

# THE INFLUENCE OF EXTERNAL FACTORS ON THE CHANGE OF PLANT COMMUNITIES IN THE LANDSCAPE COMPLEX OF THE CHECHEN REPUBLIC

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## Abstract

*The forms of anthropogenic impact and its degree were not the same in different epochs, changing, of course, with the development of the economy of farms. In the Chechen Republic, the processes of pollution, degradation and desertification occur on more than half of the territory. As a result, the water-regulating role of forests disappeared, rivers became shallow, and many sources were depleted. The influence of human activity on the vegetation cover in the steppe and semi-desert landscape complexes of the Chechen Republic is no less powerful than in other regions, they differed not so much in the ways of influence, but in the scale of the changes caused, in some cases larger, in others less. The deforestation of forests on the territory of the Chechen Republic was carried out in two stages. The first in the middle of the 19th century, the tsarist troops reduced forests on an area of more than 70% of the territory, the forest cover decreased from 80% to 35%. The second stage covers the Soviet period, when the forests of the Black Mountains were subjected to continuous logging in the mountain forest belt, freeing up land for tobacco culture. As is known, after these deforestation, landslide processes intensified in the areas of forest information. On significant areas there was a cooling, forests were replaced by meadow plant formations. In the territories subjected to economic activity, the spread of new plant species occurs, causing radical changes in vegetation, still leaves a certain imprint on the formation of various associations. First of all, it is necessary to focus on the spread by anthropogenic activity of various weed species of grasses that grow next to cultivated ones, are unpretentious to new living conditions, adapt well, give a lot of seeds, and also have the ability to vegetative reproduction. Deforestation and fires lead not only to the disappearance of individual species, but also leave a certain imprint on the vegetation cover of adjacent meadows and steppes, the herbage of which changes in the direction of increasing xerophytization. The purpose of the study is to study the influence of anthropogenic factors on landscapes and the patterns of changes depending on the stages of development of degradation processes.*

**Keywords:** Chechen Republic, landscapes, mountain-forest landscapes, semi-desert, steppe, disturbed landscapes

## I. Introduction

The study of the influence of anthropogenic factors on changes in plant associations is always a priority, due to the preservation of biodiversity, especially in regions such as the North Chechen Lowland with arid climatic conditions that caused a sharp change in meteorological climate parameters.

Economic activity causes fluctuations in the main parameters of phytocenosis if the intensity or form of exposure changes over the years. Entropic fluctuations are always combined with ecotopic and other types of fluctuations.

The aim of the study was to identify the degree of transformation of some vegetation

parameters under the influence of cattle grazing. The object of the study was the territory of the North Chechen lowland. The region under study is located in a semi-desert zone. The climate of the territory is continental. Average temperature in January: - 4.4 ° C, July +24 ° C; precipitation - 200-300 mm per year.

## II. Methods

To assess the state of phytocenosis, 18 geobotanical descriptions and 34 characteristics of the floristic composition of the forest community registration sites were used by the author of the study in the period from 2019 to 2021. Field observations and collections were carried out in the summer months.

Geobotanical descriptions were made and processed using the floristic approach adopted in phytocenology. The total number of species ( $\alpha$ -diversity), projective cover, and biomass were used as criteria for assessing the state of phytocenosis. Changes in the parameters were analyzed taking into account the weather characteristics of each year of the study: air temperature and precipitation.

Assessment of the degree of anthropogenic disturbance of forest phytocenoses was determined by stages:

1) intact forest condition; 2) disturbed; 3) severely disturbed.

Type of phytocenosis: weeds. The composition of trees: oriental beech, hornbeam, ash, oak. The closeness of the crowns is 0.4. The average age of the trees is 60-80 years; the average height is 17 m; the bonus is 2-3 grade. Anthropogenic impact – areal logging. However, typical vegetation begins to recover as anthropogenic pressure is removed.

## III. Results

### I. Consequences of anthropogenic influence on humid landscapes

Anthropogenic pressure over the past 50 years, due to the intensification of agricultural production, has increased several times, and deflationary processes have taken on threatening dimensions in terms of the coverage of the territory by de-traditional processes.

But at the same time, soil and climatic conditions are of no small importance, which either enhance or reduce the intensity of erosion processes. For the development of water erosion, it is necessary to have large masses of precipitation, which can create a surface runoff forming a washout of soil soils poorly protected by vegetation. So. Almost the entire southern part of the Chechen Republic is in the zone of development and possible development under favorable climatic conditions for its development, namely atmospheric precipitation. From 600 mm in the extreme south of the Chechen plain to more than 1000 mm in the mountainous part of precipitation, with such a strongly dissected and with large steepness up to 900 slopes in the mountainous part, water erosion processes occur in an active mode, despite the forest cover of this territory.

In the territories subjected to economic activity, the spread of new plant species occurs, causing radical changes in vegetation, still leaves a certain imprint on the formation of various associations. First of all, it is necessary to focus on the diversity of anthropogenic activities of various weed species of grasses that grow next to cultivated ones, are unpretentious to new living conditions, adapt well, give a lot of seeds, and also have the ability to vegetative reproduction.

Deforestation and fires lead not only to the disappearance of individual species, but also leave a certain imprint on the vegetation cover of adjacent meadows and steppes, the herbage of which changes in the direction of increasing xerophytization.

Predatory destruction of forests leads to different results depending on habitat conditions. In

steppe depressions and along temporary watercourses, trees are completely destroyed, continuous afforestation of such territories occurs, and only by chance single specimens of common oak and poplar or small areas of stubbornly restoring oak–hornbeam forest on the slope of the Tersk ridge near the village of Tolstoy–Yurt still survive in them, but in most cases thickets remain witnesses of the former woody vegetation medlars of German, blackthorn and forest pear.

Economic activity destroyed primarily the most valuable hard rocks – oak, beech, ash, hornbeam, birch, yew berry, which led to their complete disappearance in many places, especially in the flat part. Only the floodplain oak forests have been preserved as islands in the floodplains of the Terek, Sunzhi, Argun and Hulkhulau rivers, although they are in a deplorable state today.

Landscape and ecological diagnostics of geosystems made it possible to carry out zoning of the landscapes of the republic according to the degree of anthropogenic disturbance (fig.1).

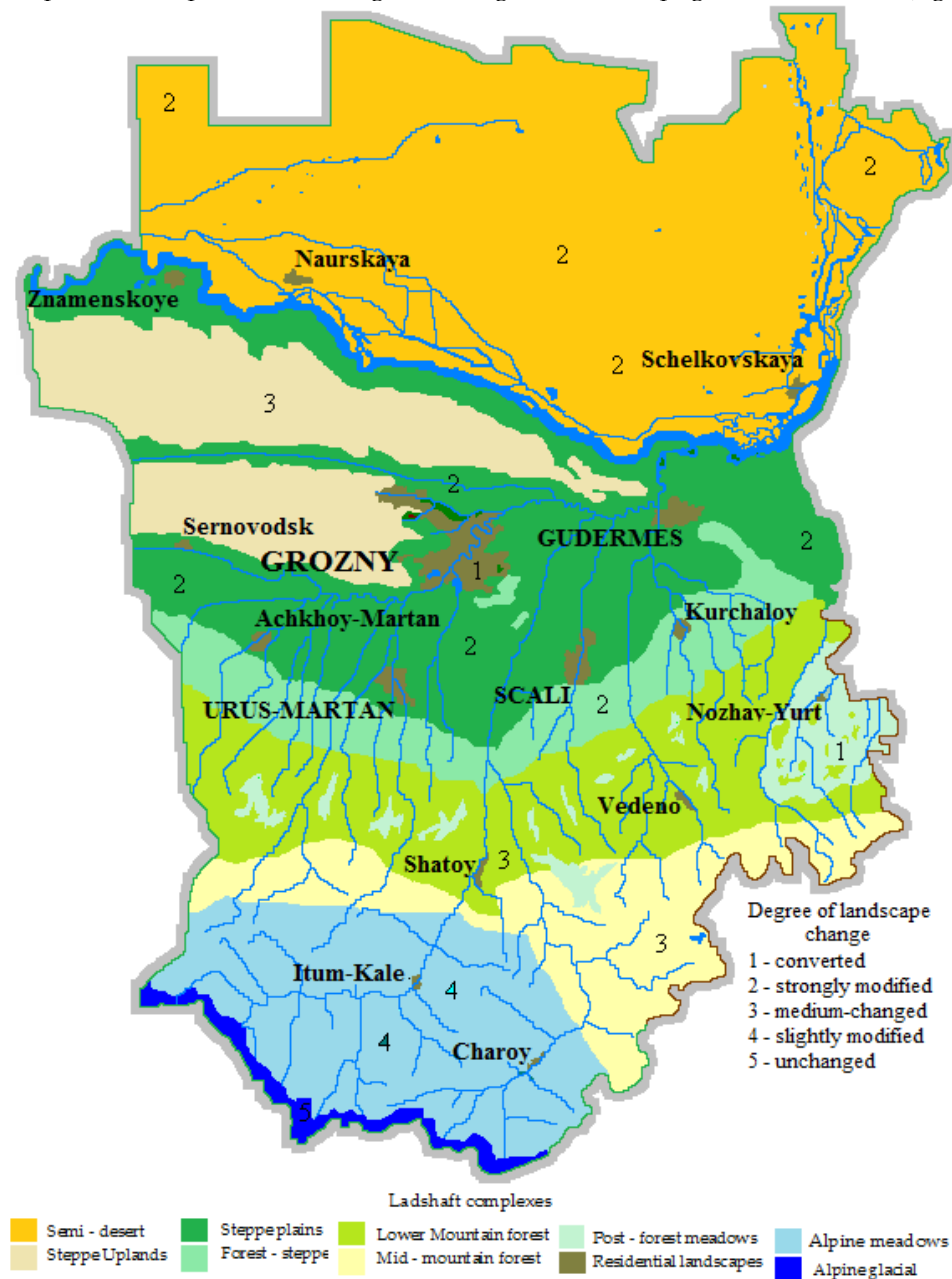


Figure 1: Map diagram of anthropogenic disturbance of landscapes of the Chechen Republic

In somewhat better conditions, there was woody vegetation in the mountainous part of the Chechen Republic, with the exception of evergreen pines and berry yew, which were almost completely destroyed and preserved only in hard-to-reach places. Based on the analysis of the maps of the stability of landscapes to the effects of economic activity on their natural components, the following conclusions can be drawn: - soils of arid and mountain geosystems have a very low degree of resistance to anthropogenic influences; - average stability indicators are characteristic of soils of mountain and forest landscape complexes; - a significant part of the industrial potential of the Chechen Republic is located in the steppe zone, natural conditions existing in steppe landscapes (high wind speed, low frequency of calm) contribute to the rapid dispersion of pollutants entering the atmosphere, soil cover is also highly resistant to anthropogenic impact, surface waters have low stability in the steppe zone, where they have the greatest anthropogenic impact.

High-mountain landscapes are mainly affected by pasture, within the subalpine and alpine zones. Values of disturbance of pasture lands of landscapes within the values of 0.4-0.6. In the Alpine zone, the disturbance coefficient varies from 0.2 to 0.4. The same disturbance indicators characterize the mountain forests on the Lateral Ridge and its spurs. The landscapes of the nival belt are practically untouched by economic activity. In the north of the republic, the meadows in the Terek floodplain have been slightly changed, and are mainly used as hayfields. The lands under pastures and arable lands were the most destroyed. Within localities, the disturbance coefficient reaches 1.0. Continuous deforestation and fires lead not only to the disappearance of individual species, but also leave a certain imprint on the vegetation cover of adjacent meadows and steppes, the herbage of which changes in the direction of increasing xerophitization. In the area of art . Petropavlovsk on the slopes of the Tersky ridge there was a change of the wheatgrass–fire meadow by the Tipchakov–zhitnyakov community associated with the cutting down of a large area of the nearby broad-leaved forest. Very soon, within two years after that, clover (*Trifolium* species), *Sangui–sorbaofficinalis*, *Filipendulaulmaria*, *Viciacracca*, *Lathyrustuberosus* and a number of other mesophytes disappeared in the grasslands of neighboring meadows.

Birch and aspen trees are slightly better preserved. In relatively good condition, except for military operations, beech forests, which occupy almost 65% of the forest area. The ratio of areas with different values of landscape disturbance (NL) is given in table 1.

**Table 1:** Areas of landscape complexes of the Chechen Republic with different degrees of disturbance

Landscapes	The Importance of Landscape Disturbance	Square, %
Converted	0,8–1,0	15
Heavily modified	0,6–0,8	25
Changed averages	0,4–0,6	35
Slightly altered	0,2–0,4	15
Unchanged	0,0–0,2	10
Total		100

Thus, the immediate results of deforestation should include, firstly, a sharp afforestation of the territory, secondly, the reduction or even disappearance of certain species of trees and shrubs, and thirdly, a change in the herbage of adjacent territories, expressed in increased xerophyte.

## II. Consequences of anthropogenic influence on arid landscapes

The situation is different in the north of the Chechen Republic, where soil and climatic conditions are different from the mountainous part. Here, the amount of precipitation does not exceed 300 mm, the soils are composed of loose, unrelated, fine particles or open masses of sand, which become easy prey even to winds with low speed.

However, along with those soil and climatic conditions, the main reasons that caused the

development of erosion processes here of such intensity, which led to the loss of natural fertility of soil differences, are large overloads of arid pasture ecosystems by overgrazing livestock without observing pasture rotations.

Excessive grazing of livestock, on loose sandy soil massifs leading to rapid destruction of sod, loosens the top layer of soil, where there are no organic substances and there are pockets of razevaniya [1;2].

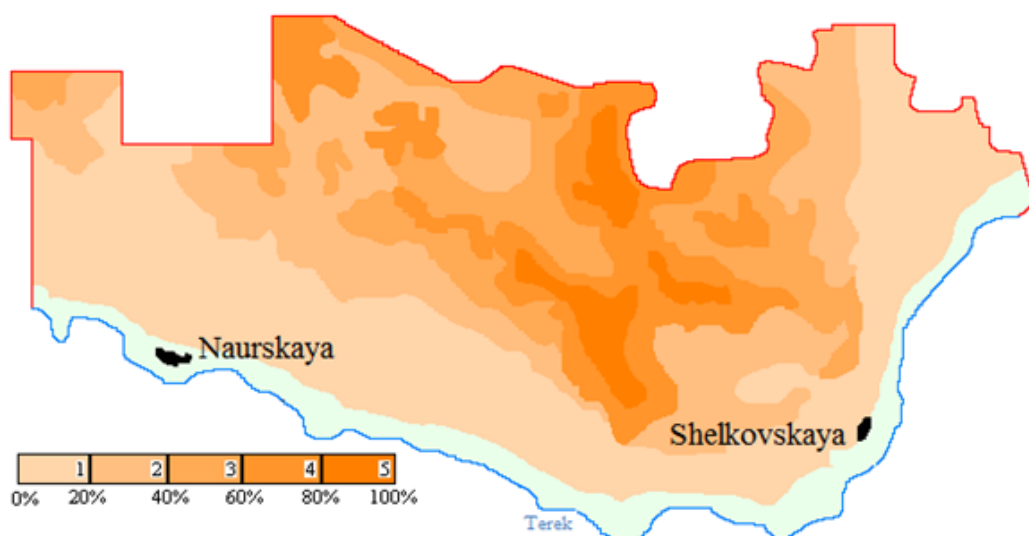
The development of deflationary processes is also facilitated by plowing soils with a light mechanical composition without observing the rules of anti-erosion agrotechnologies necessary in these cases (fig. 2).

Often land users violate elementary norms of protective land use, plow and sow in the direction of the prevailing air flow.

Huge areas of potentially dangerous land subject to deflationary processes are immediately plowed, plowed with the turnover of the soil layer, using heavy machinery and trailed equipment, which greatly enhance erosion processes, in the structure of agriculture, large areas are occupied by row crops, a lot of annual grasses, very slow introduction into practice of techniques where strip and backstage placement of crops.

Large areas have been developed in arid ecosystems by erosion processes intensified by climate warming, which have led to irreversible modifications of the landscape of the arid zone complex, very serious threats to its soils and land resources. The analysis of soil and climatic maps of the Chechen Republic has shown that almost the entire territory has the conditions for the occurrence of deflationary processes, with the exception of the nival zone, where only water-glacial processes are active.

As noted above, deflationary processes are actively occurring in the northern and central part of the region, which is facilitated by the temperature regime with an average monthly +23-26° with the indicators of the summer months, characterized by sandy and sandy loam soils with light mechanical composition, with precipitation from 200 mm in the North Chechen lowland, up to 450-500 mm per year on the Chechen plain, the soil cover consists of chernozems with medium and heavy mechanical composition, wind erosion is poorly developed [1;2].



1. Area of weak deflation; 2. The area is subject to weak and medium deflation; 3. An area of medium and strong deflation; 4. An area of strong deflation; 5. An area with exposed sands.

Figure 2: Map-scheme of zoning on the manifestation of deflationary processes

Soil erosion studies have shown that 599 thousand hectares of the area of agricultural land resources in the region have potential dangers for manifestations of deflationary processes, and 330 thousand hectares are already in degradation. Erosion processes affected 23.8% of arable lands, 53% of hayfields ecosystems and 64% of pasture ecosystems of the ecosystem area of the Chechen Republic (fig.3).

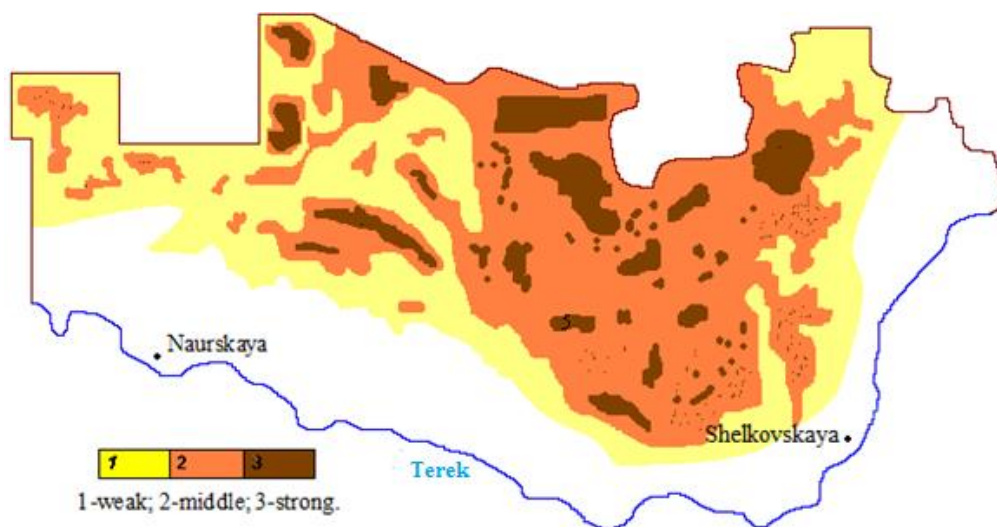


Figure 3: Degree of manifestation of desertification processes in landscapes

Eroded arable ecosystems that need to be planted with perennial grasses and then used as hayfields for 3-5 years, and forage ecosystems need to be afforested on areas of more than 4 thousand hectares, it is necessary to carry out terracing of steep slopes - by 2.7 thousand hectares, it is necessary to carry out radical improvement on an area of more than 48.2 thousand hectares of pasture ecosystems, excluding from Pasture turnover for 3-4 years is 21.3 thousand hectares. Geobotanical and agroecological surveys have shown that surface improvements of pasture ecosystems need to be carried out on areas of more than 527 thousand hectares. hectares. In the arid ecosystem, the cooling of the blowing basins was provided, followed by fixing them by sowing perennial grasses. In each landscape zone, special crop rotations are needed to protect the soil, which would contribute to the formation of a closed canopy of vegetation, this is the most reliable means of protection against wind forces destroying the soil surface [3;4;5].

Erosion zoning of the territory of the Chechen Republic was carried out based on the conducted research, assessments and analysis of all available material on soils, erosion processes, climatic fluctuations of the last 50 years, geomorphological and geological studies were carried out taking into account all types of management.

4 erosion areas have been identified:

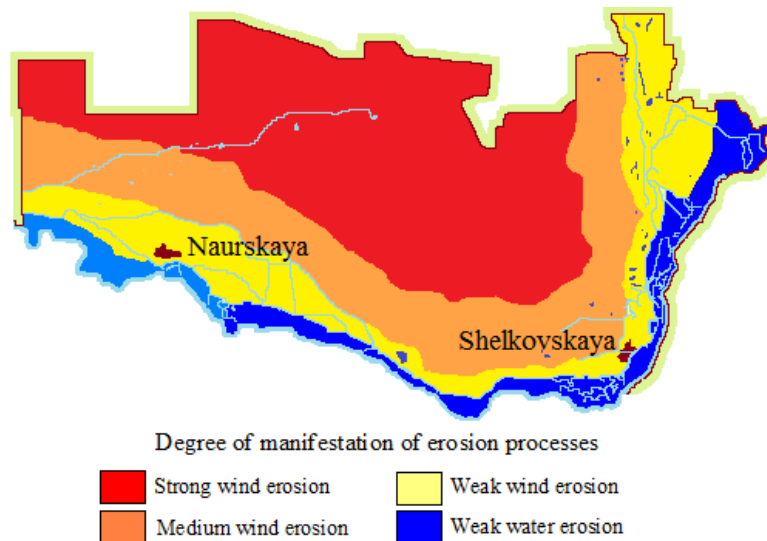
1. Strong wind erosion;
2. Average wind erosion;
3. Weak wind erosion;
4. Weak water erosion (fig.4) [6].

Erosion zoning of the Chechen Republic should be taken as the basis for further development of soil protection measures, as well as for the prospects of agricultural development. The agricultural sector of the Chechen Republic is located in five depression zones, there is intensive

production. Areas where deflation processes occur intensively in the soil-protective crop rotation, the use of perennial grasses is recommended.

There are 52.8 thousand hectares of arable land under the soil protection crop rotation, they are allocated taking into account geomorphological conditions and the degree of manifestation of soil erosion processes.

Taking into account the nature and intensity of the manifestations of erosion processes, it is necessary to develop a set of agrotechnical measures for each selected erosion area, providing for soil treatment, which increases its water-absorbing properties, increases resistance to flushing and wind blowing. Protection of soils from erosion processes with the help of plant formations.



**Figure 4:** Zoning of territory according to the degree of manifestation of erosion processes

The soil cover, which is located under vegetation, is not subjected to deflationary processes by water flows. The planned erosion control measures should be based on the protective properties of vegetation.

In arid ecosystems, which will, depending on the nature of the physical properties of the composition of the rocks composing the soil, should be connected, the following agrotechnical techniques are proposed:

- minimization of pre-sowing soil treatment;
- root and surface land improvement;
- rational use of pastures (hay – pasture turnover, normalized grazing);
- strip placement of crops;
- waste-free tillage with flat-cutting tools;
- sowing on stubble;
- backstage crops;
- cross-sowing.

The territorial coverage of the activation of erosion processes in the Chechen Republic is large, and as a consequence – a significant decrease in the natural fertility of soil differences, hence the qualitative state of soil and land resources stimulates the scientific community of the Chechen Republic to develop and implement a scientifically based general scheme of anti-erosion measures, which formed the basis of the program to optimize the environment.

## IV. Discussion

Of all the environmental factors affecting the change of vegetation cover, anthropogenic impact (areal logging, grazing, fires) has a significant impact.

The study of the reviews of vegetation cover and its individual groups, as well as the peculiarities of the transformation of plant communities, have become the subject of close study by an increasing number of researchers, among whom one can name Yu. Ya. Anikin, [7], M. A. Berezutsky [8;9;10;11], P. L. Gorchakovskiy [12;13;14] and others. However, almost all researchers, including our studies of the past years of the transformation of vegetation under the influence of anthropogenic activity, are devoid of completeness.

The analysis of the above mentioned works, as well as the results of our own long-term research, allowed us to identify the main factors of anthropogenic transformation of plant communities on the territory of the Chechen Republic. The degree of impact was assessed by us visually using the following scale: very low; low; medium; high; very high; highest.

Summing up, we can conclude that the high degree of development of the territory of the Chechen Republic and intensive economic activity contribute to the degradation and radical transformation of natural landscapes, where the main restoration process can be considered self-growth of natural pastures.

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