Impact of Climate Change on Ecosystems in the Context of Sustainable Development

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Abstract. Data from the World Meteorological Organization (WMO) indicate an abnormally rapid increase in the average annual temperature in recent decades. In the entire history of direct instrumental observations, there has never been such a long and strong warming. Climate change is one of the most acute problems facing the current generation, as it poses a real threat to the development of human potential and the improvement of the quality of life. UN Secretary-General Ban Ki-moon has called climate change the top geopolitical and economic issue of the 21st century. Speaking at a special high-level meeting on climate change (September 22, 2009), he emphasized that this problem threatens development, peace and prosperity, will lead to water, food and land scarcity, will cancel out progress in achieving the Millennium Development Goals, will increase poverty and lead to the destabilization of weak states and the fall of regimes.

1 Introduction

In most developing countries, millions of the world's poorest people are already experiencing the negative impacts of climate change. The ever-increasing impact of droughts, increased storms and hurricanes, floods, and environmental degradation are becoming increasingly powerful barriers to the efforts of the world's poor to create a better life for themselves and their children [1]. At the same time, many developing countries fear imposing restrictions on their critical energy development programs, as well as imposing new rules that could hinder the satisfaction of their many needs, from infrastructure to business development.

Developed countries are responsible for most of their past greenhouse gas emissions and for a large amount of emissions per capita. As the Report argues, building a “climate resilient” world is already possible today, but achieving such a massive transformation requires acting now, acting together and acting differently than before. Countries need to start taking action now, as we are building power plants, reservoirs, buildings, transportation systems and cities today that are very likely to last for the next 50 years or more. The innovative

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technologies and crop varieties that are being piloted today could create energy and food sources that could meet the needs of three billion more people by 2050 [5]. Countries need to act together as no country can stand aside from the challenges posed by climate change and global cooperation is vital to improve energy efficiency, develop and deploy low carbon technologies and develop alternative energy sources. Countries need to act differently, as doing business as usual could lead the world down a potentially catastrophic path with unacceptable development costs.

2 Research methodology

The modern scientific theory of global climate change has been developing for several decades. To date, it has been established that an increase in the average temperature of the Earth's surface (an increase of 0.8°C since the middle of the 20th century) is accompanied by the melting of glaciers, a rise in the level of the world ocean, and the oxidation and heating of sea water [3]. Global climate change already today leads to a variety of physical, socio-economic and humanitarian consequences. Insurance companies record a steady increase in the number of natural disasters and adverse events - floods, hurricanes, heat waves, hail, droughts, wildfires [6]. The total damage they have caused since the 1980s exceeds $5 trillion. The consequences of a 5°C warming by the end of the 21st century are assessed as catastrophic, both for the health and life of the planet's population and for the global economy [5]. Concern about the climate threat from the scientific community is gradually being transferred to politicians, investors, public figures and ordinary citizens around the world. As of February 2020, 189 countries have signed up to the Paris Agreement, which aims to keep average temperature increases well below 2°C and ideally not above 1.5°C, improve adaptive capacity to climate change impacts, and transition for low carbon development. Companies with environmental commitments and sustainability programs are growing faster than their competitors. States are planning to introduce border carbon regulation (for example, the Border Carbon Tax in the European Union). Investors around the world are reacting to these moves and sentiments by withdrawing funding from fossil fuel sectors. Oil and gas and electric power companies are actively restructuring assets in favor of low-carbon projects, as well as increasing investments in renewable energy, biofuels, CO2 capture, energy efficiency, and hydrogen technologies [3]. These global trends already fully affect the Russian Federation.

The global climate threat for Russia is even more urgent than for many other countries - over the past 40 years, climate warming in the country has been 2.5 times faster than the average for the planet (and in the Russian part of the Arctic - 4.5 times faster) [5]. Climate change in Russia already poses a threat to human health and life, provokes forced migration, threatens food security and poses a threat to infrastructure. At the same time, in Russia the problem of climate change is not among the priorities of state policy, both at the federal and regional levels. On the part of corporations, interest in reducing the carbon footprint is gradually growing - but, first of all, under the influence of European shareholders and investors [2]. Regardless of the goals and fulfillment of Russia's obligations to reduce emissions on its territory, the climate agenda poses a long-term threat to Russian exports in relation to the main commodities - oil, oil products, coal, natural gas, metals, products of the forestry and chemical industries [3-4]. Without special response measures, this could lead to a long-term limitation of the growth of the Russian economy. Russia's reaction to the climate threat may depend on the pace of the global response to climate change and the attitude of Russian society and the state to this problem. The main choice arises between two extreme scenarios – “Continuation of the current policy” and “Global climate unity” [2]. There are risks in both scenarios. The continuation of the
current policy increases the negative impact of climate change, and in the future this may lead to consequences that are difficult to predict, a reliable and comprehensive assessment of which is not available in Russia. The national economy is threatened by a limitation of GDP growth due to a decrease in demand for Russian exports. The overlap of these two risks limits the scope for costly climate change adaptation and disaster recovery. In the Global Climate Unity scenario, climate change is slowed down by global active measures to reduce greenhouse gas emissions. At the same time, in Russia there is a risk of losing current sales markets and falling revenues of the basic sectors of the economy, as well as tax revenues to the budget [3]. An increase in the cost of heat and electricity is inevitable. At the same time, an accelerated transition to a low-carbon economic development model will diversify the economy and create incentives for innovation. The risks of the “Continuing current policy” scenario turn out to be significantly higher and lead to the destruction of the country’s economy in the future, so moving towards the second scenario seems to be a more reasonable response by Russia to the climate threat than discussions about the causes of climate change. Establishing a state climate monitoring system, restarting the energy efficiency program (and other ways to reduce greenhouse gas emissions), developing carbon-free exports (for example, based on hydrogen), increasing CO2 absorption on managed lands are the first steps that can move the country towards low-carbon development [4]. In any case, without a change in attitude to the climate threat on the part of the Russian authorities and society, movement along this path will be slow and painful. However, there is not much time left for this.

3 Results and Discussions

Concern about the climate threat from the scientific community is gradually being transferred to politicians, investors, public figures and ordinary citizens around the world [7-8]. This section briefly describes the main ways in which these stakeholders respond to the climate threat. At the interstate level, the problem of climate change was seriously noticed in the mid-1980s. - with the participation of the UN Environment Program and the World Meteorological Organization, the Advisory Group on Greenhouse Gases was created, which became the prototype of a higher-level Intergovernmental Panel on Climate Change (IPCC, IPCC) at the UN. The IPCC is an intergovernmental organization headquartered in Geneva, jointly founded by the United Nations Environment Program and the United Nations World Meteorological Organization in 1988 and has 195 members (including Russia). Its purpose is to regularly assess the science behind climate change, its impacts and future risks, as well as adaptation and prevention options. The IPCC does not conduct its own scientific research - its role is to convey to policy makers and policy makers the generalized consensus information from scientific (peer reviewed) and other publications - in the form of regular Assessment Reports, each of which supplements and refines the results of the previous one. The list of sources for writing the Fifth Assessment Report includes several thousand publications. This work is led by the IPCC Bureau (with the participation of Russia), thousands of scientists from all over the world (including from Russia) are involved in it, mostly on a volunteer basis [6]. Links to publicly available Russian-language summaries of the main IPCC reports are provided in the list of recommended sources [5]. The energy sector remains the key source of emissions – the combustion of fossil fuels in various industries and the leakage of methane during the extraction, transportation and distribution of fossil fuels. The Kyoto Protocol was the first international agreement aimed at limiting the growth of anthropogenic emissions of greenhouse gases [6]. It was created on the basis of the principle of common but differentiated responsibility of the developed and developing countries of the world in reducing emissions (within the framework of their joint use of appropriate mechanisms and
tools). As part of this agreement, developed countries have limits on emissions, while developing countries do not. During the time that has passed since its signing, developing countries (primarily China) began to emit more than some developed ones, and the mechanisms laid down in the protocol did not work effectively enough [7]. The Paris Agreement was adopted in 2015, in many respects, in the development of the experience of interaction between states under the Kyoto Protocol. Measures of economic incentives for reducing greenhouse gas emissions – “carbon taxes”, emissions trading systems - are effective mechanisms to achieve the goals set. According to the World Bank, by 2019 already 46 countries, including Australia, South Africa, Brazil, Argentina, China, Turkey, Ukraine and Kazakhstan, and 28 individual regions (in particular, some US states) have either already launched a CO2 emissions trading system or other forms of carbon pricing and carbon charges, or plan to do so in the near future [8]. The EU Emissions Trading Scheme (EU ETS) is the world's first major greenhouse gas trading system and remains the largest to this day. However, the emissions trading system is not the only effective method of climate policy. For example, over the past ten years, the EU has adopted an extensive set of regulations targeting various aspects of sustainable growth and energy efficiency [9]. Increasing the energy efficiency of the economy and reducing greenhouse gas emissions are of great importance for the medium- and long-term energy policy and economy of Russia, since the country has a very high specific energy intensity of the economy, exceeding twice the same world average, 2.3 times the specific energy intensity in the United States and in 3 times - in the developed countries of Europe and in Japan.

Difficulties in providing domestic and foreign markets with energy in the proper volume are growing. In particular, the following trends can be noted [10]:

- domestic energy consumption is beginning to outstrip domestic energy supply;
- the pace of lucrative export markets is increasing;
- the pace of oil and gas production is slowing down. High specific energy intensity reduces the competitiveness of commodity producers, requires the attraction of additional financial costs for the energy supply of the country, causes a significant amount of emissions of harmful substances and greenhouse gases into the environment and increases the consumption of non-renewable natural fuel resources, primarily hydrocarbons. Energy shortages can be a significant deterrent to a country's economic growth and are already acutely felt in major cities. These problems are especially acute in the context of the financial crisis and economic downturn, when it is necessary to find and involve all available resources to optimize the costs of the state and business. Increasing energy efficiency is such a resource, but barriers related to lack of motivation, information and coordination, experience in financing energy saving projects hinder the realization of energy saving potential in the country. The economic importance of international measures to stimulate and enforce energy efficiency is growing. Leading countries are considering the introduction of protectionist measures (customs duties) against energy-intensive foreign products with high specific greenhouse gas emissions during their production. The use of restrictive “green” duties can seriously reduce the competitiveness of Russian companies - exporters of metal, pulp, and a number of other goods. Investments in improving energy efficiency can largely solve the problem of energy supply throughout Russia and are characterized by economic efficiency [11]. Thus, the capital costs of saving one ton of primary energy in the Russian Federation are on average 10–15% of the capital costs required to create new energy supply capacities. One of the most important tasks facing the country is the modernization of outdated infrastructure and some industries. First of all, it is necessary to realize the organizational and managerial potential of energy saving, primarily in the public sector. The introduction of limits on fuel and energy resources and other strict measures to save energy are the easiest way to reduce budget expenditures and reduce the burden on the environment. The Kyoto Protocol (KP) to the UN Framework Convention on
Climate Change (FCCC) is one of those international agreements in the field of environmental protection, according to which the Russian Federation can claim the role of a world leader in fulfilling its main obligations [12]. Russia successfully fulfills institutional requirements and fulfills its quantitative obligations to limit greenhouse gas emissions in the period 2008-2012 with a huge margin. After the decision of the United States not to participate in the KP, announced in March 2001, this international agreement could enter into force only if it was ratified by the Russian Federation. Russia determined the fate of the Kyoto Protocol, and Russian ratification found itself at the center of a struggle between various political forces, both external and internal. Ultimately, the Russian leadership decided to ratify the treaty, but the fierce struggle was not in vain: the "information war" in the media created a negative image of the KP among part of the public and the political leadership of the country [13]. As a result, this slowed down the activities of the Russian Government to create a regulatory framework for the preparation and implementation of joint implementation projects, which made it difficult for Russian companies to enter the international carbon market. Russia's actual refusal to participate in the carbon market created the threat of lost profits of tens of billions of euros. In the foreseeable future, Russia obviously has more reserves to reduce emissions at acceptable costs than developed countries. If the energy-saving (innovative) scenario is implemented, which involves the active introduction of energy-saving technologies and the development of renewable energy sources, the reduction in greenhouse gas emissions in 2020 compared to 1990 will be about 15%. This means a much more comfortable implementation of comparable quantitative emission limits than most countries. The Kyoto Protocol has created an international carbon market with very specific incentives for the implementation of activities leading to the reduction of greenhouse gas emissions. There are three flexible mechanisms under the KP to achieve emission reduction targets [14]:

- Clean Development Mechanism, CDM (Article 12), a system for trading in project emission reductions between developed countries with quantified emission reduction commitments in the period 2008-2012, and developing countries with no quantitative commitments;
- joint implementation projects, JI (Article 6), project emission reduction trading system between developed countries;
- International Emissions Trading, IET (Article 17). There are two alternative options for participating in the JI mechanism - JI Option 1 (Track 1) and JI Option 2 (Track 2).

When preparing the CP, the existence of a mechanism for international trading in emissions rights was a key condition for the adoption and implementation of strict quantitative obligations by a number of developed countries (USA, Canada, Japan, some EU members) [17]. Unfortunately, Canada's refusal to comply with the KP obligations and the US refusal to participate in the KP has drastically reduced the scope of emissions trading and Russia's prospects for earning serious profits from trade. However, in the future, the international carbon market is seen as an important tool for large-scale transfer of financial resources to developing countries, facilitating the transfer of advanced technologies in the field of energy production and consumption. Russia retains the opportunity to receive significant economic and political dividends from participation in emerging international carbon markets through the direct sale of part of the accumulated quota reserve and through the participation of Russian companies in joint implementation projects [16]. It is in Russia's interests to remove as many barriers and restrictions as possible in international trade in greenhouse gas emission rights in order to optimize the overall costs of combating climate change and maintaining economic growth rates. The projected growth in demand for carbon certificates and an increase in international trade can be considered as one of the main criteria for the acceptability of the future regime (and quantitative commitments of the main countries) for Russia [15].
4 Conclusions

One of the most important directions of the economic policy of developed countries is the provision of financial assistance, technical assistance and trade preferences to developing countries at the state level. The total volume of official development assistance from developed countries has been consistently increasing in recent years. The current realities of world politics and economics, the status of the Russian Federation as a member of the UN Security Council, the G8 determine the intensification of the country's policy in the field of international development assistance (IDA), including an increase in budget expenditures for these purposes. The annual amount of Russian participation in the financing of IDA programs and multilateral initiatives (excluding debt relief for the poorest countries) has doubled compared to 2003-2004, and in 2005-2006, amounted to about 100 million US dollars per year. In 2007, the volume of Russian assistance amounted to about 210 million US dollars. In the short term, Russia intends to continue to increase its contribution to development assistance as a donor country and bring these volumes up to 400-500 million US dollars per year. In particular, we are talking about a significant increase in contributions to the Global Fund to Fight HIV, Tuberculosis and Malaria, as well as the global action plan to combat avian influenza. At the beginning of this year, the Russian government decided to increase Russia's participation in the 15th replenishment of the capital of the International Development Association by 70% compared to the contribution of the Russian Federation to the 14th replenishment. At present, Russia is carrying out multifaceted work on the formation of a national system of assistance to international development. Not only the intentions of governments and authorities in cities and municipalities are changing, but the moods and behavior of ordinary citizens, consumers of goods and services, are changing. The carbon footprint is gradually becoming an important characteristic of products. A similar change in consumer preferences has already occurred as a result of campaigns to support and promote energy efficient technologies. Thus, the Energy Star brand, which has become an international energy efficiency standard, has become one of the parameters by which consumers make their choice, and are also willing to pay more for a similar product or service produced by responsible brands.

References

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