

Launch of Pilot Carbon Polygons in Russia and Their Importance Today: Review

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Abstract: With the growth of the population in recent decades, the need to increase the production of goods, food, machinery, vehicles and other related products was also inevitable. To meet these requirements, it is necessary to increase mass production. The by-product of such events can be a massive release of unwanted chemicals into the atmosphere, mainly CO₂, as it causes the most damage to the environment, completely rebuilding and, in the worst case, destroying well-established ecosystems or environments. If to be put in simplest form Global warming. In recent times, one can view the global warming as a trendy issue, which is actually a more complex and dangerous problem if it gets out of control. Therefore, the problem is taken into the category of mandatory. Carbon polygons were cited as a possible solution to the problem, as they would be used as research sites to better understand unwanted CO₂ emissions and how to control and reduce them. Hence, this article discusses such a concept as carbon polygons, what they are, how they work, why they are needed and what importance they have for now and in the near future.

1 INTRODUCTION

It is hard to imagine how humanity would have progressed without such hydrocarbon energy sources as coal, oil and gas. Indeed, due to their ease of extraction, efficiency and availability, they have become one of the main prerequisites for the rapid development of the industry. However, we have had to pay dearly for the use of these non-renewable resources. Their use entailed a strong negative impact on the environment, which caused global climate change, which is understood as part of the general changes in the natural environment on Earth, due to changes in the heat balance of the atmosphere, ocean water circulation and the water cycle, fluctuations in solar activity, space and anthropogenic factors. In the future, the negative consequences of these changes can become catastrophic for the world community. Already, many countries are facing increased intensity of fires, droughts and floods. In this regard, the topic of the need to take decisive measures to reduce anthropogenic emissions and increase the absorption of greenhouse gases from the atmosphere has often been raised. The world community realized that further uncontrolled use of hydrocarbons would only aggravate the situation and decided to take the

issue seriously. Taking beforementioned statements into consideration the Kyoto Protocol was signed first, and then the Paris Agreement, which were supposed to reduce the amount of CO₂ emissions into the atmosphere. In particular, countries that have signed the Paris climate agreement need to keep the increase in global average temperature within 1.5-2°C until the end of the 21st century compared to the pre-industrial period. Those countries that are not very successful in this will start to pay: their products exported to the European Union will be subject to a special tax. In 2019, Russia also signed it. Later, Russian scientists were tasked with developing a methodology for measuring emissions and removals of greenhouse gases. To accomplish this task, in February 2021, the Ministry of Science and Higher Education of the Russian Federation, by order No. 74 dated February 5, launched a pilot project to create carbon polygons in the regions of Russia for the development and testing of carbon balance control technologies (figure 1) (Carbon Polygons. <https://carbon-polygons.ru>; Carbon Polygons. <https://minobrnauki.gov.ru/action/poligony/>).

Planned as part of a pilot project polygons under the organizations of the Ministry of Education and Science of Russia



Figure 1: Map of carbon polygons.

2 WHAT ARE CARBON POLYGONS?

According to the official website of the Ministry of Science and Higher Education of the Russian Federation, «carbon polygons are territories with a unique ecosystem created to implement measures to control climate active gases with the participation of universities and scientific organizations» (Carbon Polygons and Carbon Offsets. <https://encyclopedia.pub/entry/16008>).

Simply put, these are areas specially designated for the study of the ability of various plants to absorb carbon.

The aim of the project is to study the carbon balance in the ecosystems of the Russian Federation and the development on this basis of technologies for monitoring carbon runoff and emission, as well as methods for calculating the carbon balance for different types of ecosystems. Moreover, the theoretical knowledge obtained as a result of research should be tested on real and critical conditions and put into practice.

The landfills should work for at least 15 years, but the creators expect their activities will never stop. It is expected that in the near future several dozen carbon test sites will be created and their network will cover the entire territory of Russia (Magomedov, 2020; Magomedov, 2021).

3 WHAT ACTIVITIES WILL BE CARRIED OUT AT THE CARBON LANDFILL?

The most important research in the field of ecology will be carried out at the carbon polygons (Recyclemag, 2021):

- experiments to measure the emission and absorption of greenhouse gases using ground and remote methods to assess the spatial and temporal variability of the flows of climatically active gases;
- development and adaptation of agricultural 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;
- Development of technology for assimilation of heterogeneous data (satellite and terrestrial);

inventory, remote and direct measurements) into a common model of sources and sinks on the territory of the region and the Russian Federation. Verification with direct ground;

- Search for the most suitable plants for absorption;

In addition to research work, educational activities will also be carried out at the test sites:

- training of highly qualified personnel in the field of the latest methods of environmental control, promising technologies for the low-carbon industry, agriculture and municipal economy;
- creation of special training programs;
- popularization of science among students and schoolchildren.

4 CARBON POLYGONS IN THE CHECHEN REPUBLIC

The Chechen Republic became one of the first subjects of the Russian Federation, which took part in the creation of a network of carbon polygons. In 2021, a «WAY CARBON» carbon polygon was created on its territory with a total area of 1785 hectares. Two universities decided to take part in the program at once, Kadyrov Chechen State University and the Grozny State Oil Technical University named after Academician M. D. Millionshchikov. Kadyrov Chechen State University became the operator of a carbon polygon for growing and researching plants with high sequestration potential. Research in the field of ecological monitoring of the environment, including the analysis of the impact of oil pollution and geothermal sources on the formation of the carbon footprint, was undertaken by the Grozny State Oil Technical University named after Academician M. D. Millionshchikov.

"WAY CARBON" will specialize in the following activities:

- Assessment of the sequestration potential of various soils and ecosystems, including those in foothill and mountainous areas (Zubrzycki, 2014);
- Study of the impact of regenerative animal husbandry on the sequestration potential of pastures;
- Efficient use of sequestration technologies in pastures;
- Creation of carbon farms in the regions of the Chechen Republic;

- Assessment of the impact of agrochemical stimulation of vegetation growth in the plains, foothills and mountains;
- Carrying out selection work to create new breeds of vegetation (or adaptation of existing ones) with increased commercial, sequestration and growth characteristics;
- Monitoring of the ecological species composition of vegetation, biotic and abiotic stress, control of disturbances in the use of water resources, as well as general ecological control and monitoring of the environment.

Research activities will also be carried out:

- Assessment of the variability of the agroclimatic conditions of the North Caucasus in connection with global climate change;
- Interpretation of remote sensing data using artificial intelligence methods to study the carbon balance of mountain and foothill ecosystems (on the example of the Chechen Republic) (Fuentes, 2020);
- Study of the sequestration and emission potential of the «EcoGrozny» carbon polygon and the development of science-based decarbonization technologies (on the example of the Chechen Republic);
- Ecological diagnostics of carbon sequestration in the landscapes of the Chechen Republic;
- Study of greenhouse gas emissions by ground methods when fallow lands are involved in agricultural turnover;
- Study of the sequestration potential of pasture and meadow phytocenoses of the Chechen Republic.

Due to the lack of necessary personnel, various educational programs have been developed: geoinformatics, geoecology, veterinary and sanitary expertise, and others.

In addition, Kadyrov Chechen State University and the Grozny State Oil Technical University named after Academician M. D. Millionshchikov decided to educate the population about the activities and goals of the carbon polygons, future biotechnologies and renewable energy sources. Summer schools will be held annually on various topics for people of different ages and professions, including for middle and high school students.



Figure 2: Way Carbon (photo by Andrey Kasatkin - Saint Petersburg Electrotechnical University "LETI").

5 THE IMPORTANCE OF CARBON POLYGONS IN OUR TIME

First of all, the importance of carbon polygons undoubtedly lies in conducting research on the emission and deposition (absorption) of greenhouse gases, since global climate change in nature can have a negative impact on the lives of citizens of the Russian Federation, and this is a threat to national security.

Also, due to the decision taken by the EU to make its economy climate neutral by 2050, exporting companies in Russia will have to pay a cross-border tax in the coming years.

In addition, based on the knowledge gained from the carbon landfills, carbon farms will be created, areas where the same knowledge will be applied in practice.

They are needed in order to create such natural conditions that carbon dioxide will be deposited (absorbed) as efficiently as possible. If one talks about polygons with an emphasis on scientific research, then carbon farms are also a commercial project. Owners of sites with vegetation that absorbs large amounts of carbon dioxide and other greenhouse gases can produce carbon credits and become participants in an emissions trading system that companies will buy to avoid paying carbon taxes.

Also, a bonus is that there will be a strong demand for such “green” professions as climatologists, ecologists, botanists, geologists, geographers and even IT (for collecting and analyzing large amounts of information).

6 CONCLUSIONS

Based on the above, one can conclude that carbon polygons occupy one of the key roles in the development of the Russian Federation, since only in this way can it take a leading position in the "green" race without harming the economy.

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