THE INCREASE IN THE INTENSITY OF DESERTIFICATION DUE TO CLIMATE CHANGE IN THE TERRITORY OF THE NORTH CHECHEN LOWLAND

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Abstract

Desertification processes that have covered significant areas in the North Chechen Lowland, caused by anthropogenic impact exceeding their stability, have intensified due to climate change. The temperature regime has changed significantly over the past 30 years, the temperature has increased by 1-1.5 degrees, and the amount of precipitation has decreased – less than 250 mm per year, evaporation has increased and in summer can reach up to 2500 mm or more. Under these conditions, degradation processes leading to the reduction of vegetation cover and to the destruction of soil cover, causing the activation of deflationary processes. Dust storms have become quite frequent. The areas exposed to desertification processes exceed more than 270,000 hectares, including more than 100,000 hectares of open sand masses overweighed by wind.

Keywords: desertification processes, climate change, deflation processes, arid landscapes, North Chechen Lowland

I. Introduction

Arid landscapes occupy the northern regions of the Chechen Republic. Within this type of landscapes, 1 subtype is distinguished — semi—desert and desert, which is divided into 1 genus - lowland-lowland accumulative with wormwood (with fragrant wormwood, Tauric and Lerkha), solyanka deserts and wormwood-cereal semi-deserts and 3 types of landscapes (Fig. 1.).

The relief is dominated by low-lying plains with absolute heights from 5 to 200 m, composed of Pleistocene marine rocks and loess-like loams. The climatic conditions are characterized by continentality and aridity. The temperature of the coldest month (January) ranges from -4.4 to 1.8° depending on the location. The hottest month is July, with a temperature of 23.5-25.2°. Accordingly, the annual temperature reaches 9.7-11.1 °. The sum of active temperatures reaches 3550-3600 °. The low amount of precipitation (300-350 mm) determined the "fragility" of the connections between the components of nature and the "vulnerability" of semi-desert landscapes. The soils here are sandy, chestnut and light chestnut with an abundance of salt marshes and salt marshes. They are not very fertile, so for a long time the main resource used in human economic activity was the wormwood-grass steppes adjacent to the floodplain of the Terek River. When moving to the northeast, with the increase in aridity of the climate, vegetation is thinned, sod cereals gradually disappear and pickles acquire an increasingly important role in the cover. At the same time, the influence of microrelief is increasingly beginning to affect the composition of vegetation cover. Even with minor changes in the surface, there is a sharp change in plant groupings: from grass-steppe associations of wormwood and solyanka.

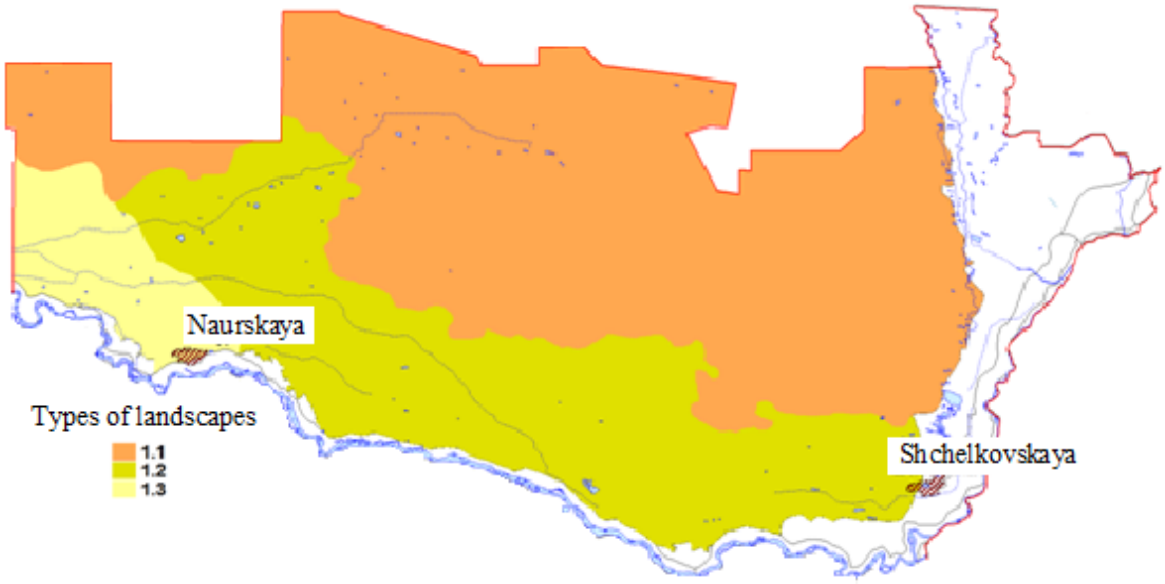

Figure 1: *Types of arid landscapes of the North Chechen lowland*

The legend of the map

1.1. A low-lying slightly inclined alluvial plain, composed of developed and intertwined sands, with a wide range of Aeolian relief forms, with semi—desert (Taurian wormwood, Marshall, Austrian) and sand-loving (erianthus Rowenna, impereta cylindrical, kendyr Sarmatian) vegetation on light chestnut soils - occupies the territory of the Tersk sandy massif, where typical Aeolian landforms with the most arid climate;

1.2. A low-lying, slightly inclined alluvial plain, composed of developed and intertwined sands with fragments of Aeolian relief, with grassy and grassy desert steppes and sand lovers on light chestnut soils, adjoins the Tersk sandy massif from the south, but the Aeolian landforms are not so widely represented here and mainly in the northern part, the climates are only slightly less drier than in the Tersk sand massif;

1.3. A low-lying slightly inclined alluvial plain composed of sands with fragments of Aeolian relief, with grassy semi-steppe and steppes (grassy-grassy, grassy—wormwood and borodachev) on dark chestnut soils is the least arid and somewhat more elevated part adjacent to the Tersk sandy massif from the southwest, Aeolian relief is extremely rare, The composition of the flora is influenced by the proximity of the real steppes.

The information currently available on the nature and distribution of the vegetation cover of the Zaverechye has accumulated as a result of research by a number of botanists. Of these, P.V. Novopokrovsky (1922, 1925, 1926), S.A. Vinogradov, G.A. Tolchin (1932), S.E. Rozhenits-Kucherovskaya (1925), A.D. Gozhev (1930), S.M. Borisov (1946) should be noted. Since the end of the 19th century, pastures of arid landscapes have been actively used year-round, which naturally led to their degradation and the manifestation of deflationary and Aeolian processes here. The anthropogenic factor intensified by climate change actively interfered with the natural course of evolution of these landscapes, which led to a significant transformation of natural components and the geosystem as a whole.

II. Methods

The North Chechen lowland has significant diversity of vegetation cover both in its genesis and species composition. Here we find plant associations of past eras, as well as modern formations and adjacent territories. In order to better understand the origin of the existing forms of plant associations, the history of their formation has been traced since the beginning of anthropogenic.

The territory of the North Chechen lowland in the modern era, three transgressions of the Caspian Sea have been traced: Baku, Khazar, Khvalyn, which alternated with periods of sea retreat - regressions. The territory of the North Chechen Lowland released after the Khvalyn transgression is exposed to climatic and anthropogenic factors. The main methods of our research

of vegetation cover are the field route, which allowed us to establish the evolution and its patterns. Botanical methods are based on direct observation of the external appearance of forms and elements of plant associations, identification of their features and typical features, as well as the study of their spatial relationships.

In visual ground surveys, the main work is carried out at the reference points. They are chosen so that they can characterize one of the forms of plant associations, or a system of genetically related groupings. At the reference points of the study, a detailed botanical and geographical assessment of the studied plant associations is given: their appearance and spatial placement are described. The main method was field research by routes that ran from south to north, the reference points were located at the corners of squares with sides of 5 km. Dozens of photographs were taken. The basis has been laid for further studies of vegetation cover. The complex nature of our research has allowed us to determine that the main factor that provoked deflationary processes here is the anthropogenic factor. Since the second half of the last century, the process of intensive warming began, which naturally intensified deflationary processes.Our research covers a significant part of sandy landscapes that are subject to intense deflationary processes.

III. Results

A new type of landscape has been formed, where the anthropogenic factor of evolution plays a significant role. The Naursko-Shelkovskaya natural and anthropogenic landscape occupies the western part of the Priterskiy sand massif on the territory of the Naursky and Shelkosky districts. The natural functions of the landscape have been preserved over a significant area, they are weakened by forms of farming (watering and irrigation) and overgrazing of livestock. The coefficient of anthropogenic disturbance is 0.9.

The component subsystem is represented by a set of all natural components that have been modified by humans to varying degrees. The soil and plant components were particularly affected. Most of the landscape consists of upper quaternary alluvial-marine deposits (sands, sandy loams). Modern alluvial deposits (pebbles, sands, sandy loams) are common in the Terek Valley.

The terrain is dominated by alluvial-marine Late Pleistocene flat lowlands with fluctuations in relative heights of no more than 80 m. The maximum heights in the north-west of the landscape are up to 100 m. The alluvial-marine Holocene lowlands are widespread in the northeast. In the south, the landscape is bounded by the flood plain of the Terek River. The central position is occupied by the alluvial plain of Ak-Terek. The climate is harsh, the average temperatures in July are up to +25, in January – 4.0, -5.0 OC. A small amount of precipitation falls per year (250-300 mm) with an evaporation rate of 900-1000 mm. During the period of full vegetation of plants (from April to October), the amount of precipitation is even less — 120-150 mm. The transition through 0 C and the beginning of the frost-free period in the landscape takes place on average on March 6-10. The average daily temperatures exceed the threshold of +5.0 oC on March 27-30 and only by April 17-20 begins the period of full vegetation, lasting 185-190 days. During this time, the potential of active temperatures of 3540.0-3550.0 °C accumulates on the territory of the landscape. GTC = 0.4-0.5; the moisture coefficient rarely exceeds 0.3 per year. The summer months are the driest of the year (Cvl< 0.2), the number of days with relative humidity below 30% at 13 o'clock is about 11-18 (in some years more).

The river network is represented by the Terek transit River, which has no tributaries. Surface runoff is increased by a system of canals and irrigation systems. The Tersko-Kuma Canal, its Naursko-Shelkovskaya branch, begins its course here. The Burun Branch departs from these channels to the northeast. Groundwater aquifers are confined to the Akchagyl and Absheron rock layers. The zonal type of vegetation is cavill-grass communities in combination with soleros.

This is a typical vegetation of semi-deserts. In the east of the landscape, a significant area is occupied by vegetation of bumpy sands. In the lower reaches of the Terek, meadow-marsh and salt marsh vegetation of the floodplains and floodplains was widespread. The soil cover is dominated by light chestnut soils of sandy loam and light loamy mechanical composition. In the northern and northeastern regions of the landscape, salt marshes and salt marshes occupy from 10 to 40% of the area. Significant areas fall on the alluvial soils of the Terek River Valley.

The composition of material culture has been enriched with man-made components: roads, power lines and communications, canals, drilling rigs and oil storage facilities, artesian wells, farm buildings and rural settlements. The ploughing of the territory is large and exceeds 45%. The main arable lands are adjacent to irrigation systems.

The morphological subsystem has good pasture and soil resources. Areas with natural FABRICS prevail The biocenotic subsystem is represented by natural TCS, which occupy more than 60% of the area and are used as pastures: 1) oligodominant bioecosystems of cereal-wormwood communities; 2) oligodominant bioecosystems of wormwood communities, soleros. Geotopes with a quasi-natural environment include: 1) monocultural bioecosystems of irrigated lands (vineyards, fodder, melons, etc.); 2) monocultural bioecosystems of rainfed lands with a predominance of winter wheat; 3) rare forest belts in the northern regions of the landscape (Fig.2).

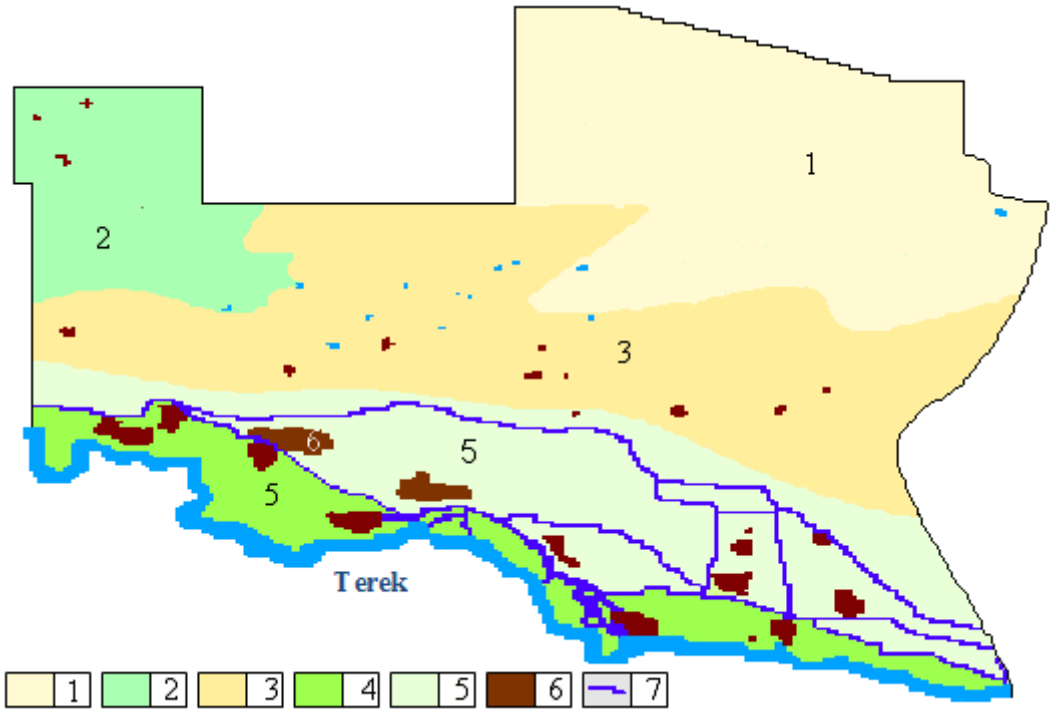

Figure 2: *Morphological structure of the Naursko-Alpatov natural and anthropogenic landscape of 1-5 localities (description in the text) Symbols:*

1).marine accumulative lowlands, composed of Khvalyn deposits (sands, clays), with sagebrush deserts and agrophytocenoses on light chestnut soils;

2) Aeolian deflationary-accumulative lowlands, composed of Aeolian deposits, which are overgrown with cereals; 3) alluvial-marine accumulative plains, composed of Khvalyn continental and marine deposits, with wormwoodgrassy desolate steppes on light chestnut soils;

4) floodplain modern alluvial plains with salt marshes and marsh-salt meadows and floodplains on alluvial saline meadow-marsh soils;

5) river terraces on alluvial deposits with chestnut and patches of dark chestnut soils;

6) residential complexes (Naur, Alpatovo, Ishgorskaya, etc.) mainly with cottage buildings, gardens and vegetable gardens, pasture pastures and irrigation canals. The population density is 10-18 people per km2;

7) irrigation canals

The functioning of modern landscapes still retains a natural character, but anthropogenic processes have made significant changes to their structure, especially component ones (water

cycle, geochemical processes, growth of anthropophytes in vegetation, etc.). Dynamics occurs according to a semi-desert type in a continental climate (hot dry summers and moderately cold low-snow winters). The optimal ratio of heat and moisture is observed only from mid-April to mid-June. The evolution of landscapes is associated with their transition to the stage of natural-cultural (northern) and cultural-natural (southern parts). With the introduction of large masses of water into natural circulation by the Tersko-Kuma Canal, large areas of semi-deserts were plowed. Low soil fertility has determined the involvement of a large number of chemical elements, including toxic ones, in natural cycles. Currently, the semi-desert landscapes have begun to show the processes of their degradation (soil salinization, waterlogging, wind erosion, desertification, etc.). The territory of the North Chechen lowland belongs to the zone of insufficient moisture (aridity of the climate, lack of moisture, salinity of soils, soils of light mechanical composition), fragility and instability of natural ecosystems. Irrational and uncontrolled use of natural forage lands of the North Chechen lowland, high loads on natural pastures, often 2-5 times higher than their soil infertility, progressive desertification of the territory of the North Chechen Lowland. Thus, 50-70 years ago, an unsatisfactory economic condition was noted only on 8% of the area of natural pastures, and currently more than 80% of the area of pastures in the North Chechen lowland has been knocked down, degraded and subject to deflationary processes.

IV. Discussion

The methods of accelerated ecological restoration are based on the basic scientific principles of biogeocenology, physical geography, ecology and geoecology.

These are the principle of floristic and coenoptical completeness of communities, the concept of the types of adaptive strategies of plants, the principle of ecological differentiation of ecological niches and the interaction of species, and the principle of conformity of the design of restored pasture ecosystems with zonal types of biogeocenotic structures (Shamsutdinov, 1998). Lalymenko and Albukaev made a huge contribution to the study of the geoecological state of the arid territories of the Chechen Republic, 1997.

The region belongs to the southern tip of the agricultural belt of Russia with its arid, semiarid and dry semigumid zones - lands of varying degrees of vulnerability affected by desertification. Therefore, the development of a scientific basis for the organization of systematic actions to combat desertification of agricultural lands, using the example of this region, is extremely important to ensure the sustainable development of the entire North-Eastern Caucasus, and will be a guideline for carrying out similar work in other regions prone to desertification (Petrov, 1950,1973).

Sand dunes are found in relatively small areas in the northern and eastern parts (Lalymenko, Albukaev, 1978., Bayrakov, 1996, 1978, 2009).

V. Conclusion

One of the most important environmental problems of our time is anthropogenic desertification, which has covered significant areas of land on our planet. The predominant territory of the arid zone of the North-Eastern Caucasus is used extensively, mainly as natural pastures with unstable and unproductive vegetation cover. An attempt to intensify the economic use of natural pastures without carrying out the necessary agroforestry measures in a semi-desert zone leads to degradation and desertification of landscapes (Bayrakov, 1997, 2004).

According to its physical and geographical features and from the point of view of the direction of economic use, the Priterskiy sand massif is a sharply defined area. The uniqueness of its landscapes in comparison with the surrounding spaces is determined, first of all, by the hydrological conditions of the sands. Typical meadow phytocenoses are found in depressions with close groundwater occurrence. The properties of sands to accumulate and retain moisture

throughout the growing season, to some extent neutralize and mitigate the effect of arid climate, create conditions approaching those of a more northern steppe zone.

When using semi-desert ecosystems as forage lands for year-round grazing, it is necessary to take into account the type of grazing cattle and the climatic conditions in which the ecosystem of pasture lands functions. The rate of the desertification process depends on their ecological state and degree of destruction, the threshold values are 0, 25, 50, 75 and 100% of the ecosystem area. If we trace the history of the development of the vegetation cover of the plain, then we can restore the course of restoration to its original state according to the following scheme:

• at the first stage, arable land is overgrown with associations of wormwood, which includes other species: porcine, roofing and spreading bonfire, larkspur, bunny, small-flowered milkweed and field bindweed. This group of plants in this composition develops within 5-10 years;

• at the second stage, the dominance gradually shifts to a plant association with roofing and spread-out bonfires, which includes wormwood, milkweed Seguer, tipchak, like sandy, larkspur, borage, carrot, whiteflower dubrovnik, blue alfalfa and a number of other plants;

• at the third stage, we notice an increase in the sod of piggery, when its rhizomes are closed, conditions of constraint are created and often the displacement of previously dominant plant species and piggery almost completely takes over. In addition to the above-mentioned plant species, this new association includes euphorbia, thyme, roofing and spreading bonfire, broom wormwood, hair-like feather grass, whitewater dubrovnik, bunny, larkspur, watermelons, broad-leaved cormac, bobberry, stinky and some others.

• the final stage of the restoration process creates a tipchak-kovyl steppe in the North Chechen lowland consisting of tipchak, hair-shaped kovyl, sea wormwood, prostrate kochia, combed wheatgrass, noble yarrow and tamarix.

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