Current state of biota of the Urus-Martan forest reserve of the Chechen Republic

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Abstract. The article studies the state of biota in the Urus-Martan forest reserve located in the Chechen Republic, the degree of its anthropogenic transformation as a result of agricultural and production activities. A comprehensive bioecological analysis of flora and fauna was carried out, rare and protected species were assessed in terms of anthropogenic changes in the reserve. The methods of cartography, multimedia modeling of satellite images, accounting for the number of species and ecological-faunistic analysis were used. Changes in the reserve borders optimizing the reserve territory were described. Practical recommendations were provided.

1. Introduction

Over the long history of mankind, there has been an increase in intensity of anthropogenic pressure on natural systems which are increasingly transforming the natural environment, including in the territory of the Terek River Basin [1].

To prevent destruction processes, specially protected natural territories (SPNT) are created; they become centers of restoration of the natural balance or hinder adverse changes. They turn out to be the mechanism that maintains the systemic-ecological balance [2].

Protected areas should be territories with a minimal background anthropogenic pressure. The need to monitor the status of these territories was justified by N.F. Reimers [3]. Meanwhile, in the conditions of current nature management, the existence of protected areas does not always mean a decrease in the anthropogenic impact.

The Chechen Republic has a variety of natural zones: landscapes change from a semi-desert to the steppes and forest-steppes. In the southern part, there is a mountain forest belt, a mountain meadow zone, and a nival belt.

Thanks to such characteristics, the Chechen Republic is one of the most interesting corners of Russia. In connection with similar specifics of the geographical location of the region and its landscape features, a number of protected areas were created. The Urus-Martan State Forest Reserve created in 1970 in the mountain forest zone of the Urus-Martan and Shatoi administrative districts is one of them. Its area is 31 thousand hectares, including: 29 thousand hectares of forest land, 2 thousand hectares of fields, pastures and hayfields.
Geomorphologically, the territory of the Urus-Martan reserve covers areas of the Chechen piedmont inclined plain (in the northern part with elevations of 100–200 m and in the southern with elevations of 200–350 m), the low-mountainous terrain of the Black Mountains (350–970 m) and, the mid-mountainous relief Pasture ridge. The ridge-hilly lowlands of the Black (Forested) mountains are located south of the Chechen foothill plain, characterized by a strongly dissected relief and soft, smooth outlines. The slopes of the mountains are relatively gentle, the peaks are smooth. Only in some areas, there is a certain asymmetry. The steepness of their southern slopes indicates a monoclinic structure. The absolute heights range between 350–400 and 800–1200 m above sea level.

The eastern, western and northern slopes of the Black Mountains ridges are covered with forest with numerous hollows, gullies, and river valleys. The main forest-forming species is oriental beech, mixed with hornbeam, ash, linden, elm, mountain maple, field and alpine oak, birch, cherry, pear, and apple tree.

The soil cover consists of meadow-chernozem, meadow, gray forest and mountain brown forest soils [4].

2. Methods and materials
The material was field research conducted on the territory of the Urus – Martan Reserve in 2017–2018. Soil traps were set up on the territory of the reserve, insects were manually collected, herbarium material was collected, vertebrate studies were carried out according to the standard methods. The methods of cartography and ecological faunistic analysis, the trap-day method and the method of analysis of animal traces were used. To analyze the anthropogenic load, a multi-time composite on the basis of satellite images obtained 2018 and 2015 was created.

3. Results
On the territory of the reserve and in the immediate vicinity, there are no large sources of pollution. The territory was designed taking into account land settlements, agricultural land, industries, etc.

The northern border of the reserve runs along the border of the villages Martan-Chu and Komsomolskoye, which may have an adverse anthropogenic impact. In the north, the reserve borders with agricultural land, which is a buffer zone. Currently, agrochemicals (especially pesticides) are not applied on the fields located near the territory of the reserve.

In the east, the reserve borders with settlements located in the valley of the Argun river. Protective forests in the village Laha-Varanda play role of buffer zones, reducing the impact of the settlement on the natural ecosystems of the reserve. Residential territories of Lakha-Varanda do not adjoin directly to the border of the reserve, but have a natural barrier in the form of a forest, which reduces the negative impact on the ecosystem of the reserve. The village Chishki at the eastern border of the reserve does not have an impact on the ecosystem of the reserve.

The southern border adjoins the villages Bolshoi Varandy and Syuzhi with a small number of inhabitants.

The territory of the reserve is a system of ridges divided by rivers, which contributes to the formation of a wide range of ecosystems.

Particular attention should be paid to an industrial career in the extraction of gravel whose border is near the eastern part of the reserve south of Yarysh-Marda, since non-compliance with the conditions for extraction can damage forest ecosystems.

Currently, the mining has a negative impact on natural ecosystems due to runoff flowing down the slopes. Almost along the entire border of the quarry territory, runoffs down the slopes are observed (Fig. 2). Space images reflecting the changes show runoff from the quarry in the western part. They extend along the valley of the left tributary of the Argun river. The width of the zone of influence is 70–120 m. As a consequence, erosion processes and water pollution of the river can develop (Fig. 3).
To identify changes, a multi-time composite was created based on satellite images made in 2015–2018 (Fig. 4).

An analysis of satellite images made in 2015–2018 allows us to conclude that the anthropogenic load was concentrated on lands excluded from the reserve. Due to the complex topography and a high share of forest vegetation, the territory of the reserve does not have disturbed ecosystems. Most of the areas of forest vegetation that have changed their state are the result of avalanches, since chaotic scattered tree trunks are deciphered in detailed satellite images. In other areas where the changes were observed, there are slides, as they are located on the steep slopes of the mountains.
The study of the vegetation cover of the Urus-Martan reserve can be obtained from the materials included in the capital reports and generalizations in the Caucasus. The opinion about the originality, richness and ancient nature of its flora and vegetation is supported by many researchers [5–10]. The individual part of the Eastern Caucasus (for example, Dagestan) is an independent unit (large rank) in floristic, florogenetic and botanical-geographical zoning [5, 8, 15].

It was revealed that the flora of the Urus-Martan Reserve consists of 308 species belonging to 76 families and 180 genera.

There are 87 species needing protection. There are 7 endemics, 19 relics, 37 species for which the range is located in this area, 24 globally rare species, 11 species with “locus classicus”.

The flora of the reserve includes 157 food plants, 288 forage plants, 178 medicinal plants, 120 poisonous plants, 202 honey plants, 314 ornamental plants, and 81 industrial plants.

The anthropogenic interference violated and changed natural connections in the steppe-meadow and forest ecosystems of the reserve, due to the long-term logging, although the natural properties are manifested in the forest belt. Most of the outskirts of the reserve and along roads, especially in the vicinity of settlements, have been economically developed.

The results of studies on the composition and structure of vertebrates showed the following:

The Mammals class is represented by 46 species from 6 orders and 16 families (Table 1)

The biodiversity of mammalian species is determined by the presence of a large number of different biotopes, including intrazonal ones, which is a feature of the republic. It determines the widespread representation of vertebrates [12]. Taking into account the identified biotopes, five ecological complexes of mammals were identified: mammals of open spaces, forest, tree-shrub, near-water, valley-river and semi-aquatic mammals, underground soricidae. Some of them have been imported and acclimatized.

The main taxonomic structure of birds is formed taking into account migratory species, including 107 species from 13 orders: falcon-like – 15, chicken-like – 2, crane-like – 5, charadriiformes – 9, pigeon-shaped – 5, cuckoo-shaped – 1, owl-shaped – 4, goat-shaped – 1, swine-like – 1, rush-like – 3, hoop-like – 1, woodpeckers – 1, passerines – 59. From the list of the main bird species indicated, passerines, charadriiformes and falcons account for 76.8 % of the total variety of birds in the Urus-Martanovsky wildlife sanctuary. The dominant position is occupied by bird species associated with tree – shrub habitats and forest plantations. They form a core of the nesting avifauna, and are represented by passerines.
Table 1. The composition of the mammals in the Urus-Martanovsky reserve

| Orders     | Families                  | Species |
|------------|---------------------------|---------|
| Eulipotyphla | Talpidae F.               | 1       |
|            | Erinaceidae F.            | 1       |
|            | Soricidae F.              | 3       |
|            | Rhinolophidae L.          | 2       |
|            | Vespertilionidae G.       | 6       |
| Chiroptera |                          |         |
| Lagomorpha | Leporidae B.              | 1       |
| Rodentia   | Sciuridae G.              | 1       |
|            | Gliridae T.               | 2       |
|            | Cricetidae F.             | 8       |
|            | Muridae T.                | 5       |
| Carnivora  | Canidae G.                | 4       |
|            | Mustellidae S.            | 7       |
|            | Felidae G.                | 2       |
|            | Ursidae G.                | 1       |
| Artiodactyla | Suidae Gray.             | 1       |
|            | Cervidae Gray.            | 1       |

The ecological structure of the avifauna is diverse and includes three groups of species: dendrophils, campophiles, and sclerophiles [13].

A secondary position is occupied by bird species living in aquatic and near-water habitats along small rivers – Martanka, Tangi, Goichu, Surat, Roshnaya and others. They form part of the nesting avifauna of the Urus-Martanovsky reserve, represented by species of passerines and charadriiformes. The white wagtail Motacilla alba L., the cuckoo Cuculus canorus, the kingfisher Alcedo athis L., the dipper Ciclus ciclus L. Charadriiformes were found. Of gulls, S hirundo L. can be found in the lower part of the rivers.

Among amphibians and reptiles, besides rare and protected species, Bufo viridis Laur (Anura, Bufonidae), Hila arborea L. (Anura, Hilidae), Rana ridibunda L. (Anura, Ranidae) and Rana macrocnemis B. (Anura, Ranidae) were found. The swamp turtle Emis orbicularis L belonging to the Testudines (Emeridae) was found. From the suborder of lizards (Sauria), we found Anguis fragilis (Sguamata, Anguidae), Lacerta agilis boemica S. (Sguamata, Lacertidae), Lacerta striata E. (Sguamata, Lacertidae aesca), Sguamata, Lacertidae. Darevskia (Lacerta) praticola E, (Sguamata, Lacertidae) and Natrix natrix L, (Sguamata, Colubridae), Natrixguamata L. Colubridae), and Coronella austriaca L, (Sguamata, Colubridae) were found as well.

Special attention was paid to rare, protected species [14].

Protected species of ichthyofauna

On the territory of the Urus-Martanovsky reserve, in small rivers and spring waters, we found the trout Salmo trutta morfa fario – a species listed in the Red Book of the Chechen Republic. [14]. Its number is slightly higher than in the unguarded territory of the republic, but nevertheless it is decreasing which requires the monitoring of its habitat.

Protected species of batrachofauna

Rare species of amphibians of the Urus-Martan reserve include representatives of species of two orders: Caudata and Anura. Triturus vulgaris lantzi W. lives in the forest belt of the republic, including the reserve, as it is attached to shallow shaded forest ponds with clean water. There is more and more evidence that the Bufo verrucosissimus P lives in the middle mountains; in the forest belt, there is gray toad listed in the Red Book of the Republic.

The list of rare and protected amphibian species.

Urodela
Salamandridae
Triturus vulgaris Lantzi W.
Anura
Buffonidae
Bufo verrucosissimus R.

**Protected species of herpetofauna**
Among the reptiles, there are three rare species listed in the Red Book of the Republic. In the forest belt and on forest outskirts, one can find the Caucasian Vedeno lizard and the Georgian Chechen lizard, and in the mixed grass meadow biotopes of the middle mountains of the reserve, the viper Lotievi lives.

The list of rare and protected reptile species.

Sguamosum
Lacertidae
Darevskia (Lacerta) caucasica vedenica D,
Darevskia (Lacerta) rudis chechenica E,
Viperidae
Vipera Lotievi N. at al.

**Protected species of ornithofauna**
On the territory of the Bragunsky reserve, there are 9 species of birds with a different protection status. Up to 11–12 protected species nest or presumably nest on the territory under consideration. According to the ecological structure, these are mainly dendrophilic and campophilian birds.

The list of the main rare species of birds in the survey area.

Falconiformes
Falconidae
Falco peregrinus T.
Falco vespertinus L.

Accipitridae
Circus macrourus G.
Aguila pomarina P.
Aguila cyrisaetos L.
Ghaetaus barbatus L.

Strigiformes
Strigidae
Bubo bubo L.

Galliformes
Tetraonidae
Lururus Mlocosieviczi T.

Passeriformes
Lanius excubitor L.

**Protected Theriofauna Species**
11 species of rare and protected mammal species with a different conservation status and biotopic confinement were found on the territory of the Urus-Martan Reserve. According to their ecological status, they can be attributed to steppe species – xerophiles (steppe ferret), dendrophils (forest cat, giant evening supper, etc.), hygrophilic near-water (Caucasian otter European mink,) eurybiontic species (badger).

The list of rare and protected mammalian species.

Insectivora
Soricidae fiscer
Sorex Raddei Satunin
Chiroptera Blumenbach
Vespertilionidae gray
Nictalus lasiopterus schreber
Miotis blithi tomas
Rhinolophidae lesson
Rhinolophus hipposideros
Bechstein rhinolophus ferrumequinum schreber
Carnivora bowdich
Ursidae
Ursus arctos linnaeus
Mustellidae sweinson
Meles meles – Linnaeus
Lutra lutra linnaeus
Mustella lutreola linnaeus
Mustella eversmanni
Felidae gray
Felis silvestris Linnaeus

In 4 biotopes, 3,677 mammals from 4 orders and 46 species were found: Coleoptera, Hymenoptera, Lepidoptera, and Odonata.

Table 2 presents the species listed in the Red Book of the Chechen Republic.

| Odonata          | Coenagrion scitulum (Rambur, 1842) |
|------------------|-----------------------------------|
|                  | Gomphus flavipes (Charpentier, 1825) |
|                  | Gomphus vulgatissimus L., 1758      |
|                  | Libellula depressa L., 1758         |
| Lepidoptera      | Parnassius nordmanni Menetries, 1849|
|                  | Polyommatus daphni Denis et Schiffermuller, 1775 |
|                  | Colias aurorina Herrich-Schaffer, 1850 |
|                  | Catocala sponsa Linnaeus, 1767      |
|                  | Papilio Machaon, Linnaeus, 1758     |
| Hymenoptera      | Megascolia maculate                |
|                  | Xylocopa valga Xylocopa violacea   |
| Coleoptera       | Carabus adamsi Ad.1817             |
|                  | Carabus cumanus F-W.               |
|                  | Carabus planipennis Belousov, 1985  |
|                  | Carabus boeberi A.1817             |
|                  | Carabus maurus A. 1817             |
|                  | Carabus macropus Chaud. 1877       |
|                  | Cytherus aeneus F-W. 1824           |
|                  | Rosalia alpine, Linnaeus, 1758      |
|                  | Ocypus olens O. Müller, 1764       |

The results of the expeditions to the reserve area confirmed the assumption of the great environmental value of the territories. The information about a number of protected species is a sufficient argument indicating the nature-protected value of the reserve.

4. Conclusion
Given the intensive economic development of the territory of forest and meadow-steppe lands, it is necessary to identify the most significant and biologically productive natural areas in order to preserve their biodiversity and maintain them in a natural state [15]. At the same time, it is necessary to exclude developed and heavily modified areas from the protected areas. The boundaries of the protected areas should be adjusted so that they coincide with existing natural or artificial landmarks (ridges, canals, roads, etc.). It is recommended to exclude the following areas: areas including the neighborhood with Roshni-chu, Martan-chu, Pioneer, Chishki and farmland around them. The existing border is not correct which does not allow establishing the natural border of the reserve, covering valuable areas. It
is proposed to align the reserve border along the line “height 809 – along the southern border of Komsomolskoye (Goi-chu) – to Pionerskoye (Lakha-Varanda)”, having cut off an existing ledge of the territory of the reserve, in the form of an isthmus, opposite Alkhazurovo. The territory of this ledge has been developed and does not have any environmental significance.

On the eastern border of the Urus-Martan Reserve, it is advisable to exclude Chishki and set the border of the reserve along the official border of the Urus-Martan district.

On the southern border, it is necessary exclude the surroundings of the village Bolshoi Varandy, significantly deforested and anthropogenically transformed to a height of 029. The changes satisfy the requirements of the reserve's tasks. Moreover, the category of protected areas does not change.

Thus, the boundaries of the Urus-Martan State Nature Reserve are as follows.

The reserve with a total area of 12.6 thousand hectares will be located in the Urus-Martan and Shatoi regions of the Chechen Republic within the following boundaries:

The northern border: from the north-western corner of the 6th quarter of the Urus-Martan district forestry to the east along the northern border of the forest fund to the north-eastern corner of the 2nd quarter of the Piedmont district forestry;

The eastern border: from the northeast corner of the 2nd quarter down the eastern border of the forest fund to the southern corner of the 40th quarter of the Piedmont precinct forestry;

The southern border: from the southern corner of the 40th quarter of Piedmont precinct forestry to the west along the southern border of the forest fund to the southwestern corner of the 47th quarter of the Urus-Martan district forestry;

The western border: from the southwestern corner of the 47th quarter of the Urus-Martan district forestry up the western border of the forest fund to the northwestern corner of the 6th quarter of the Urus-Martan district forestry.

References
[1] Bathiev A M 2010 Krizisnoe sostoyanie i puti resheniya prirodoohrannyh i ekologicheskih problem basseyni reki Terek 4-6 3–8
[2] Tishkov A A 2005 Biosfernye funktsii prirodnih ekosistem Rossii (Moscow: Nauka) 309 p
[3] Rejmers N F 1992 Ohrana prirody i okruzhayushchej cheloveka sredy (Moscow: Prosveschhenie) 320 p
[4] Golovlev A A and Golovleva N A 1989 Pochvy Checheno-Ingushetii (Groznij: Groznenskoe kn. izd-vo)
[5] Kuznecov N I 1909 Principy deleniya Kavkaza na botaniko-geograficheskie provincii (St. Petersburg) 176 p
[6] Kuznecov N I 1989 Geobotanicheskoe issledovanie severnogo sklona Kavkaza Izv. Imp. rus. geogr. ob-va XXVI
[7] Grossgejm A A 1936 Analiz flory Kavkaza (Baku) 269 p
[8] Grossgejm A A 1946 Rastitel'nye resurny Kavkaza (Baku)
[9] Fedorov A A 1952 Zhizn' rastenij In 6 volumes
[10] Tumadzhanov I I 1966 Lesnaya rastitel'nost' doliny Teberdy v svete poslelednikovoj istorii razvitiya (Moscow; Leningrad)
[11] Haradze A L 1939 Materiaily k izucheniyu nival'noj i skal'noj flory Verhnej Svanetii Tr. Gruz. geogr. ova
[12] Bathiev A M 2010 Mestnaya fauna (Groznij) 162 p
[13] Gizatulin I I, Hohlov A N et al 2001 Pticy Chechni i Ingushetii (Stavropol': izd. SOPR) p 142
[14] Krasnaya kniga CHEchenskoj Respubliki. Redkie i nahodyashchiesya pod ugrozoj ischeznoveniya vidy rastenij v zhivotnych 2007 (Groznij) 432 p
[15] Abduralmanov G M, Shkhagapsoev S H and Bathiev A M 2014 Sovremennoe sostoyanie regional'nogo gornogo bioraznoboziya, problemy ego sohraneniya i rational'nogo ispol'zovaniya Ustojchivo razvitie gornych rajonov Severnogo Kavkaza v usloviyakh global'nyh izmenenij Mater. nauchno-prakt. konf. (Groznij) pp 162–7
[16] Avtaeva T and Kushalieva Sh 2017 New Data on Ground Beetles (Coleoptera, Carabidae) of the Mountain Areas of the Chechen Republic Bull. of Moscow Reg. State Univer. Ser. Natural sci. 4 6–14 DOI: 10.18384/2310-7189-2017-4-6-14

[17] Avtaeva T A, Kushalieva Sh À and Fominykh D D Life cycles of ground beetles of the genus Carabus Linnaeus, 1758 under natural conditions in the Chechen Republic Euroasian entomol. J. 16(4) 375–87