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## The Impact of Natural and Anthropogenic Factors on Biodiversity of Arid and Semi-Arid Zones of Eastern Georgia

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### Abstract

The biodiversity of Georgia, as well as the whole Caucasus, is under the extreme threat. Most of the forests are modified by human influence. Due to overgrazing, the natural vegetation is almost destroyed and the erosion process is taking place. Natural vegetation is preserved in just a little part of its historic area. Current threats to Georgia's biodiversity are: poaching, cutting down the forests, overgrazing, illegal trading of species of plants and animals, and etc. As a result, the living habitat of living organisms is degraded, the number of species is decreased and ecological processes are disruption – all of them lead to the destruction of biodiversity.

Natural and anthropogenic factors are well expressed on large areas of the ecosystem of arid and semi-arid areas in the east of Georgia. A large part of arid and semi-arid ecosystems itself is rare biotope for Georgia, that is why some species are found only here in Georgia.

The negative impacts of natural and anthropogenic factors affect the flora and fauna diversity, resulting in a possible degradation of plant communities, semi-desert and desert plant characteristic species – *Salsola* spp, *Artemisia fragans*, *Gamantus pilosus* et al. and the expansion of the plant communities *Artemisietum*, *Artemisieto-salsoletum*, *Botrichloeto-artemisietum*. Also, the impoverishment of animal composition – disappearance of some insectivorous and rodents, for example, *Crocidura leucodon*, the vole *Microtus socialis*, *Sorex volnuchini*, the expansion of hares *Alactaga* spp, which is typical to a desert landscape.

The current level of negative impact of Natural and anthropogenic factors goes beyond the boundaries of the resistance of the ecosystem, and therefore, more or less irreversible degradation processes have been developed. All of this might cause irreparable harm to Georgia's biodiversity.

**Keywords:** biodiversity, arid and semi-arid ecosystems, natural and anthropogenic factors.

### 1. Introduction

Georgia is located in the Caucasus, on the boarder of Europe and Asia. Almost every type of the subtropical climate zone is developed here. Georgia, as eco-region of the Caucasus, is rich in endemic plant species and is involved in list of the planet's 34 most diverse and endangered hot spots.

The geographic location of Georgia caused its natural diversity. Peculiar natural characteristics of the region results in the existence of characteristic flora and fauna. There are different types of vegetation: the desert and semi-desert vegetation, arid light forests, steppes and deciduous forest elements. In addition, there are rocky xerophytes, riparian forests along the rivers

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and foothill bushes. Such diversity of vegetation within small areas is generally typical to the Caucasus region (Gvarishvili, 2013).

Caucasus' arid and semi-arid ecosystems are characterized by a dry climate, long and hot summers and mild and relatively short winters. The wettest period is short spring. The region's two main rivers are the Alazani, and the Iori. On both sides of the river Iori there are dry steppes, while on the banks of the Alazani there is moderately humid climate. The region is rich in endemic plants and endangered species.

## 2. Results and discussion

The natural and anthropogenic factors greatly influence biodiversity of arid and semi-arid areas. Natural factors include frequent aridity, during which, rate of precipitation is low, but air temperature is high, and therefore, moisture reserves in soil are declining, and unfavorable conditions for normal growth and development of the plant are created. Decrease of soil fertility in semi-desert areas of Georgia, are caused by salinization and solonetz processes. Salinization processes of the soil may be related to erosion processes of saline rocks, mineralized ground water, and some other factors. In addition, there is a contamination of the soil caused by the use of fertilizers (organic and mineral) and unsustainable use of pesticides in agriculture, heavy metals appearing in soil, as well as soil polluted by household and industrial waste, which causes serious damage to the ecosystem (Mchedluri, Vefxvadze, 2018).

The semi-arid zone of Eastern Georgia – from front slopes of Gombori range down to the Alazani-Iori mouth historically has been the winter pasture of Georgia. During the winters of the last decades, economic activity of the territory doubled. Negative impacts of sheep's extensive grazing causes the following: the impoverished, modified in many places and declined grass cover, a projective cover, effects of erosion and salinization of soil are observed. Almost disappeared Incense tree arid sparse forest fragments, riparian forests are oppressed, phyto-cenosis structural formation is violated, the vitality of plants is extremely weakened, and etc. The picture of soil erosion is catastrophic, which is reflected in the destruction of upper layers, increasing the content of minerals causing the soil salinity. In turn, it has great influence on the vegetation in these areas and in accordance with the output of the biomass. For these reasons there is the tendency whereabouts of the sheep towards the river bank. In "unbreakable" cenosis such as *Botriochloeta* soil cover is often degraded.

We should take special note of the negative impact of grazing during the spring, when the plant begins new vegetation. During this period, the sheep do not graze wormwood (*Artemisia fragrans* – desert and semi-desert type of vegetation dominant edificatory) and *Bolriochloa ischaetum* (steppe type of vegetation dominated edificatory) and fully feeds on the new green vegetation. The combined vegetation cover is mostly damaged, which have a special value for melioration of pasture, as well as for improvement of structural formation of vegetation. After the transfer of cattle to summer pasture, plants full annual life cycle can not go on. Both their vegetative and generative renewal is very limited and therefore, the phyto-cenosis are too poor and simple. The process is annually repeated, and finally begins irreversible process of vegetation digression (Mchedluri, 2020; Mchedluri, Vefxvadze, 2018a).

Grazing negatively affects the ornitofauna. It puts a particularly huge damage to ground nesting birds, such as e.g. Pheasant, because during their breeding period sheep is not yet withdrawn from the region, leading to the destruction of grass cover.

The small mammals survey showed that characteristic to the field species is rare – the vole, which indicates degradation of the study area, but there are a lot *Ammodytidae* colonies, which inhabit only in wormwood which in itself is an indicator of degradation.

The eastern part of the study area is full of elements semi-desert, indicators of which are hares (*Allactaga williamsi*, *Allactaga elater*). It is noteworthy that natural factors determining vulnerability become especially acute on the anthropogenic pressure background. The current level of the negative impact of human activities (sheep breeding, agriculture, excessive and unsystematic mining of natural resources, deforestation, wrong melioration, and etc.) go beyond the ecosystem resistance (self-capacity) limits, therefore, more or less irreversible process of degradation is developed: productivity of ecosystems and plant vitality is reduced, desertification processes are evident (the elements of desertification are observed in riparian forests), there has been soil erosion and salinization. Various components of the ecosystem, including species and individual

cenosis, vulnerability are the result of some particular anthropogenic factors or their combined activities. For example, riparian forest degradation is caused by cutting down the trees and grazing. The main reason for the vulnerability of many animal populations is poaching and the lack of food base. The influence of natural and anthropogenic factors is well expressed on fairly large areas of the ecosystem of the arid and semi-arid areas (Mchedluri, Vefxvadze, 2018).

A large part of the arid and semi-arid ecosystems itself is rare biotopes for Georgia (arid light forests, deserts and semi-desert elements), because of which some species are found only here in Georgia such as viper, francolin, striped hyena, gazelle. Among the spread insects 24 species were included in the Red Book, including: *Papilio machaon*, *P. alexanor orientalis*. *Inphichlides podalirius*. *Utethesia pulchera*. *Arctia caja*. *Coenonimpha saadi*, and so forth (The second National..., 2014–2022).

Other noteworthy vertebrate rare species from the Red Book include: *Pelobates syriacus*, *Eryx jaculus*, *Eumeces scheineri*, *Elaphe longissima*, *Haliaeetus albicilla*, *Aythya nyroca*, *Perdix perdix*, *Mesocricetus brandti*, *Suncus etruscus*, *Nyctalus leisleri*, *Lutra lutra*, *Hyaena hyaena*, *Lynx lunx*, *Gazella subgutturosa*, *Cervus elaphus*.

Rare and endangered species of small mammals also include: *Sorex volnuchini*. *Crocidura leucodon*. *Allactaga elater*. *Cricetulus migratorius*. *Allactaga willamsi*, and so forth.

Some species of birds and small mammals are rare globally and are included in the World Conservation Union (IUCN) Red list. For example: *Phalacrocorax pygmeus* – LR; *Aegypius monach* – LR; *Haliaeetus albicilla* – LR; *Aquila heliaca* – VU; *Tetrax tetrax* – LR; *Aythya nyroca* – VU; *Rhinolophus ferrumequinum* – LR. cd; *Rhinolophus hipposideros* – VU.A2c; *Barbastella barbastellus* – VU.A2c; *Dromys nitedula* – LR.nt, and so forth (The second National..., 2014–2022).

Negative impact of natural and anthropogenic factors negatively affects the diversity of arid and semi-arid ecosystem that could lead to impoverishment of floristic composition of the vegetation, degradation of plant communities. The expansion of plant species characteristic to desert and semi-desert (*Salsola* spp, *Artemisia fragans*, *Gamantus pilosus* et al.) and plant communities (*Artemisietum*, *Artemisieto-salsoletum*, *Botrichloeto-artemisietum*) and others.

Also, the impoverishment of animal composition – disappearance of some insectivorous and rodents, for example, *Crocidura leucodon*, the vole (*Microtus socialis*), *Sorex Volnuchini* (*Sorex volnuchini*), existence of hares (*Allactaga* spp), which is typical to the desert landscape.

### 3. Conclusion

Particular part of Georgian territory is located within the arid and semi-arid zone. On the Caucasian background discussion of the Georgian landscapes shows that aridity is the least characteristic to our country. However, this does not mean that Georgia is not facing drought and aridity problems. On the background of global warming, favorable natural factors for aridity become more intense, resulting in the increase of natural aridity. This is evidenced by the frequency of droughts, which took place on the territory of the latter period.

Vulnerable to desertification regions in Georgia were determined Kakheti and Kvemo Kartli. The number of areas vulnerable to climate change and anthropogenic impacts is even higher.

Natural and anthropogenic factors on the biodiversity represent a serious problem. The main natural factors are: climatic, hydrological, morpho-dynamic, soil and others. Anthropogenic impacts on ecosystems regard overgrazing, reduction of forest areas, agriculture, urbanization and more.

Cutting down the forest, burning pasture, and overgrazing cause serious harm to the biological diversity and cause impoverishment of fauna. The forests lose function of the habitats of large mammals, which causes them to disappear, or migrate. Burning pasture has a very negative impact on the hilly pastures hillsides and on the density of bushes in the ravines, that is why they face their degradation and destruction. In turn it leads to increased evaporation of moisture from the soil, the disappearance of bushes and enhancement of desertification effect. Especially natural landscapes are dramatically changing as a result of burning pasture areas on the territory, where erosion caused by overgrazing is obviously expressed.

Cultivation of grasslands and riparian forests affects the natural landscape change. The territories which are covered with steppe plants become weedy; unique riparian forests are destructed and replaced with gardens. Most of the arable land in such areas is used today, which

excludes the possibility of restoring the natural grove here. The remaining abandoned places were degraded and weedy. As a result of cultivation of grove forests, their function of keeping away winds and bank protection is reduced, which contributes to desertification considering the climate change trend. Deforestation has a very negative impact on the biodiversity of arid and semi arid zone. In the second half of the last century, there were reports of various species of animals and birds in the river Alazani and Iori groves, which are virtually disappearing after the destruction of grove forests.

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