3.	Khanty-Mansi Autonomous Okrug - Yugra, Perm Territory, Republic of Tyva, Arkhangelsk Region, Republic of Karelia, Rostov Region	Major wildfires	Control over compliance with the requirements of fire safety rules in natural areas; prevention of unauthorized burning of dry grass; creation of a fire barrier system; forest stand composition regulation; clearing the forest from clutter
4.	Khabarovsk Territory, Leningrad Region	Dangerous hydrometeorological phenomena	Development of forecasting and emergency warning systems for the population; coast protection; training and informing the population about safe behavior
5.	Krasnodar Region	Dangerous geological processes	Regulation of surface water runoff; arrangement of anti-mudflow systems; agromelioration
6.	Khabarovsk Territory, Perm Territory, Kostroma Region, Republic of Sakha (Yakutia)	Dangerous hydrological phenomena	Improving the forecasting system in areas of possible flooding; definition of zones of flooding; planning measures to prevent the negative impact of water (bank protection and clearing of river beds, regulation of river flow, construction of dams, embankments)
7.	Khabarovsk Territory, Primorsky Territory, Tyva Republic	Dangerous meteorological phenomena	Development of systems for forecasting and warning the population; informing the population about the threats of dangerous meteorological phenomena

Reducing the risks of emergencies caused by the climatic factor requires the development of systems for monitoring, forecasting and early warning of the population about possible emergencies. Preventive work with the population to prepare for a possible increase in the scale and frequency of recurrence of emergencies typical for territories, as well as the possibility of new sources of emergencies of a natural, man-made and biological and social nature, is essential for

protecting the population and territories from emergencies in the context of climate change.

The problem of climate change and ways to adapt to it should be addressed in a comprehensive manner, using to the maximum the full potential of the unified state system for preventing and eliminating emergencies. In order to increase the resilience of cities and municipalities to natural emergencies, taking into account existing and predicted climate changes, the Ministry of Emergency Situations of Russia is implementing the project "My city is safe". The purpose of this project is to intensify the work of the executive authorities of the constituent entities of the Russian Federation and local self-government to reduce the risks of emergencies and ensure the safety of the population. For this, methodological materials have been developed, and an exchange of best practices for reducing the risks of natural emergencies has been organized, including the implementation of adaptation measures to reduce climate risks at the local level.

IV. Conclusion

Taking into account climatic changes in the listed constituent entities of the Russian Federation, an increase in emergencies is predicted. Accordingly, measures to protect the population and territories in these constituent entities of the Russian Federation should be adjusted. Based on the data on exposure to climatic risks of the constituent entities of the Russian Federation and data on the number of large-scale emergencies caused by natural processes with a climatic factor, a list of constituent entities of the Russian Federation was compiled, in which the most emergencies were recorded due to natural hazards with a climatic factor, and adaptation measures.

Adaptation measures should include measures aimed at reducing the risks of emergencies caused by the climatic factor, which requires the development of systems for monitoring, forecasting and early warning of the population about possible emergencies. Also essential for the protection of the population and territories from emergencies in the context of climate change is preventive work with the population in preparation for a possible increase in the scale and frequency of emergencies typical for territories, as well as the possibility of new sources of emergencies of a natural, man-made, biological and social nature [11].

Thus, the problem of climate change and ways to adapt to it should be addressed in a comprehensive manner, using to the maximum the full potential of the unified state system for preventing and eliminating emergencies.

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