

LANDSCAPE FEATURES OF CARBON POLYGON OF THE CHECHEN REPUBLIC

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Abstract. The article analyzes the landscape features of the carbon test site of the Chechen Republic, located in various natural and climatic conditions of the region.

Key words: carbon balance, greenhouse gases, emissions, absorption, natural landscapes, ecosystem.

Carbon testing sites are areas where research on climate-active gases is carried out with the participation of universities and scientific organizations. They include the development and adaptation of technologies for measuring above-ground and underground phytomass, agrochemical studies of soils, measuring the emission and absorption of greenhouse gases by ecosystems, the active use of remote sensing technologies using space and unmanned platforms, the development and adaptation of mathematical models for calculating the carbon balance of ecosystems in reference areas.

A system of carbon polygons is being created within the framework of the national action plan for adaptation to climate change until 2022, approved by the Government of the Russian Federation in December 2019. Activities carried out in this direction are designed to reduce the risks of systemic restrictions in the trade balance from Western partners [6, 10].

In February 2021, the Ministry of Science and Higher Education of the Russian Federation launched a pilot project to create carbon testing sites in Russian regions for the development and testing of carbon balance control technologies. As part of the implementation of a pilot project on the territory of the Chechen Republic, a carbon testing site "Way Carbon" was created in 2021.

As part of the development of the carbon test site in the Chechen Republic, the development of methods for assessing the carbon balance based on a comprehensive interpretation of geophysical and geocological data is very promising. The development of mathematical models of the carbon balance of mountain and foothill ecosystems, which can be extrapolated to other mountain regions of Russia, is also very relevant.

Compared to other regions of Russia, the territory allocated for the carbon test site in the Chechen Republic has a wide range of natural landscapes. They cover a fairly large range of altitudes from south to north (from 100-1500 m to 2500 m), including landscapes of subalpine meadows, mountain forest landscapes, forest-steppe and steppe landscapes [4-6].

Steppe landscapes are mainly distributed south of the river. Terek within the Nadterechnaya Plain, Terek-Sunzha Upland, Alkhanchurt Valley and the northern part of the Chechen Sloping Plain. The hills are composed of Miocene-Pliocene deposits of the Neogene system, the plains are composed of loess-like loams, underlain by undivided deposits of the anthropogene system (Atlas of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1978). The climate is temperate and humid. The humidification coefficient is from 0.61 to 0.9 - increases from north to south and towards the tops of the ridges. The annual precipitation increases to the south and amounts to 400-600 mm (Agroclimatic reference book for the Chechen-Ingush Autonomous Soviet Socialist Republic, 1960). Chestnut and dark chestnut soils predominate. Leached carbonate chernozems in combination with carbonate, solonetzic and washed away chernozems are characteristic of the Terek-Sunzha Upland. The Alkhanchurt valley is dominated by solonetzic and solonchak varieties of chestnut soils. Meadow-chernozem and meadow-chernozem carbonate soils are common on the Chechen inclined plain and along river valleys (Atlas of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1978). The natural landscapes of the steppe zone are characterized by forbs-fescue-feather grass and bearded vulture, in places plowed steppe cenoses; forb-grass steppes with ravine forests; forb-grass wormwood steppes; secondary wormwood-boradacha steppes with shiblyak

fragments [1-3]. Most of the steppes and meadow steppes are plowed and turned into agrocenoses. On the lower terraces of the Terek and Sunzha rivers, intrazonal landscapes are common, represented by floodplain broad-leaved forests of the bayrach type.

Broad-leaved forests have been preserved on the slopes of the northern exposures of the Terek-Sunzhensky ridges.

Forest-steppe landscapes occupy the territory between the Sunzhensky, Novogrozny, Gudermes ridges in the north and the Black Mountains in the south, within the southern part of the Chechen inclined plain. According to its geological structure, the Chechen Plain is a foothill trough of the earth's crust, adjacent directly to the Caucasus Range. The relief is dominated by high plains composed of alluvial deposits, dissected by river valleys, with absolute heights from 150 to 450 m (Atlas of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1978). The climate is moderate, fairly humid, with a humidification coefficient from 0.91 to 1.2. The annual precipitation is 500-600 mm (Agroclimatic reference book of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1960). The predominant soil type is meadow-chernozem combined with medium-deep and slightly leached carbonate chernozems. Meadow-chernozem carbonate soils in combination with meadow carbonate soils are found in isolated spots. In the south of the forest-steppe zone, from west to east, along the Black Mountains, there is a strip of meadow and alluvial-meadow soils, predominantly saline and solonchic, which expands to the west and east (Atlas of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1978). Forest-steppe landscapes are almost completely plowed, cultivated and are currently represented mainly by agricultural landscapes. The remaining natural areas are represented by meadow herbs with an admixture of steppe grasses. Forests have been preserved only on the slopes of the northern exposure of the Terek-Sunzha Upland and on the lower terraces of river valleys.

Mountain landscapes occupy the northern slope of the Greater Caucasus, dissected from north to south by four parallel ridges - Chernogorsky, Pastbishchny, Skalisty and Bokovoy. The Black Mountains are composed mainly of sandy-clayey deposits of the Paleogene-Neogene system of the Cenozoic. The Pastishchny and Skalisty ridges are composed predominantly of limestone rocks of the Cretaceous system, and the Bokovaya ridge is composed of clayey rocks, black shales and sandstones of the Jurassic system. Absolute heights range from 500 m in the Black Mountains to 4494 m (Tebulos-Mta) [1, 7]. Glaciations of the Quaternary period played a major role in the formation of modern highland landscapes. Slope exposure plays a significant role in the formation of mountain landscapes. Altitudinal zonation is clearly evident in the mountains.

Mountain landscapes, based on hydrothermal, soil-geobotanical and relief conditions, are divided into:

- mid-mountain-low-mountain landscapes of broad-leaved and mixed forests and post-forest meadows;
- mid-high mountain landscapes of subalpine and alpine meadows;
- intrazonal landscapes of arid and semiarid high-mountain basins;
- nival-glacial landscapes of glaciers and snowfields.

Mid-mountain-low-mountain landscapes occupy an area ranging in altitude from 500 to 1800-2000 m, and sometimes up to 2500 m. They cover mainly the Black Mountains, as well as the lower slopes of the Pastbishchny, Skalisty and partially Bokovoy ridges. The territory is composed of Paleogene-Neogene deposits, represented here mainly by clayey, shale and limestone rocks (Atlas of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1978). The climate is temperate, soft, with a humidification coefficient from 0.91 to 1.5. The annual precipitation ranges from 500 to 700-800 mm, in some places reaching 1000 mm or more (Agroclimatic Directory of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1960). Mountain-forest brown, sometimes podzolized soils predominate in combination with humus-carbonate and meadow-alluvial soils, turning in the east into mountain-forest dark gray, swampy and fused soils (Atlas of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1978). In the low mountains, mixed forests grow, the basis of which are wild fruit trees [1, 2, 9]. The main forest-forming species are: beech, hornbeam and birch mixed with Norway maple and Tatarian maple, cordifolia linden, gray and black alder, common ash, Sosnovsky pine, pedunculate and sessile oak and other species [1, 8]. In places where forests were cleared, secondary meadows formed, represented by mountain meadow herbs.

Mid-mountain-high mountain landscapes occupy the slopes of the Pastbishchny, Skalisty and Bokovoye ridges, within altitudes from 1800 to 3700-3800 m, and are divided into three zones: subalpine, alpine and subnival [2, 3, 9]. Arid basins are also characterized by intrazonal landscapes.

Landscapes of the subalpine and alpine zones are distributed at altitudes of 1800-3200 m. The climate in most of the zones is transitional from temperate to continental, with a humidification coefficient from 1.2 to 1.5. The annual precipitation is 700-800 mm, sometimes exceeding 1000 mm. In arid basins the climate is arid, and accordingly there is less precipitation - 400 mm per year (Agroclimatic reference book of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1960). Mountain-meadow alpine thin soils and mountain-meadow subalpine medium-thick soils predominate. Along the river valleys, mountain forest primitive, slightly podzolized stony-cartilaginous soils are widespread (Atlas of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1978). The subalpine belt is represented by tall grass meadows, consisting of forb-grass and sedge meadows on mountain-meadow, thick and medium-deep soils. The alpine belt is dominated by cereals -sedge, sedge, forb-grass associations. The upper part of the belt is characterized by colorful alpine carpets (Galushko, 1975; Ryzhikov, 1991; Pribytkov, 1981) [2, 9, 8].

The landscapes of the subnival belt with rocky outcrops and screes are formed by Lower Jurassic deposits at an altitude of 3200-3800 m (Atlas of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1978). The humid and cold climate of the highlands contributed to the formation of low-grass alpine carpets with insignificant projective cover on thin mountain-meadow alpine soils with medium humus. There is no continuous vegetation in the subnival belt; it is scattered among screes and rocks. Mosses and lichens grow on the primitive soils of the belt [1, 2, 9].

Intrazonal landscapes are confined to arid and semiarid high-mountain basins located in the valley of the river. Chanty-Argun (Itum-Kalinskaya basin), in the upper reaches of the river. Sharo-Argun (Sharoya basin), in the upper reaches of the river. Gekhi, (Yalkharoe-Galanchozhskaya basin), southwest of Lake Kezenoy-Am (Makazhoiskaya valley). The moderately warm, arid climate, with a precipitation amount of 400 mm (Agroclimatic reference book of the Chechen-Ingush Autonomous Soviet Socialist Republic, 1960), contributed to the formation of dry-steppe landscapes with xerophytic vegetation here on mountain-steppe soils that were often washed away. The herbaceous vegetation of rocks and screes, which developed in mid-mountain and high-mountain landscapes, also belongs to intrazonal landscape inclusions.

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