Methods for monitoring greenhouse gases on the example of the mountain landscapes of the Chechen Republic

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Abstract. The most important factor in social-economic development of society is the success of sustainable development. It is the most important factor in socio-economic development of society to achieve the goals for economic development. Achieving the goals of sustainable development is the most important factor in social development of society. On the territory of countries and regions, economic security is one of the key components for economic security in terms of sustainable development and Economic Security. In countries and regions, it has been found that environmental sustainability is one of the key components for economic security in terms of. With its high volumes, Russia is one of the largest emitters from carbon dioxide in Europe due to his large production and oil and gas produced. A significant reason for this is the presence of carbon dioxide in Russia. The main reason for this is the presence of carbon dioxide in the Russian Federation. Participants in the Kyoto Protocol allow Russia to take account of its gases and take measures to reduce them. The participation in the Kyoto Protocol allowed Russia to take responsibility for its own emission, as well as take steps to reduce them. To take responsibility for its emission and make measures that reduce them was also possible. It was also possible to take responsibility for its emissions and take steps that reduce them. The reason for this is that it has been involved. This is due to the fact that it was participated in the.

1 Introduction

Global climate change is the most acute environmental and economic problem, and an increasing number of countries are faced with its adverse consequences: dangerous meteorological phenomena, increased morbidity and mortality, and ecosystem disruption. International institutions emphasize the need for an urgent response to limit the pace of climate change in order to reduce possible risks [2]. The consequences of global warming are especially dangerous for the northern territories, such as Russia. Here, climate change can manifest itself in the destruction of infrastructure and fundamental buildings, the emergence of an anthrax epidemic due to the thawing of permafrost and the cattle burial grounds located in it [1]. In addition, there is reason to believe that the change in climatic conditions will be followed by an increase in morbidity and mortality due to an increase in

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the frequency of heat waves and insufficient implementation of adaptation measures. Despite the need to adapt the living environment to climate change, the key way to reduce climate risks, according to some researchers, is the decarbonization of the economy, which involves reducing greenhouse gas (GHG) emissions, mainly carbon dioxide. Given the scale of the current climate agenda, all countries of the world are calling for the decarbonization of economic activity, regardless of their level of economic development and specialization. However, for states whose economy is based on resource- and energy-intensive industries, the implementation of decarbonization will be more difficult than for developed countries with a post-industrial economic system [3]. Accordingly, for Russia, reducing the carbon intensity of the economy is a very important task, and therefore the goal of the work was to identify the problems of decarbonization of the Russian economy. The scientific novelty of the study lies in the analysis of the key instruments of decarbonization of the Russian economy and the identification of the features of their use.

2 Research Methodology

In the costs of organizing carbon plantations, there are: pre-launch costs; start-up costs; plantation costs; plant management and support. The costs of organizing carbon plantations include: start-up costs; start-up costs; plantation maintenance costs; costs of organizing accounting for carbon sequestration; disposal costs [3]. In order to determine the standard costs for the creation of carbon plantations, the standard method and the Technological map were used, including the name and area in what types of work are performed by adopted technology. The technique was used as well as the Standard Method with the Technological Map: information on the number and size of tasks that have been performed, the composition and need for tools, equipment and personnel, the number and skills of workers for their operation, information about daily surcharges and allowances, insurance premiums and the price of insurance premiums [5]. When determining the cost of creating and maintaining a carbon farm, the following factors were taken into account: - plant species composition, planting density, planting method and type of forest planting material, etc.; - cultivated agricultural crop, cultivation agrotechnics. In the technological map, the costs of labor, material and monetary resources for individual production operations and in general for the entire volume of work performed were calculated, the unit cost of production was calculated for the main costs - standard costs per unit area. Poplar seedlings with a closed root system were used in the calculations as the main fast-growing hardwood species for the purposes of creating a carbon polygon, and pine seedlings with a closed root system were used as the main coniferous species in the calculations. In the Chechen Republic (see fig. 1). A herb appeared to consist of flowers alone. The herbage seems to be completely composed of them [4]. Thanks to it, the alpine meadows that are not high in size, and whose base is forbs, have received an image of "carpet" as well as figurative expression: low-growing forested meadows. Thanks to this. In the forests of more developed soils, alpine meadows are dominated by grasses (squat fescue and winding mellowgrass) or Asiatic Oats. A low-growing sedge (Sedges: sad, Yuetta, Meinhausen) and low-growing sedges (sedges: sad. Yuetta, Meinshausen). As a result of this, the meadows are high-quality fodder lands, since its constituent plant contained protein (10.5%), fat (2.2%), as well as fiber (26.8%) and small carbon (27%). The Kuban hollywort, 4-leaf clover are the legumes. Various types of bluebells, forbs are represented by different kinds of bluebells: forget-me-nots and gentians, etc. White-bearded grass is not eaten by livestock due to its extremely coarse stems and leaves [6]. It is also important to note that white-bearded grass is not eaten by livestock due to its rarest colorful stems and leaves. White-tailed grasses are most common in the Biychesyn tract. The spread of White-tailed grasses is especially

widespread in the Biychesyn tract. An area of such large areas, even in the distance, is still distinguished from distant by its whitish tint.

Fig. 1. Forest in the Chechen Republic

The commitment to "eradicate extreme poverty among the people who depend on forests" by 2030 reflects a crucial aspect of global sustainability. Poverty among forest-dependent communities has been a persistent issue, necessitating focused efforts within the UN Strategic Plan for Forests. Achieving this goal is integral to fostering economic equity, social justice, and environmental conservation worldwide. Forests play a multifaceted role in the livelihoods of many communities, providing essential resources and services. Poverty eradication within these communities is not only a moral imperative but also a strategic move toward achieving a sustainable future [7]. The commitment recognizes that economic development should not come at the expense of forest ecosystems and their capacity to support life. It aligns with the broader mission of the United Nations to ensure that no one is left behind in the pursuit of global development. The timeframe of 2030 signifies the urgency of this endeavor, emphasizing the need for swift, coordinated actions. Implementing effective policies, securing land rights, and promoting sustainable forest management are key strategies to achieve this commitment. By working collectively toward this goal, the international community can pave the way for a more equitable, prosperous, and ecologically balanced world.

3 Results and Discussions

The countries of the Caucasus and Central Asia tend to have low forest cover. Forests and other wooded land (FOWL) on average account for about 8% of the total land area, with this figure varying between 4 and 13% in most countries [4]. The exception is Georgia with over 40% forest cover. In the past, the region's forest cover was higher (65% in Georgia), but successive negative impacts on the forests have destroyed them or contributed to their degradation, while the forests have not been able to recover on their own due to harsh environmental conditions and ongoing anthropogenic pressure. Although the data are scattered and no competent accounting of forest resources in the region has been carried out, it can be assumed that several events have taken place over the past two centuries that have had a large impact on the region's forest cover:

• Social and economic upheaval during the rise of Soviet power in the 1920s, prompting the local population to overuse their forests for energy and raw materials.

• The high demand for wood and firewood from the local population and other regions of the USSR put great pressure on forests during the pre-war industrialization, the war and the recovery period.

• In the 1950s and 1960s, the Soviet authorities decided that the needs of the USSR for timber should not be met in the Caucasus and Central Asia, and assigned almost all the forests of the region to the "first group", with priority given to protective functions: logging (cutting for the purpose of logging) was strictly limited [5]. Timber, wood products and energy resources were delivered from other regions of the USSR, which reduced the pressure on the forests of the Caucasus and Central Asia. After independence, the structure of the internal trade of the USSR was destroyed, and the forests of the region were subjected to increased exploitation to ensure high demand for building timber and, above all, for energy (the import of oil, coal and gas was abruptly stopped, as trade relations collapsed); all of this took place at a time of dramatic institutional change. Forest institutions were deprived of resources. Conflicts, including in Tajikistan, Nagorno-Karabakh and Abkhazia, have only increased this pressure. In a difficult period of rapid change and high tensions, as well as problems of public budget deficits and governance in general, forest-related issues have received low political priority.

Carbon polygons make it possible to carry out a number of important research in the field of ecology. For example: − development and adaptation of ground-based technologies for field and forestry agrochemical control of soils and respiration of greenhouse gases; − development and adaptation of technologies for remote accounting of above-ground and below-ground phytomass, rhizosphere, agrochemical control of soils and respiration of greenhouse gases; − development and adaptation of mathematical models for primary gross productivity, primary net productivity, net CO2 exchange between the ecosystem and the atmosphere, respiration and other parameters of the carbon balance of ecosystems in reference areas. In February 2021, the Ministry of Science and Higher Education of the Russian Federation launched a pilot project to create carbon polygons in Russian regions to develop and test carbon balance control technologies. This carbon landfill was created on agricultural land with an area of 600 hectares in the Kaluga region and located within the boundaries of the Ugra National Park. The initiator of the project is the Ctrl2GO group, the project was named "Carbon" [8, 9]. The start of the project was preceded by large-scale scientific work related to the creation of digital models of the study areas, field analysis of the territory to calculate biomass, plant species composition and soil conditions. The work and collection of information was carried out using space satellites, unmanned aerial vehicles and ground-based sensors for various purposes. The obtained scientific data are summarized in a single system. Their analysis is carried out by a specially developed artificial intelligence, which, based on the results obtained, will be able to model data from other climatic and natural zones much faster. In the future, it is planned to open similar carbon polygons in other regions for a more detailed analysis of the properties of Russia's natural zones [6]. In the future, it is assumed that the network of carbon landfills will cover the entire territory of Russia.

According to the authors, carbon landfills solve a very serious economic issue - reducing the tax burden on Russian enterprises (fig. 2). However, in our opinion, carbon polygons and their activities are also of great scientific importance. While most of the developed countries were working on new sources of energy, green technologies, the use of which to a lesser extent affects the environment, Russia preferred to stick to its traditional types of fuel: oil, coal and gas. Over time, the refusal to explore new types of energy could lead to a serious scientific and technical lag of the Russian energy and industry from developed countries, which again affects the welfare of the country.

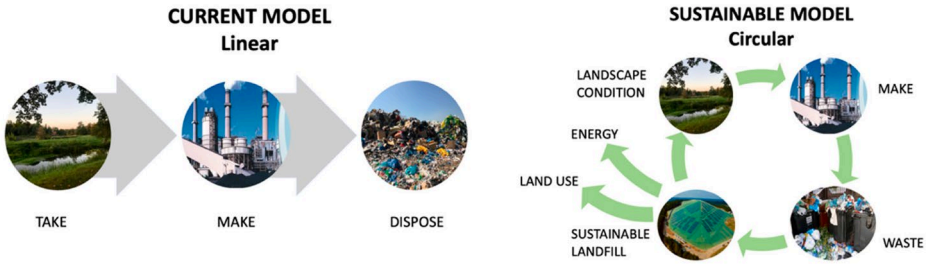

Fig. 2. Landfill Impacts on the Environment.

The Ctrl2GO company itself claims to be "one of the largest providers of data analysis solutions in Russia." She specializes in the development and implementation of digital products in the industry. Many of the developments of this company are partially used in the agro-industrial complex of Russia - and all of them are tied to the use of modern digital technologies, which significantly increase labor productivity. The same company is the initiator of the carbon landfill project. In addition, the activity of carbon landfills, according to the authors, increases our knowledge about the sequestration potential [8] (for greenhouse gases) of the territories. Also, their activities increase our knowledge of adaptation to global climate change and global warming - this is the adaptability of natural or anthropogenic systems in response to real or expected climate change, which allows you to reduce your own vulnerability and use favorable conditions about their adaptive capabilities and use favorable conditions. In addition to the above, a scientific complex is being created that is able to automatically measure the level of absorption of carbon dioxide (as well as other components of greenhouse gases) in various climatic and natural zones. Such measurements are essential for a domestic manufacturer, since in Russia there are no state methods for assessing the level of absorption of greenhouse gases. Deputy Minister of Economic Development Torosov said that the methodology for calculating the carbon footprint, which the European Union plans to apply, remains largely closed and incomprehensible, since it takes into account only the level of carbon dioxide emissions on the territory of the state: there are no calculations for its consumption by nature. At the expense of the carbon landfill project, the state plans to develop an alternative scheme for calculating fees for the carbon footprint and propose adjustments to the European Union. Clearly, Europeans are the world leaders in tracking and calculating carbon emissions. They were the first to launch satellites that constantly monitor the situation, so they had more time to determine the impact of emissions on the climate. American companies are not far behind: they have a serious technological base, which they use to develop their technologies. Russia looks a little behind on this list, as it lacks a wide array of satellites to monitor climate change, an incredibly powerful IT sector to quickly analyze data, and even cover the entire country with polygons. On the other hand, the lagging behind, as a rule, develops faster due to already known technologies. The company Ctrl2Go proposed an option that does not require large investments in spacecraft. It is enough to extend the polygons to a greater number of climatic zones, collect data and simulate the level of carbon dioxide air pollution as close as possible to reality.

The carbon landfill project has not yet been launched at full capacity, it is too early to draw conclusions, but the beginning is at least impressive with its technological solution. Special attention should be paid to the legal regulation of the process of creating a carbon landfill project. The organization of research and scientific and technical activities on the territory of national parks is mainly regulated by the Federal Law "On Specially Protected Natural Territories", the Federal Law "On Science and State Scientific and Technical Policy". Also, for the implementation of activities, it is necessary to obtain the consent of

the director for scientific work of the nature protection zone and Rosprirodnadzor [9]. Activities in specially protected natural areas should be carried out by methods that do not violate the rules of nature protection in these areas.

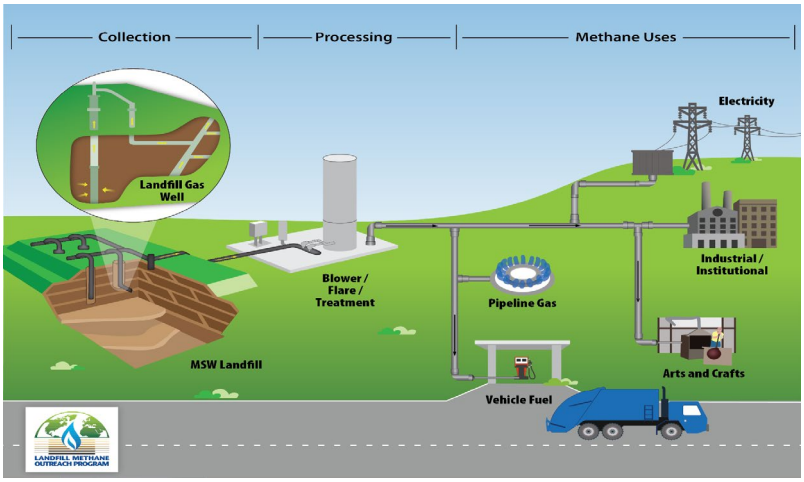

Fig. 3. Basic Information about Landfill Gas

In the future, the legal regulation of the project may change due to the planned cooperation with universities and research and educational centers (RECs) in different regions and the Ministry of Natural Resources. According to the authors, there is no doubt that RECs should participate in the program for the creation of carbon landfills, since they have all the possibilities for this. And it is important that RECs interact with business and unite regions that are diverse in terms of natural and climatic parameters. For example, the West Siberian REC has already announced that it will take part in the program. This is one of the 15 RECs planned for creation, which is already operating and whose specialization includes: biological safety of humans, animals and plants; Arctic research; digital transformation of the oil and gas industry. The West Siberian Research and Educational Center has identified several priorities for scientific and technological development, which include counteracting technogenic, biogenic, and sociocultural threats [10]. In general, the interest in the carbon landfill project corresponds to the specialization of the REC and can help both in the implementation of the national project "Science", according to which in 2024 Russia should enter the top five countries carrying out research and development, and in solving environmental problems that are a priority. In 2019, the Government of Russia approved the “National Action Plan for Adaptation to Climate Change for the period until 2022”, which provides for the implementation of Russia’s international obligations under the UN Framework Convention on Climate Change and other international environmental treaties. To accelerate the spread of the carbon landfill project, the Ministry of Education and Science of Russia sent a proposal to the Russian Ministry of Natural Resources to include carbon landfills in the plan to reduce greenhouse gas emissions. Since the carbon landfill project is based on the widespread use of digital technologies, Ctrl2Go can qualify for concessional loans and other types of government support. This right is granted to it by the Government Decree “On Approval of the Rules for Granting Subsidies from the Federal Budget in the Framework of Supporting Projects to Transform Priority Sectors of the Economy and the Social Sphere through the Implementation of Domestic Products, Services and Platform Solutions Created on the Basis of End-to-End Digital Technologies, Using Concessional Lending”, adopted within the framework of the national project “Digital Economy”.

4 Conclusions

An important tool for managing sustainable development is greenhouse gas monitoring. In this article, the object of research is greenhouse gas monitoring as an important tool for managing sustainable development. For the monitoring of emissions in dynamics, it is important to assess the level of gases that are present in an environment. It helps you to understand the effectiveness of measures for reducing emission and correct them in time. The existence of methods allow, on the one hand, to monitor emissions from stationary sources, and on the other hand, to take into account emission in the air from mobile sources. But both types of pollution affect the whole picture. For example, this paper provides an overview of monitoring methods and described the functional features in carbon polygons. The function is determined by the functional features that are used to monitor greenhouse gases by natural ecosystems with the help from research institutions and university groups. Among other things, the importance of greenhouse gas monitoring for the development of the country, which is not possible with the proper methodological tools, is substantiated.

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