Impact of climatic effects on the environment and the economy of the Russian Arctic

T Sorokina¹, A Trofimova¹, N Kondratov¹, Yu Shumilova²

¹Northern (Arctic) Federal University named after M.V. Lomonosov, Arkhangelsk, Russian Federation
²Federal Budget Institution "Northern Research Institute of Forestry", Arkhangelsk, Russian Federation

t.sorokina@narfu.ru, a.trofimova@narfu.ru, n.kondratov@narfu.ru

Abstract. The Arctic is a high-latitude part of the Far North, including the land area and the marine environment of the Arctic Ocean within the exclusive economic zone of the Russian Federation. The importance of the Arctic issues are conditioned by the fact that in the Russian Federation shaping and scientific rationale of the priorities of circumpolar territory development are ones of the key objectives of Russian economic development and modernization. Russian Arctic development should be based on the principles of resource efficiency and precautionary principle. It should be founded on cutting-edge research and professional competencies of labour force, who are adapted to work in the Arctic, and should be accompanied by innovative technologies. Studying different directions and problems of the Arctic development shows a particularly crucial role of geography in framing and solving national economic purposes. The role of geography is becoming more important not only because of huge impact of the geographical factor in the Far North and the Arctic regions but also due to remarkable differentiation of natural and social conditions of economic activity. In recent decades, the Arctic is undergoing rapid transformations in the natural and socio-economic environment, which are developing against the background of a lack of knowledge about them. One example is climate change, which can have an impact on environmental management on a global scale.

1. Introduction

The importance of studying and forecasting trends of global climate change including the ones in the Arctic zone of the Russian Federation (AZRF) has been particularly emphasized in the past few decades. Many states of the world, their unions and industrial corporations focus their attention on the Arctic region owing to the natural-resource, transport and logistic, geopolitical, environmental, economic and social-cultural status of the Arctic. Peculiar features of the AZRF influencing natural resource use are severe natural climatic conditions, perennial ice cover and pack ice in the Arctic seas, poor sustainability of ecological systems and their dependence on minor human impact, and some other characteristics [1], [5].

2. Main part

Among subarctic countries the biggest area of the Arctic with the territory of more than 9 million square kilometres is owned by Russia [1]. In the last few years the government of our country have
taken certain systematic steps towards asserting national interests in the Arctic zone, providing population security and transition to sustainable social and economic development. Goals, objectives and mechanisms aiming to implement Russian governmental policy in the Arctic including the ones of environmental security sphere are reflected in several documents. The framework documents are “The Basics of the State Policy of the Russian Federation in the Arctic for the Period till 2020 and for a Further Perspective” and “The Strategy for the Development of the Arctic Zone of the Russian Federation and National Security up to 2020” [9] approved by the President of the Russian Federation in 2008-2013. These instruments are expected to be implemented within the framework of the programme “Socio-economic development of the Arctic zone of the Russian Federation up to 2020” approved by the Russian Government Resolution No. 1393 of 17 December 2014. The State Commission for the Arctic Development was founded by the Russian Government Resolution No. 228 of 14 March 2015. Priorities in development of the Arctic region presented in the above mentioned documents include comprehensive social and economic development based on sustainable environmental management, environmental security and elimination of adverse effects from anthropogenic activities in the face of increasing economic activity and global climate change, transport and industrial infrastructure modernization, conservation of traditional natural resource use of indigenous people, international cooperation, development of science and education. The basic means of the state policy realization concerning environmental safety provision in the AZRF contain introducing special regulations of environmental protection and natural resource use, including environmental monitoring; rehabilitation of natural landscape; utilization of toxic industrial wastes; promotion of chemical safety in areas with dense ethnic populations [7].

Enhancing international cooperation in ecological and environmental protection fields appears to be currently important in view of the land area and significance of the Arctic for humankind development. In 1991 the Declaration on the Protection of the Arctic Environment and the Arctic Environmental Protection Strategy were formally adopted in Rovaniemi (Finland) by the representatives of Denmark/Greenland, Iceland, Canada, Norway, Sweden, the USSR and the USA. These documents imply protection, improvement, restoration and environmental monitoring of ecosystems, enhancement of the environment quality, sustainable use of natural resources and definition, limitation and finally pollution prohibition of the Arctic.

Approved instruments formed the basis for establishment of the Arctic Council in Ottawa (Canada) in 1996. For a long period of time the Arctic Council has remained the unique circumpolar authority for environmental protection and promotion of sustainable development of the Arctic. Scientific and organisational work is carried out by several working groups in the framework of the Council. For instance, the Working Group for Eliminating Pollution in the Arctic has been realising the Arctic Council Action Plan to Eliminate Pollution in the Arctic from 2006. The Working Group papers of practical interest are the ones on international cooperation in the Arctic region, management and disposal of polychlorinated biphenyls, dioxines, mercury, pesticides, radioactive wastes, substances contributing to global warming.

The “The Snow, Water, Ice and Permafrost in the Arctic” paper was prepared by the Working Group for Implementing Arctic Monitoring and Assessment Programme in 2011 [6]. Certain conclusions made by the group of scientists indicate accelerating of climate change and the loss of land-based and sea ice in the region which makes it important to continue international cooperation in prediction of climate change and implementation of environmental monitoring. The Arctic Council report notes that the years from 2000 to 2012 have become the warmest period in the Arctic in recorded history. In 1970-2012 warming process in the Arctic was twice as fast as in the other parts of the world. During that period of time, the average amount of precipitation in the Arctic increased by 15 per cent, the region’s sea ice area fell by 10-15 per cent, the area of land-based snow cover decreased by 10 per cent. Most of glaciers are losing mass and near-surface permafrost has warmed by 1-2°C. Freezing periods of the northern rivers and lakes have decreased, water flow of the rivers to the Arctic Ocean and arrival of warm water of the Pacific Ocean have increased. According to the paper on climate change and its impact on the territory of the Russian Federation [8], thickness of the sea ice
in the Russian Arctic has diminished by 40 per cent. The glacier area of Novaya Zemlya and Franz Josef Land has decreased by more than 720 square kilometres, while the ice extension has diminished by 250 cubic metres (1.5 per cent). No trend of slowing global warming has emerged within Russian territory.

Taking into account the facts that temperature trends in the Arctic region changed a number of times during the XXth and the XXIst centuries and there is a certain lack of regular instrumental monitoring of the period, it is practically impossible to draw a definite conclusion about climate change in the Arctic. The Arctic Ocean is expected to get clear from ice in summer periods in the XXIst [3]. Influence of climate change impact on the ice coverage of the Arctic Ocean is significant both for ecosystems and economic, social and national security areas of Russia. Negative consequences are considered to be the ones of high probability. The increasing time of open water season would lead to development of marine shipping [10], including sea transportation of cargoes, tourism and ecotourism, especially by the Northern Sea Route. Changes in ice conditions would possibly cause troubles to navigation process but at the same time would open access to natural resources of the Arctic including offshore oil deposits in the Arctic Ocean that are estimated to maintain up to 13 per cent of the world’s undiscovered petroleum resources [11]. Such situation would allow to open possibilities for economic development, employment generation, but at the same time it would cause serious problems for the environment and business and farming activities. For instance, the decline in the Arctic sea ice, especially in early autumn, increases devastating impact of marine storms on a coastal zone and coastal infrastructure, poses life threats to people working and living on the territory.

One of the advantages of the presence of Russia in the Arctic with regard to other countries and regions is generally high adaptive capacity of the country which is provided by large territories, low temperatures for much of the year, a small share of the population living in the areas that are particularly vulnerable to the climate change detrimental effects.

Global warming may lead to fishing industry development, including herring and cod capture. Fish habitats and fish migratory paths may change, while ice cover changes in the Arctic Ocean may dramatically deteriorate environment and natural habitats of some fauna species like the polar bear [12].

Taking into consideration the expected changes in the World Ocean ice cover in both the northern and southern hemispheres, the economic problem of the future of icebreaking fleet appears. On the one hand, climate change in the Arctic would allow vessels to access high latitudes which would lead to increase in economic and other activities in the region. On the other hand, at least seasonal ice coverage (of lower thickness, closeness and extension) and iceberg increase would make access to the Arctic Ocean be a challenge to marine vessels [13].

Among the adverse impacts of climate change on the Russian Federation territory there is a health risk increase for some groups of the population (growth of the morbidity and mortality rate). An increase in the frequency, intensity and duration of windstorms and droughts in some regions and cases of waterlogged soil, extreme precipitations and floods in other regions can be considered as climate change detrimental effects. Then, climate change leads to growth of fire hazards in woodlands, permafrost degradation damaging buildings and supply lines in the northern regions, environmental balance problems, displacement of some species by other species.

In the context of such climate change as rise in air temperature which causes spread of infectious diseases there are several examples to be discussed. For instance, the tick-borne encephalitis agent was isolated for the first time in the Far East by Lev Zilber, a virologist. In the 1930s combined expeditions of Soviet scientists conducted a more detailed study into epidemiology, clinical picture and prevention of the disease. The site of the disease has moved considerably far to the North since that time.

The permafrost zone occupies more than 60 per cent of Russia’s overall land area. Due to thawing of ground some fossil remnants of prehistoric animals (like mammoths in Yamal and Yakutia) emerging on the surface can act as transmitting agents of dangerous parasitic intestine infections such as girardiasis and ascryptosporidiosis. Rise in temperature and humidity increases the spread of
infectious diseases transmitted by intermediate hosts like insects and rodents. In the face of climate change, possible sites of malaria, plague, hemorrhagic fever, some serious infectious diseases like West Nile fever, yellow fever, Dengue fever and others can be reactivated as these diseases were not able to exist in cold climate [2], [4].

Issues about biodiversity protection have been developed at the international level. There is a number of international legal instruments applied in the mentioned field, for example, The Convention on Biological Diversity [14]. New different documents are being adopted nowadays, first of all, the ones regulating the following issues in the Arctic. The International Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean [15] was adopted as a reaction of the subarctic and other countries concerned to climate and biodiversity change. It’s worth noting that a particular role coastal countries of the Arctic region defined in the Agreement not only benefits but also brings special responsibilities to the world. In turn the responsibility of that kind requires serious legislative regulation of measures for the conservation of biological diversity in the Arctic Council member-states and in the international arena. Regardless of the overall positive assessment of international legal instruments for biodiversity protection adopted so far, we need to state the fact that reduction and loss of biodiversity still remains a key problem. Such an international non-profit organisation as the International Union for Conservation of Nature and Natural Resources plays an important role in the world biodiversity protection and annually publishes the Red Book where 27 000 species are identified as endangered ones.

Global warming causes permafrost degradation including increase in the thickness of seasonally thawed layer. Being of special importance for the territory of West Siberia and taking into consideration the lowland and plain character of the relief with dominance of organic soil, infrastructure facilities and supply pipelines are particularly at risk. The biggest gas-producing stations which are the major source of Russian gas resources are located in the region. The anticipated alteration in the hydrological regime is fraught with an increased risk of flooding in estuaries of some rivers flowing into the Arctic Ocean.

3. Conclusion
Taking into account consequences of climate change and providing sustainable development of the Russian Arctic there needs to be a shift to strategic planning approach which implies a long-term outlook and the system approach to development and implementation of socio-economic programmes. The mentioned measures should ensure reduction of negative impacts and maximum use of opportunities offered by climate change directly or indirectly (through implementation of energy-efficient and energy-saving technologies). It should contribute to the security in the Arctic region (for instance, through developing monitoring systems of assessment, risk prevention, early warning information on natural hazards and support of indigenous population) and national security of our country.

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