Brief analysis of the vegetation cover native to the Russian Caucasus

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Abstract. The article presents the results of a study of the vegetation cover within the Russian Caucasus. The natural belts present on this territory are listed - steppe, forest, oeroxerophyte belt, subalpine, alpine. A brief description of each of them is given - distribution over altitude levels and different territories (subjects) of the North Caucasus, distinctive features of vegetation cover, plant communities and groupings along altitudinal belts and in the longitudinal direction. Typical representatives of the flora of the territories under consideration are listed, among which relics, endemics, economically useful and rare species are widely represented. The materials of the article can be taken into account when monitoring the state of the populations of these species and the vegetation cover in general in the subjects of the North Caucasus.

1. Introduction
The Russian Caucasus, as a part of the Caucasus, is included in the 200 priority ecoregions of the world and among the 25 ecoregions with the highest level of biological diversity on a global scale [1]. This territory is receiving increased attention from the World Fund for Conservation of Russia as part of the WWF world network, where the nature conservation strategy for preserving biodiversity from the impact of human activities should be implemented.

The history of the study of flora is inextricably linked with the accumulation of factual material on the study of the flora of the Caucasus as a whole. The study of the flora of xerophytes in the Russian Caucasus was carried out by botanists and specialists in related fields of science such as: V.Ya. Nagalevsky, T.A. Snisarenko, M.A. Taysumov, M.A.-M.Astamirova, R.S. Magomadov, A.S. Abdurzakov [2-7] and others.

The study of the vegetation cover as a component of the geographical landscape is a prerequisite for the implementation of the most important problem on a global scale - the preservation of biological diversity. One of the components of such studies is a comprehensive study of coenofloras and their spatial distribution in a particular territory, depending on many environmental factors - geographic location, relief, climate, the nature of moisture, etc. In this regard, the most urgent is the study of the vegetation cover, which exhibits pronounced azonality and is subject to the influence of the island effect, which, in turn, leads to a disjunction of the ranges of certain species and the ecological isolation of phytocenoses.

The relevance of the study is determined by the need to generalize and analyze the results of expeditionary observations and scientific publications on the vegetation cover and flora of the Russian
Caucasus, which will serve as a rationale for resolving the issues of protecting individual species, plant groups and maintaining the Red Book of the subjects of the North Caucasus and the region as a whole. In the applied aspect, an inventory of the gene pool and useful plants of the flora is also important.

The purpose and objectives of the study is to analyze the vegetation cover, the distinctive features of the flora of high-altitude zones, the geographical distribution of species and plant complexes within the Russian Caucasus. To achieve this goal, we studied the distribution of plant communities and their typical species, including those subject to protection, along natural belts and in the longitudinal direction in different territories of the North Caucasus.

2. Materials and Method
The object of the study was the vegetation cover and belt distribution of species across the Russian Caucasus. The material for this work includes field observations and herbarium collections of employees of the Academy of Sciences of the Chechen Republic, the Complex Research Institute named after V.I. H.I. Ibragimov RAS and the Chechen State Pedagogical University during expeditionary research (2010–2019).

Scientific (Latin) names of species, genera and families are given according to S.K. Cherepanov [8].

3. Results and Discussion
The nature of the vegetation cover in the mountainous part of the Greater Caucasus is closely related to the features of the relief, climate, soil cover, and altitude. This is reflected in the phenomenon of altitudinal zonation, which is expressed in a change in vegetation types due to changes in climatic factors (moisture, thermal regime) and an increase in hypsometric indicators [9, 10]. With the rise in the mountains, there is a change in such vegetation belts as steppe, forest-steppe, forest, subalpine, alpine, subnival, nival [11].

There is also a belt of oeroxerophytes (semiarid vegetation or upland-xerophilic belt), to an unequal extent and differently expressed along the northern macroslope, represented by various plant groups - from arid woodlands and shrub shibles to tomillars [9, 12].

On the plains of the Ciscaucasia, there are two belts: semi-desert (Eastern Ciscaucasia, the northern part of the Central Ciscaucasia, the northern part of the Central Ciscaucasia and steppe.

The steppe belt occupies open spaces of the Central and Western Ciscaucasia, as well as the foothills and the lower mountain belt. In the Ciscaucasia, at present, the steppes in most of the territory are plowed up, their fragments have survived in rugged upland areas, along ravines, on slopes; areas of upland virgin lands are less common. On depressions of the terrain, thickets of steppe shrubs are widespread from Amygdalus nana, Prunus stepposa, less often Caraganamollis. On the eastern slope of the Stavropol Upland, the herb-grass steppes turn into fescue-feather grass, then into fescue and further into fescue-wormwood dry steppes, occupying the most arid northeastern part of the Central Ciscaucasia [11].

Throughout the mountains of the North Caucasus, there is fragmentary feather-grass-forb steppe with a predominance of Stipapulcherrima, confined to stony southern slopes with thin, underdeveloped soils and mountain chernozems, mainly on limestones. In the central part, the vegetation of the steppe zone is represented by steppe meadows and meadow steppes, which are dominated by herb-low sedge-fescue, fescue-low-sedge with the participation of Carexhumilis, fescue-wormwood and forb-bearded phytocenoses, rarely, meadow steppes with a predominance of Carexhumilis, Festucavalesiaca, Brachypodium pinnatum, and mesoxerophilic forbs [13].

In Dagestan and in the dry valleys of North Ossetia, in the area of sandstones and shales, mountain steppes with Festucavalesiaca, Stipatirsa, S. daghestanica, Elytrigiaracillima are widespread, with the participation of species of the genus Artemisia and Astrapagalis, and rare herb groups with Salvia daghestanica, Psephellus daghestanicus, Sedum involucratum, Thymus daghestanicus, Allium albidum, Ephedra procera and other xerophytes, on the steep gravelly and stony slopes shibleak and freegana are developed, dominated by Spiraeacrenata and Astracanthadenudata[11].
In the North-Western Caucasus at altitudes of 800-900 m above sea level feather-grass-forb steppes prevail, consisting of separate sod, dispersed between boulders. Such phytocenoses include Festucavalesiaca, Koeleriagracilis, Melicatranssilvanica, Brachypodiumpinnaatum, from the forbs Allium rotundum, Alyssum tortuosum, Iris taurica, Salvia ringens, Sideritistaurica, etc. [11]. At the upper limit of their distribution, especially on the Markoth, Navagirsy, Kotsekhur ridges and on individual peaks, mountain relict steppes with Stipapulcherrima and abundant Mediterranean herbs from Paionianatenuifolia, Eremurusspectabilis, Himantoglossumcaprinum, Tulipagesnertensiana, Onosmapolyphylla, Thymus markhotensis, Genistalypskyi and etc.[14].

In forest-steppe areas, the steppe occupies mainly upland areas on leached chernozems. These are meadow steppes, which are the most mesophilic version of the steppe with an almost closed herbage of a rich species composition, with a large participation of dicotyledons, in some places prevailing over grasses. The slopes of the Tersky, Sunzhensky, Kabardinsky and other ridges, the Stavropol Upland are covered with bearded steppes, rising in the Central Ciscaucasia up to 600-700 m above sea level. m. [11].

The forest belt along the entire northern macroslope is confined to different altitude levels - from 100-300 to 1800-2000 m in the west and from 800-1000 to 2400-2600 m in the east. In turn, three parts are distinguished in it: the lower forest belt is formed mainly by oak and oak-hornbeam forests; middle forest belt - beech, beech-fir, beech-hornbeam forests, occupying heights from 600 to 1300 m above sea level; the upper forest belt is formed by birch or coniferous forests at an altitude of 1800-2400 m above sea level. [11].

Oak and hornbeam forests are developed in the Western Caucasus, mainly in the low and middle mountains, and in the Northwest Transcaucasia there are areas of broadleaf forests with undergrowth of Buxuscolchica and Taxusbaccata [9].

The central part of the North Caucasus, along the length between Elbrus and Kazbek, including the northern slope of the Rocky Range, is occupied by a relatively narrow strip of mountain deciduous forests, mainly from Fagusorientalis [9], pine forests are also widespread, including rocky, mixed forests, birch and birch crooked forests [15]. Here, the main forest-forming species are Pinussnosowskyi, Betulalitwinowii, and B. verrucosa, to which Sorbuscaucasigena, Salix caprea, S. kuznetzovii are admixed, and, less often, Padusracemosa, Populus tremula, and Alnus cinerea. Of the shrubs, various species of the genus Rosa (R. dumalisBeschst., R. elasmacantha Trautv., R. iberica Stev. ex Bieb., R. marschalliana Sosn.), Rubusbuschii, Ribesbiebersteinii, Grossulariareclinata, etc. are widespread. The upper horizons are occupied by coniferous forests, and birch crooked forests are developed at the uppermost border. The lower mountain belt in the central and eastern parts is occupied by coniferous forests, and birch crooked forests. The oak-hornbeam forests of the Caspian slope of Dagestan in the foothill zone have been almost completely cut down and replaced by secondary shrub thickets dominated by Paliurusspina-christi. Small fragments remained from these forests, above which there is a belt of beech forests with an admixture of hornbeam and some other species - Acer campestre, Betularaddeana, Sorbuscaucasigena, etc. The strip of birch crooked forest is poorly expressed, mainly in the southern part [9].

In the Ciscaucasia, forests have survived along the above-floodplain terraces of the Kuban valley and on the Kuban sloping plain, where they are more often replaced by shrubs and small forests [17]. In the southwestern part of the Stavropol Upland, deciduous forests occupy valleys and gullies, rise along the slopes of outlier mountains to a plateau (Stavropol Plateau, Mount Strizhament). Such
forests are dominated by *Quercus robur*, *Fraxinus excelsior*, and *Carpinus caucasica*; *Acer campestre*, *A. platanoides*, *Pyrus caucasica*, *Malus orientalis*, *Cornus mas*, etc. are found as admixtures; in some places relict areas of the beech forest from *Fagus orientalis* have been preserved.

Broad-leaved forests are found on the slopes and at the foot of the Kavminvod laccolithic mountains, especially developed in the cities. Beshtau, Breakup, Iron, Mashuk, Sheludiavaya. Forests are represented by such species as *Fagus orientalis*, *Carpinus caucasica*, *Fraxinus excelsior*, *Quercus robur*; on Beshtau, at the upper edge of the forest, there is a birch crooked forest.

In the Eastern Ciscaucasia, oak forests grow on the northern slope of the western part of the Sunzhensky ridge, and their fragments are also found in gullies on the southern slope [11].

The oeroxerophyte belt is localized above the forest belt along river valleys and in arid basins. The vegetation cover here is complex and consists of numerous microgroups, which differ sharply from each other in their coenotic character, since they develop in arid conditions on mountain slopes characterized by a wide variety of microrelief elements. The belt is not continuous, it is represented by spots in a chain of arid basins located between the Skalisty and Lateral ridges. Their most significant areas are located in the upper reaches of the Kuban and Baksan, but this belt reaches its greatest development within the limits of Dagestan, occupying all the southern mountain slopes [9].

In this belt, thorny cushion biomorphs are widespread, which form such species as *Astracantha aurea*, *A. denudata*, *A. caucasica*, which cover most of the slopes of arid basins; less often, in the eastern part - *A. caspica*, *A. microcephala*; in Dagestan - *Dendrobrychis cornuta*. The outcrops of parent rocks are associated with polydominant phytocenoses with the participation of *Juniperus sabina*, which also include other shrubs (*Ephedra procera*, *Spiraea hypericifolia*, *Berberis vulgaris*), herbaceous plants (*Nepetabiebersteiniana*, *Teucrium orientalis*, *Salvia caneshestanus*, *Thymus daghestanicus* and others). Geophytes and therophytes, about 80 species in total [18].

On the territory of Vnutrigorny Dagestan, the composition of upland xerophytes is determined by the parent rocks. On limestone slopes, a shiblyak from *Ephedra procera*, *Spiraea hypericifolia*, *Rhamnuspallasii*, *Dendrobrychiscornuta*, etc. is developed, from herbaceous plants *Convulvulus ruprechtii*, *Salvia daghestanica*, *Scabiosagumbetica*, etc. *Astragalusaureus*, from the herbaceous *Stipadaghestanica*, *Limoniopsisowerinii*, *Salvia beckeri*, etc. [9].

The subalpine belt is confined to heights of 1800-2800 m above sea level. Here, in addition to typical subalpine meadows, depending on the conditions, three more types of vegetation develop - thickets of subalpine junipers, thickets of rhododendron (rhodoretums) and tall grasses [9].

The thickets of junipers from *Juniperus sabina* and *J. hemisphaerica* are usually confined to the dry slopes of the southern exposure. They are elements of upland xerophilous vegetation [9]. *Juniperus sabina* has the shape of a dwarf tree growing together with *Berberis vulgaris*, *Astracantha aurea*, species of the genus *Rosa*, dwarf shrubs *Thymus daghestanicus*, *Theucrium orientalis*, etc. [11].

The thickets of *Rhododendron caucasicum* (rhodoretums) are located on the border of the forest and subalpine, and can reach the alpine belt along the uneven microrelief. Typical clean thickets, devoid of admixtures of woody species, the first layer is *Rh. caucasicum* and some shrubs. Such thickets develop on the northern slopes at a steepness of 250-400, at an altitude of 2200 to 2700 m. Usually they are accompanied by a small number of "permanent satellites", the composition of which varies depending on conditions and geographic location [16].

Tall grass is represented by communities of tall herbaceous plants up to 2-2.5 m in height, living in the upper part of the forest and the lower part of the subalpine belts; it plays the role of a transition zone from a forest to a real meadow. It has a fragmentary distribution and is confined to habitats with increased moisture. Phytoecologically characterized by the absence of a sod process, poorly expressed layering, and a small amount of main components (Grossheim, 1948). Such communities are based on such mesophilic species as *Liliummonadelphum*, *Delphinium flexuosum*, *Aconitum orientale*, *A. nasutum*, *Heracleumasperum*, *Symphytumasperum*, *Cephalariagigantea*, *Telekiaspeciosa*, *Adenostylesmacrophylla*, *Cicerbitamacrophylla* and others [11].
Meadows form the basis of subalpine vegetation. These are steppe meadows dominated by *Bromopsis variegata*, variegated meadows dominated by *Festuca varia*, herb and gramineous-forb, meadows composed of diverse communities characterized by a rich species composition (50-70 species of angiosperms), among which the most characteristic are *Anemonastrum fasciculatum*, *Geranium renardii*, *G. ruppechti*, *Betonicacamarantha*, *Veronica gentianoides*, *Scabiosa caucasica*, and others, as well as sedge meadows, where *Carex tristis* is most common, forming grass-sedge associations [11].

The Alpine belt, depending on its geographical location, occupies an altitude of 2200 to 3300 m above sea level. Plant habitats in the alpine belt are characterized by rockiness of the substrate, a thin soil cover and the severity of a cold and relatively dry climate, as well as the intensity of solar illumination [11]. There are significant outcrops of bedrock, vast areas occupied by stone placers, talus, moraine ridges, avalanche fanning cones, etc. The vegetation cover is similar in a number of features to that in the tundra zone, namely: general life forms (cushion, creeping, rosette, stunted forms), common ecological groups (psychrophytes and cryophytes), plants are distinguished by a short growing season, the predominance of vegetative reproduction over seed, a significant life span, etc. Some researchers call the alpine belt mountain tundra [15].

In the alpine belt, the following types of vegetation are distinguished: rock-talus, carpet, meadow, barren. Rock-talus vegetation is composed of petrophytes, which form various and numerous plant groups, abundant in endemic species, especially in the central part of the Greater Caucasus, where rocky endemics such as *Minuartiabrotherana*, *Gypsophila imbricata*, *Charesiaakinfevii*, *Saxifragacolumnaris*, *S. dinniki*, *Campanula hypopolia* are concentrated. hypopolia and many others [9]. There is a high participation of representatives of the families Caryophyllaceae, Brassicaceae, Saxifragaceae, Rubiaceae, Asteraceae [19].

Alpine carpets are formed by low-growing plant communities with a predominance of dicotyledons, forming a dense sod of mainly rosette-rod biomorphs. Carpets are usually found in relatively small areas, with the exception of zibbaldium and cuff carpets, which are widespread in the central part of the northern macroslope of the Greater Caucasus [15].

Alpine meadows are formed by shallow sedge, legume shallow sedge, herb shallow sedge, dense turf grass, cobresia and other communities. The main sod-formers are *Carex tristis*, *C. meinshauseniana*, *C. huetiana*, *Festuca ovina*, *Poaalpina*. Alpine meadows have a high projective cover (95-100%), and the species composition is limited mainly to 25-30 species, among which *Campanula biebersteiniana*, *C. ciliata*, *Gentianaangulosa*, *Gentianellabiebersteinii*, *Taraxacumcrepidiforme*, etc. are common [15].

Wastelands include plant communities formed by mosses and lichens with a sparse layer of flowering plants (some species of cereals and dicotyledons), as well as psychrophilic shrubs and shrubs such as *Empetrum caucasicum*, *Salix kazbekensis*, *S. hastata*, *S. pontosericea*, *Rhodococcumvirgatum*, *Vaviloviaformosa*, *Pseudovesicariadigitata*, *Trigonocariuminvolucratum*, *Jurinellamoschus* etc. The pioneer groups of cushion biormorphs are most widespread here: *Drababryoides*, *D. mollissima*, *Saxifragamoschata*, *Campanula fominii* etc.

For the most part, lichen wastelands are developed, represented by an epilithic group of lichens. The subnival belt is located at altitudes from 3200 to 3800 m above sea level. m., the upper limit of which is the so-called "level 365" (the absolute height above which the snow cover lasts 365 days a year [15]. The relief bears traces of glacial activity, abounds in troughs, glacial amphitheaters, circuses, carriages, etc. [11]. Rocky, rubble, talus and moraine habitats prevail, the vegetation cover is sparse and simplified, and includes obligate endemic plant species such as *Ranunculus arachnoideus*, *Corydalis palldiflora*, *Sedum stevenianum*, *Vaviloviaformosa*, *Pseudovesicariadiigita*, *Trigonocariuminvolucratum*, *Veronica bogosensis*, *Pseudobetkecaucasica*, *Jurinellamoschus* etc. The pioneer groups of cushion biormorphs are most widespread here: *Drababryoides*, *D. mollissima*, *Saxifragamoschata*, *Campanula fominii* etc.
Empetrum caucasicum, as well as cereals and sedges (Festucapusina, Carextristis), as well as grasses and sedges (Festucapusina, Carextristis) [20].

The nival belt is located above 3200-3800 m above sea level and is an area of modern glaciation of the Greater Caucasus, where year-round negative air temperatures and a complete absence of soil and higher plants are characteristic [11].

In general, the vegetation cover in the mountains is differentiated depending on the thermal regime, soil conditions, exposure, height above sea level, which creates whole spectra of local zoning, characterized by a variety of vegetation cover. There are transition zones-ecotones between the altitudinal belts, in which the species of the lower and upper belts are found, therefore, clear boundaries between them are not traced, which greatly complicates their identification [15].

The vegetation cover of the study area contains many relics of species of different ages, reminiscent of the floras of past eras. Among the Tertiary ones, there are: Allium ursinum, A. paradoxum, Acer laetum, Hedera plantaginoides, Asarumibericum, Periploca viridiflora, Betularaddeana, Brunneramacrophylia, Ostryacarpus, Azaliapontica, Rhododendron caucasicum, Clematis integrifolia, Atropacausica, Viola mirabilis, Vitissylvestris, (survived the glacial period) Helleboruscaucasicus and Sorbusstorminalis, etc. Glacial (glacial) ones include Linnaea borealis, Primulaamoena, Amuramnoidesblanda, Ranunculusauricoma, Dryascaucasicus, Daphne mezereum and others. Many relics of the xerothermal, arid period: Eremuruspectabilis, Сapparisherbacea, Celtisglabrata, Astragalusvarius, Caragnamollis, Coluteaorientalis, Eremospartonaphyllum, Medicagodaghestanica, Ononispusilla, Xantobrychismajorovii, Cerasusincana, Pyrussa licifolia, etc. [7].

The originality of the flora of the territory under consideration is also confirmed by the abundance of endemics of various levels in it: the Caucasus (Ornithogalumarcuatum, Liliummonadelphum, Traunsteinerasphaerica, Pseudovesicariadigitata, Colchicum laetum, etc.), the Greater Caucasus (Galanthus platyphylus, Erysimumsubnivale, Rhododendron caucasicum, Vaviloviaformosa, Viola oreadesand others), the Central and Eastern Caucasus (Galanthus angustifolius, Galanthu lagodechianus, Iris notha), the Eastern Caucasus (Omphalodesrupestris, Trigonocaryuminvolucratum, Crambe gibberosa, etc.) [7].

4. Conclusion
The article describes natural vegetation belts in the study area, we investigated 6 belts - steppe, forest, oeroxerophytes, subalpine, alpine, nival. The features of the vegetation cover of the indicated belts are noted: fragmentary vegetation in the form of separate rocky-talus groups and microgroups; sparseness and simplification of its structure, the participation of mosses and lichens and in a significant number of species of underlying altitudinal belts. Thorny cushion biomes are widespread here, which form such species as Astracanthaurea, A. denudata, A. caucasicus, which cover most of the slopes of arid basins; less often, in the eastern part - A. caspica, A. microcephala; in Dagestan - Dendrobrychiscornuta. The outcrops of parent rocks are associated with polymonostantophytocenoses with the participation of Juniperussabina, which also include other shrubs (Ephedra procera, Spiraeahypericifolia, Berberis vulgaris), herbaceous plants (Nepetabiebersteiniana, Teucriumorientalis, Salvia canescens, Thymus daghestanicusand others), geophytes and therophytes, about 80 species in total.

In the arid basins of the Eastern Caucasus, the composition of upland xerophytes is determined by the parent rocks. On limestone slopes, shibyak from Ephedra procera, Spiraeahypericifolia, Rhamnuspallare, Dendrobrychiscornuta, etc. is developed, from herbaceous plants - Convolvulusruprechtii, Salvia daghestanica, Scabiosagumbetica, etc., on the slopes of acidic rocks - mainly Juniperusoblonga, Paliurusspina-christi, Atragaulausaureus, from the herbaceous Stipadaghestanica, Limoniopisowerinii, Salvia beckeri, etc.

The vegetation cover of the study area is distinguished by its richness and originality. Relics of different ages, endemics of various levels, economically useful and rare species are widely represented here. Purposeful research in the subjects of the Russian Caucasus will significantly enrich our
knowledge of its plant resources, which is important not only for their practical use, but also for solving the problems of florogenesis, rational use, and protection of biodiversity and natural ecosystems.

The materials of the article can be taken into account when monitoring the state of the populations of these species and the vegetation cover in general in the subjects of the North Caucasus.

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