

RESISTANCE OF GEOSYSTEMS OF THE CHECHEN REPUBLIC TO EXTERNAL INFLUENCES

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Abstract

Analysis of the current state of landscapes allowed to zoning the landscapes of the republic by the degree of anthropogenic disturb. Territories with various anthropogenic disturbs reveal a clear connection with certain types of mountain landscapes. Within the high-altitude and middle-class tiers of landscapes, the pattern of man-made disturb belongs to the striped class and is formed within the high-altitude landscape zones. In the northern (low-) part of the republic, due to the unevenness of the man-made load, it acquires a mosaic pattern. Here, it is not the high-altitude, but the geomorphological factor in the placement of certain types of environmental management. The time of residential areas to the bottoms of river valleys is very rigidly manifested.

Keywords: stability of landscapes, anthropogenic disturbance of landscapes, coefficient of disturbance, functioning of geosystems

I. Introduction

The most urgent task of modern geography is to understand the patterns of changes in the natural environment in conditions of increasing anthropogenic impact on it. At the same time, the main attention is paid to the study of the stability of geosystems, which is carried out both at the local and regional levels. Sustainability is the ability of natural systems to restore damaged properties. In addition, it reflects their ability to adapt to the changed environmental conditions, to move into a new state [1,2]. When assessing the stability of geosystems, not only their structural features are analyzed, but also their interaction with other (including taxonomically larger) geosystems. In that case, stability is the opposite of stability, considered as part of the structural properties of the geosystem. According to Isachenko A.G. "... To assess the nature and depth of the impact and determine its permissible limit, beyond which irreversible and undesirable changes in the geosystem occur, it is necessary to find out the stability of the latter to man-made loads. Every geosystem, as we already know, is adapted to a certain natural environment, within which it is stable and functions normally. Many technogenic factors, especially the so-called pollution, i.e. artificial geochemical loads have no analogues in nature, and the resistance of geosystems to such disturbing factors has a specific character" [6].

II. Material and methods

The term "stability" came to geography from mechanics. However, the lack of sufficient data for calculations, the variety of systems and their components, the use of unambiguous quantitative indicators of the latter, the study of individual components, and not the geosystem as a whole, the aggregation of parts of which leads to the emergence of new qualities that are not reduced to the properties of the elements individually, cause significant methodological difficulties in solving such problems. In addition, "it is often thought that, having studied one object, they already know everything about two exactly the same objects, since two are one and one. At the same time, however, they forget that it is also necessary to investigate what is hidden behind this "and" [3,4,5]. In each specific case, various characteristics of the object, its properties, relationships with surrounding objects and with the environment are considered [6].

The identity of the most general patterns of changes in the nature of material-energy exchange and structural-dynamic features of the geographical environment [4] predetermine the characteristics of the reaction of geosystems to the impact characteristic of each hierarchical level, since "they" relate to geographical patterns of different order" [5]. Along with this, the essence of the concept of "sustainability" for the systems of the regional level of the organization remains searchable. We have developed the basic principles of studying the stability of geosystems at the regional level of the organization. They were tested on the example of predictive surveys of the orientation of the transformation of geosystems of the North-Eastern Caucasus, which occurs under the influence of natural changes and anthropogenic activity.

The territory of the Chechen Republic is located on the northern slope of the Greater Caucasus. The main morphological features of the foothill and mountainous parts of the region are due to neotectonic movements, during which the relief of the Caucasian mountain range, composed mainly of sedimentary rocks, was rejuvenated. This determined the complexity and originality of the landscape structure of the region, which is characterized by contrasts, often exceeding the differences between geographically separate regions. Each geosystem is geographically localized and bears the seal of both its location and a larger system. Therefore, outside of the study of geochores - heterogeneous spatial systems formed by geographically adjacent geomers - genetically homogeneous systems, collectively representing a structural, dynamic and functional whole [5], it is practically impossible to study the features of stability and the nature of anthropogenic transformations of geosystems. Geosystems reflecting the natural features of the region are represented by very diverse geochores - from highly fragmented alpine forms of habitats to marine accumulative sandy plains in the north with sparse vegetation cover. The nodal system - macrogeochora (districts) are represented in the region by 8 geographical objects (Fig.1). Relationships with the environment are the most important part of the functioning of the geosystem. The synthesis of these relations, the processes of self-development of geosystems and the history of their formation allows us to identify the so-called "generalized characteristic of the organization's compliance with the environment" [5].

III. Results and discussions

Thus, the concept of the stability of geosystems is considered by us more broadly, taking into account the existing internal and external intersystem connections of the geosystem, the nature of their changes, based on the analysis of its position relative to the cores of geosystems, age, the nature of inter-component relationships, hierarchy, etc. In accordance with this, the following criteria are distinguished for assessing the stability of geosystems: - originality - belonging of geosystems to one or another regional subdivisions, reflecting the typical/atypical nature of their distribution within the studied territory, the conditions of their functioning; - diversity - the variability and complexity of the subsystems that make up the geosystem and their interrelations, allowing us to judge their stability; - modifications - deviations from the root (background) norm, reflecting the degree of stability and direction of the transformation processes of geosystems; - the position in certain parts of the area that determines the conditions for the

existence of geosystems; - the age of geosystems – their relict or youth. In both cases, the systems are weakly resistant to any external influences due to poor adaptation to environmental conditions.

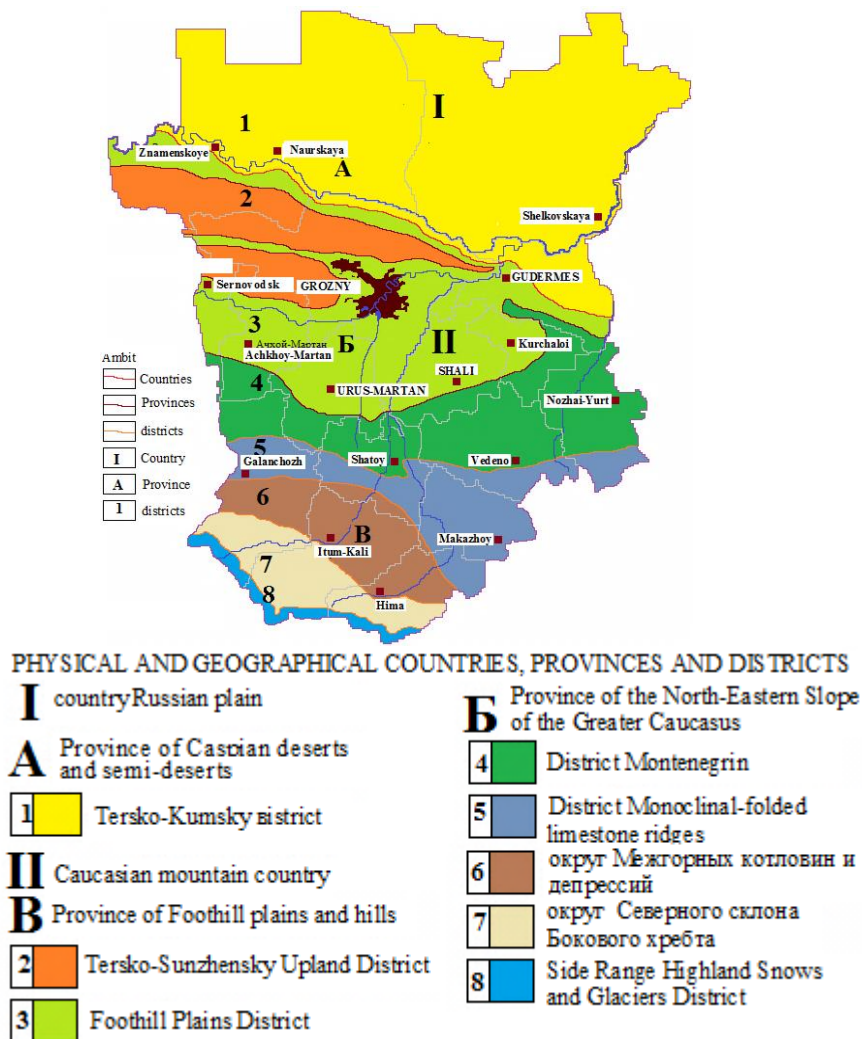


Figure 1: Scheme of physical and geographical zoning of the territory of the Chechen Republic

The use of the proposed criteria made it possible to combine the geosystems of the region into five large categories according to the degree of stability.

Almost the entire territory of the republic is characterized by intensive and diverse anthropogenic activity, which in the Sunzhi Valley becomes a noticeable factor contributing to the transformation of geosystems. At the same time, the highest technogenic and chemical pollution is characteristic of the central part of the republic, where the industrial centers Grozny, Argun, Gudermes are located, which belong to the largest environmental pollutants.

Areal sources of anthropogenic impact on geosystems are represented by agricultural lands, oil and gas deposits, building materials (sand, clay, gravel), as well as intensive, as a rule, continuous logging. This determines their essential transformations. With the frequent occurrence of fires, the existence of beech geosystems becomes problematic even in the most favorable natural conditions for them. These patterns are also characteristic of oak types of geosystems. In this case, small-leaved species or shrubby and herbaceous formations become forest-forming.

The destruction of the forests of Chechnya by fires began more than 300 years ago, the command of the tsarist troops destroyed forest vegetation by arson. Grassy transformed rows

appeared on the site of oak geosystems, as significant changes in environmental conditions occurred as a result of fires. "The change in the phytoclimate alone and the changes in the soil climate going on in parallel with it can be very noticeable and lead to such changes in the conditions of the soil regime that may be completely unfavorable for the restoration of the former vegetation, in our case beech geosystems

The total overlap of time fluctuations of extreme values of the functioning of systems and the environment created conditions conducive to structural changes in the geosystems of the region, which were activated in the process of anthropogenic impact. Under the influence of factors of climate xerophitization in the eastern and southeastern parts of the territory, the areas of small-leaved and shrubby geosystems are expanding and beech and oak geosystems are being pushed to higher levels. Anthropogenic impact largely changes the prevailing conditions, intensifying processes unfavorable for the functioning of geosystems. In particular, the thermal regime of geosystems is changing at the regional level. This is observed both in the age-old change in thermal conditions in the area of active development of the territory, and in particular fluctuations noted for certain types of geosystems [5].

At the same time, due to the greenhouse effect on the planet, a further increase in the average air temperature with a gradient of 0.26 0C per decade is expected, which will increase by 3 0C by the end of the century. The consequences of such a sharp warming can be catastrophic, especially in the boreal zone. Already at present, there is a tendency in the Chechen Republic to transform beech and beech-hornbeam geosystems that are at the limit of their optimal development, more thermophilic. A number of weather stations in the region located in various natural zones and belts of the North-Eastern Caucasus show a decrease in precipitation against the background of climate warming. There is a high intensity of regional climate warming, characterized by a linear trend of 0.6-0.8 0C.

The decrease in the moisture content of landscapes goes at a rate of 0.3-1.6 mm / year. In the long-term course of soil temperature, stable positive trends are also observed, which causes gradual degradation of the soil cover of the region, significant changes in the water and thermal regimes of soils are recorded here. This contributes to the rapid change of one type of natural geosystems to others that are less demanding of moisture and thermophilic.

This has also changed the direction of soil formation processes in the region. Under the influence of anthropogenic activity, the general trend of soil changes in forest geosystems located in the ecotone zone with steppe ones is their settling, which is expressed in approaching the surface of the carbonate horizon, a decrease in acidity, the appearance of salinity, compaction, and the formation of a columnar structure.

Beech geosystems located in the south of the temperate zone are currently functioning in the conditions of a continental climate formed in the Pliocene. These are systems with rigid connections of their constituent elements, which have a weak compensation mechanism to external influences, since the loss of even one of them affects the entire system and can cause its destruction. The possibility of their normal existence is ensured by preserving environmental conditions (soil, moisture, temperature) and the softening role of the phytoclimate, which is created by the forests themselves. Violation of this balance often leads (by fires, continuous logging) to the complete destruction of beech geosystems. This is evidenced by numerous examples of their dynamic substitutions. These communities, being relict (of the tertiary period), are stable in time and do not return to the original indigenous communities even when the anthropogenic impact is removed.

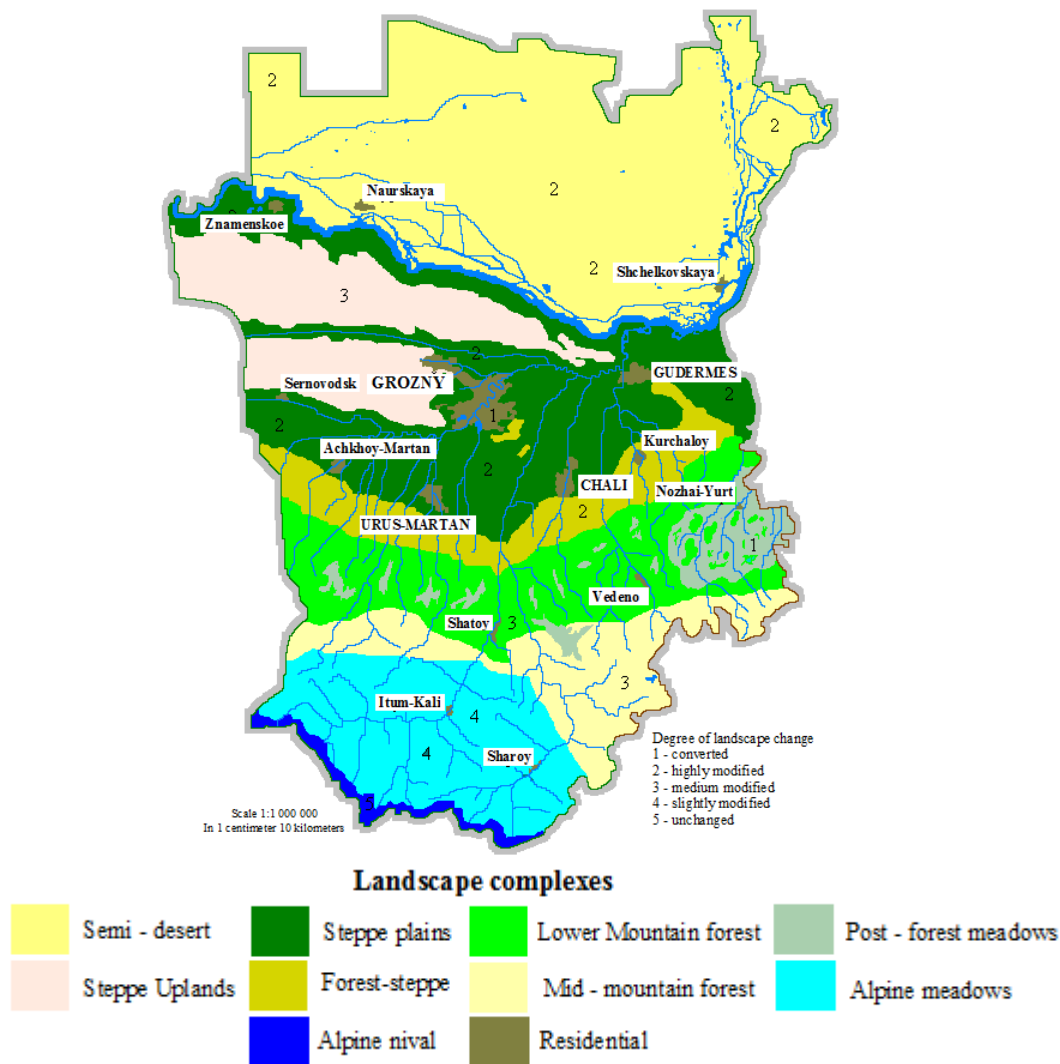


Figure 2: Cartographic diagram of anthropogenic disturbance of landscapes

VI. Conclusion

The degree of stability of the landscapes of the Chechen Republic and their disturbance by anthropogenic influences is revealed, illustrated by a series of thematic maps. According to the degree of anthropogenic disturbance, 5 classes are distinguished: unchanged, the area of which is 10%, slightly modified - 25%, medium-modified - 30%, strongly modified - 25%, transformed - 20%.

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