13 Flora

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Abstract

In Georgia, the diversity of vegetation cover is reflected in various types and variants of vegetation vertical zoning systems. This diversity is described in this chapter. The richness of Georgian flora is the high level of endemism. Approximately 21% or about 900 species of Georgian flora are endemic including about 600 species—endemic to Caucasus and about 300 species—endemic to Georgia. The number of endems in the Caucasus is up to 1500.

The physical-geographical diversity of Georgia, orogaphic contrast, the geographical and ecological isolation of the individual orographic units and river water catchment basins, as well as the diversity of vertical zoning of the phytolandscapes caused the diversity of flora and vegetation formations of Georgia.

The diversity of vegetation cover is reflected in various types and variants of vegetation vertical zoning systems. The vegetation of western Georgia forms the **Colchis type** of vertical zoning and the vegetation of eastern Georgia—the **Transcaucasian type** of vertical zoning. The transition version between Colchis and Transcaucasian types is represented in Kartli and Trialeti regions. It is true that a complete system of vertical zoning is not represented along the Caucasus, but the high mountainous zones (subalpine, alpine, subnival, and nival) are well expressed. The **central Ciscaucasian type** of vertical zoning is characteristic of Khevi; on the contrary, the **eastern Ciscaucasian type** of vertical zoning—is of Pirikita Khevsureti and Tusheti. There is a completely different system in the southern Transcaucasia (Meskheti and Javakheti), where the mountain steppe belt is developed in wide strips—the **southern Transcaucasian**, or the Western Asian type. Here the alpine belt is limited or the subnival belt is rarely expressed.

More than 4100 species (4130 species) of vascular plants are registered in Georgian flora including ferns—79; **gymnosperms**—17 and angiosperms—4034 (dicotyledons—3278 and monocotyledons—756); in the Caucasus 6350 species are registered, in the North Caucasus—3700 species, in Armenia—3700 species, in Carpathians—2000 species; in Scandinavian countries—2000 species, and in the world—270,000 species. The situation in Georgia's floristic-ethnographic regions according to the number of species is as follows: Apkhazeti—1978 species, Svaneti—1100 species, Racha-Lechkhumi—1200 species, Imereti—900

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species, Achara—1900 species, Khevi—1347; Tusheti and Khevsureti—1000 species, Shida Kartli (Ksani-Liakhvi)—1125 species, Kakheti—1400 species, Trialeti—1650 species, Meskheti—1400 species, Javakheti—1500 species and Gardabani—900 species.

The richness of Georgian flora is the high level of endemism. Approximately 21% or about 900 species of Georgian flora are endemic including about 600 species—endemic to Caucasus and about 300 species—endemic to Georgia. The number of endems in the Caucasus is up to 1500 (Gagnidze 2005).

The **main types of plant species** are: wetland, forest, shrub, meadow, high herbs, steppe, semi-desert, rock-fragment-detritus vegetation, and vegetation of coastal sand-**cobblestone** ecotopes.

Vegetations of western, eastern, and southern parts of Georgia sharply differ from each other (Ketskhoveli 1961; Kolakowsky 1961).

In the ecosystems of mesophylous forests, meadows and high herbs prevail the Caucasus, Mediterranean, Laurasian and Palearctic species; in the ecosystems of arid forests, steppes and semi-deserts prevail the Western Asian and Asia Minor species; in the water and wetland ecosystems—Laurasian (Holarctic) and Palearctic species. The rock-fragment-detritus vegetation is rich in endemic species of the Caucasus.

In western Georgia, the complete system of vertical landscape zones are well expressed, starting from the plain-lowland or the lower mountain belt to the nival-permanent snow or glacial and subnival snow lower belts inclusively. In the Black Sea coastal regions, a maritime or coastal belts are added to the phytolandscape belts, which are characterized with sandy-gravel and cobble dune vegetations (Gagnidze 1974). Their diversity is formed by the ephemeroids and ephemers of the circum-Mediterranean and Euxine coast.

In eastern Georgia, in contrast to western Georgia, semi-arid and arid belts of vegetation are represented, particularly the vegetation of semi-arid, steppe, mountain xerophilic, and arid light forests. Other belts are the same as in western Georgia.

13.1 Vegetation of Western Georgia

Vegetations of the Black Sea coastline sand, sand-pebble, and sand-cobble ecotopes. Coastal sand, sand-pebble, and sand-cobble ecotopes are one of the oldest and relic ecotopes. To these ecotopes and dunes are related peculiar vegetation and floristic complexes, characterized by different ecology, eco-bio-forms, and vegetation cover structure. This vegetation is not widely represented and extends within 100–200 m from the coast to the land. Vegetation is not dense; it is rich in spring ephemers and ephemeroids that are not characteristic of other parts of Kolkheti.

In the dunes, the groups formed from herbs and woody plants are developed. In the coastal sands, the circum-Mediterranean Sea and Black Sea coastal vegetations are grown, such as: sea daffodil (*Pancratium maritimum*), yellow horn-poppy (*Glautium flavum*), and others. Sea daffodil is a rare and dying relic that is sporadically found in Bichvinta Cape and on the coasts of Kobuleti and Batumi.

Giant cane (*Arundo donax*) grows on the sandy shore Between Bichvinta's Cape and Gagra. Among the vegetation grown in the dunes the narrowleaf cotton bush (*Gomphocarpus fruticosum*) is peculiar, which is found in the countries of Mediterranean Sea coast, the Asia Minor, the Black Sea coast, and China.

Sea spurge (*Euphorbia paralias*), sea holly (*Eryngium maritimum*), and Caucasus mullein (*Verbascum gnaphaloides*) create groups in the sand, directly in the high tide zone of the sea. The groups composed of ephemeral species—catchfly (*Silene euxina*), marine woundwort (*Stachys maritima*), as well as graminaceous-various herbs are developed in the sandy ecotopes, on which the soil formation processes have been developed; the groups of matgrass, hawthorn, and sea buckthorn are developed in well-developed sandy soils. Along with them, the ruscus (*Ruscus ponticus*) grows as well. The cenoses of the Pitsundian pine (*Pinus pithyusa*) of the Tertiary period with the subforests of pink

rock rose (*Cistus cretica*), smoke tree and others are particularly notable.

Also, the cenoses of ruscus are notable, which, like Pitsundian pine, are developed in the areas that are not covered by waves during the sea-high tides. Pitsundian pine alters its location in the north of Gagra and shifts from sandy ecotopes to the limestone rocky ecotopes.

In the sandy dunes the blackberry and introductive timber plants grow, such as acacia, gleditsia, and tree of heaven; from herbs—the invasive crown grass (*Paspalum*), horseweed (*Coniza canadensis*), and others (Kolakowsky 1961; Sokhadze 1968).

Kolkheti Lowland, foothills, low mountain, and mountain vegetation

Before humans modified the vegetation cover of the country, the impassable lowland Colchis mixed-leaved "leshambi" forest (according to Keskhoveli's (1961) terminology) with liana vegetation and evergreen shrub subforest covered the areas of Kolkheti Lowland and foothills in western Georgia that were altered by wetlands in large areas (0–250 m above sea level).

This forest was composed of alder, zelkova, willow, aspen, and wingnut trees and in some areas—hornbeam, chestnut, and Imeretian oak. Today the natural vegetation of Kolkheti Lowland and foothills is no longer preserved; wetlands are dried and forests are cut down. Tea, citrus, fruits, and vegetables are cultivated in this territory. Natural vegetation is preserved in the intermountain gorges and in the lowlands in small remnants.

Even today the forests of Kolkheti Lowland are characterized by the spread of liana, smilax, silkvine, wild grapes, leather flowers, ivy, hop, and others. In the eastern part of the Kolkheti Lowland, the Imeretian oak—resistant to dry climate is spread, as well as zelkova. The evergreen subforest is relatively poor (250–500 m).

In the coastal area (Kobuleti, Poti, and Anaklia), the peat bogs, alder, and wingnut forests are preserved. The forest edges and shallow waters in Kolkheti are covered with giant cane, cattail, reed, sedge, and other groves.

In still and slow waters the water lily, duckweeds, pondweeds, water chestnut, and water buttercups grow, in the wetlands—the species of sedge and rushes, yellow iris, and others. The relic plant—royal fern (*Osmunda regalis*) grows in the bogs.

In Apkhazeti, in the Black Sea coast, there are also found the Mediterranean Sea coastal plant such as: Greek strawberry tree (*Arbutus andrachne*) and briar root (*Erica arborea*).

The main colorfulness of the forest landscapes of western Georgia, as well as in some parts of eastern Georgia, is formed by the mountain wide-leaved forests including: oak trees, oak-hornbeam trees, beech trees, chestnut trees, dark coniferous plants including fir and spruce, pine trees, birch trees, maple trees and rowan trees.

The nature and composition of the mountain's broad-leaved forests are different in the mountain's lower belt within 500 m to 700–1000 m above sea level. Broad-leaved forests distributed here are composed of Georgian oak, hornbeam, chestnut, and Persimmons, and in moist areas—of alder.

In the subforests of these forests, the deciduous shrubs are composed of yellow azalea, common hazel, Caucasian blueberries, Colchis bladder nut, Cornelian cherry dogwood, and others. It is well-developed evergreen shrub subforest with composition of cherry laurel, holly, and common rhododendron. There are many liana plants and different species of fern in this forest. In the lower zone of the mountain, in the limestone areas, especially in the river gorges, the boxwood is common. Boxwoods are preserved in the gorges of the Bzipi and Chakvistskali Rivers and in the vicinities of the Avadhara and the Ritsa Lakes. Their twigs and branches are almost entirely covered with mosses and lichens.

In western Georgia, from 600 to 1300–1400 m above sea level the beech forests are widespread. In moist areas, it inteis mixed with chestnuts, in dry areas—hornbeams. The evergreen shrub subforest is developed there.

There are also found the fragments of redwood—yew (*Taxus baccata*). Some moist and

deep gorges are impassable due to the dense evergreen subforest. Such groves are called rhododendron shrubs. In the forests of Achara-Lazistan the endemic *rhododendron ungernii* is common.

From 1200–1300 m above sea level, the spruce (*Picea orientalis*) and fir trees (*Abies nordmanniana*) are found (Fig. 13.1), which form the dark coniferous forests belt, where the beech is found too. Evergreen and desiduous shrubs are characteristic of these forests, such as the Imeretian buckthorn, the Caucasian mountain ash, daphne, and others.

In Svaneti and Racha-Lechkhumi pine forests and spruce-pine forests are well developed. In the Achara-Imereti Range there are widespread the crooked forests of the Colchis-Lazistan relics of Pontic oak (*Querqus pontica*) and Medvedev's birch (*Betula medwedewii*) and in the Acharstskali River gorge—oak and pine forests.

The upper boundary of the forest in western Georgia stretches at 1700–2000 m and in some areas—at 2200–2500 m above sea level. It is formed by high mountains so-called park or crooked forests. In such forests, shrubs, high herbs and meadows are spread along with birch, single beech, fir, high mountain maple, rowan, and high mountain oak; they create the subalpine belt. In the Achara-Imereti Range, the crooked forests are again created by Pontic oak and Medvedv's birch. The subalpine forests are peculiar due to the strong load of snow cover. Their rods stretch on the ground and in this condition they hibernate. The roots develop in the touching area of the rod with soil, which facilitates the vegetative propagation of wood plants. The crooked forests reach the extreme boundaries of distribution of forest vegetation. On the roads of movement of snow avalanches, they descend and intrude into the forest belt.

In the subalpes the colorful high herbs are characterized by high rods and diversity. The high herbs are formed by inulas**,** hogweeds**,** Larkspurs**,** ragworts**,** aconites and bellflowers**.** In the crooked forest, the rhododendrone often grows often. It often emerges from 1800 m above sea level and then intrudes into subtropical and alpine landscapes.

In subalpes, the highland meadows are widespread; they are ecologically and phytocenically diverse. They include graminaceous (stiff brome, bunch grass, bentgrass, and matgrass), diverse herbs, graminaceous-diverse herbs and sedge meadows.

Kolkheti endemic meadows created by *Carex pontica* and endemic genus of *Woronowia speciosa* are characteristic of limestone ecotopes. Groupings of cranesbills, globe flowers, and anemones dominate among the broad-leaved—various herbs meadows. Fescue meadows are widespread (western Caucasus) too.

In western Georgia, there is the alpine belt from 2400 m to 3100–3200 m above sea level created by shrubs and meadows. In the alpine belt, rhododendrons and cranberries are common.

Fig. 13.1 **a** Upper Svanti, Dark coniferous forest (Picea orientalis, Abies nordmanniana); **b** Pirikita Khevsureti. Shatili area. Derivats of high mountain oak (Quercus macranthera) (Photos by Sh. Shetekauri)

The main formations of alpine meadows are fescue-sedge, matgrass, kobresias, and other meadows. Cranesbills—the various herbs and meadows are widely distributed; the leaves of cranesbill form the whole carpet, which takes reddish color in August, and the plant is covered with large blue flowers that give the unique look to these meadows. In the second half of August, beauties of alpine meadows of western Georgia are the endemic dazzling yellow-flowered *Crocus scharganii* or orange and pink-flowered *Colchicum speciosum.*

The alpine belt ends with diverse low herbs and rock-scree vegetation, characterized by short, stretched stems and large flowers (e.g., buttercups and bellflowers). The role of mosses and lichens also increases, resulting in the creation of alpine meadows. They develop in the smooth relief and old glacier cirques.

The subniael belt is well expressed in Svaneti and Racha from 2900–3100 m above sea level to the permanent snow line. The snow line in Apkhazeti is very low and the subnival belt is weakly represented. Both in western and eastern parts of Georgia, primitive detritus soil ecotopes are developed in this belt; the vegetation cover is fragmented and light; the vital forms of plants are different and the stretched vegetation with dense fluff and succulent leaves prevails there. The percentage of endemic plants is high. Among the endemic genus of the Caucasus the *Symphyoloma graveolens*, *Pseudovesicaria digitata,* and *Trigonocaryum involucrata* grow in the subnial belt. Characteristic plants are mouse-ear chickweed, whitlow-grasses, Caucasian larkspur, rockfoils, veronica, *minuartsia*, etc. (Nakhutsrishvili 1999).

Nival belt starts from 3500–3700 m above sea level. Only one or two species of floral plants reach the mentioned belt. In the ice-free areas the moss and lichen cenotypes are developed.

The rock-fragment-detritus vegetation in Georgia is azonal, but it is basic and widely spread in the subnival and alpine belts. In other zones, it is developed in the erosive ecotopes, avalanches, rock cornices, moraines, and cirques free of snow and ice.

13.2 Vegetation of Eastern and Southern Parts of Georgia

Vegetation of lowland, low mountain hills, and uplands in eastern Georgia. In eastern Georgia, in contrast to western Georgia, the semi-arid and arid zone of vegetation is represented. There are the following belts: semi-deserts, steppe, mountain xerophilic vegetation, and arid light forests (150–600 m); forest (600–1900 m), subalpine (1900–2500 m), alpine (2500–3000 m), subnival (3000–3500 m) and nival (over 3500 m). The forestless formations of semi-arid vegetation—vegetation of mountain fields are spotted In the forest and subalpine zones of highland of southern Georgia.

In the lowland and most part of the foothills of eastern Georgia, the steppes, deciduous shrubs (Shibliak type), and mountain xerophile formations are spread. Most parts of these spaces are occupied by bluestem steppes and buckthorn steppes with domination of matgrass, which are fragmentary altered by feather grass-Fescue steppes. In saline soils dominate mugwort semi-deserts; in the areas, where the soil is very saline, the saline semi-deserts are widespread.

There are widespread groups of dry shrubs, created from black buckthorn, matgrass, and milkvetch (*Astragalus caucasicus*). Additionally, Oriental hornbeam trees, Iberian spireas, *Atraphaeta spinosae*, tamarisk, and others are developed in the floodplain, plain, and arid forest soils.

Steppe vegetation is relatively widely distributed in the Iori Upland (in Shiraki, udabno, and Kajiri plains). Bluestem steppes dominate in brown and chernozem soils. It is rich floristically. Feather grass steps are distributed over the plained crests (Ketskhoveli 1961).

In Zemo Kartli and Kvemo Kartli Plains and Alazani Valley, the steppes are fragmentary distributed and dominate fescue, bluestem-fescue and graminaceous-various herb stepps.

Semi-deserts are stretched in the southeastern part of the Iori Upland and Eldari-Chatmi Lowland in the saline soils and clay and loamy lands or badlands. The main formalities are *Salsola*

dendroides, *Salsola ericoides*, etc. These formations are rich in ephemers and ephemeroides. In the hills and plains, in the saline soils the groups of *Salsola nodulosa*, *Petrosimonia brachiata* da *Salicornia herbacea* and other groups are formed The semi-deserts with *Statice meyeri*, *Glycerrhisa glabra*, *Nitraria schoberi*, etc., are mostly found in the saline soils of the Alazani (Ketskhoveli 1961).

Semi-deserts with mugwort are widespread in the hills and plains; they are also spread in the plain areas, saline clay, loamy and clay-rock badlands.

Steppe and semi-desert vegetation are developed on the areas of former floodplains and plain arid forests. The fragments of the floodplain forests are preserved in the bank areas of rivers.

The large areas of such forests are found in the Mtkvari, Alazani, and Iori floodplains. Their creators are: *Quercus pedunculifora* = *Q. longipes*, *Populus nigra*, *Populus alba*, etc. In the forests of Alazani floodplain, Colchis relic—*Pterocarya pterocarpa* is grown. The subforest is rich in shrubs. In the plains and plateaus, the oak forests (created by the Georgian oak—*Quercus iberica*) and oak-hornbeam forests are developed.

In the Iori Upland, the relic arid light deciduous (with Mt. Atlas mastic tree**,** acacia, and willow-leaved pear) and coniferous (juniper) forests are interesting. The remnants of arid forests are also found in the surroundings of Mtskheta (Shio-Mghvime and Karsani), Ktsia and Algeti river basins.

Mountain vegetation in eastern and southern parts of Georgia

The slopes of mountainous systems of **eastern Georgia** are covered by ecologically and phitolandcape diverse broad-leaved forest belts at a height from 500–600 m to 1800–1850 m above sea level.

In the foothills of the low mountain belt (1000–1200 m), the formation of oaks (Georgian oak), hornbeam oaks, and pine forests are represented. Chestnut forest is also developed in the Kakheti Caucasus, spruce, spruce-fir, and pine forests—in the Lesser Caucasus and in the Didi Liakhvi River gorge; spruce trees are preserved in the Ksani and Aragvi River River gorges, Trialeti Range and Algeti River basin. At those heights, the beech and hornbeam forests are also spread (e.g., in Lagodekhi and Saguramo Nature Reserves, where there is an eastern outpost of *Hedera pastuchowii*).

In Kakheti, in Babaneuri, and Lalikuri, the fragments of the relic zelkova forest are preserved and composed of *zelkova carpinifolia*, which is mixed with Georgian oak.

At the heights from 1100 to 1800–1850 m in the eastern sections of the Greater Caucasus and Lesser Caucasus, the beech, hornbeam-beech, and hornbeam mixed broad-leaved forest formations dominate. In the river gorges of the Kakheti Caucasus a lot of chestnut and lime trees are found. Kakheti Caucasus is distinguished by the fact that in the Batsara gorge—in the upstream of the Alazani River, the yew tree (*Taxus baccata)* forests are well-preserved too; The heights of the trees do not exceed 30 m, the thickness—1.5 m. They cover about 180 ha area, at the height of 1000–1500 m above sea level.

In the Didi Liakhvi River basin, in the Borjomi gorge, in northwest Trialeti, in beech forests, the relic Colchis subforest is developed with domination of common rhododendron**,** cherry laurel**,** Colchis holly**,** Caucasian whortleberry, and Colchis ivy. The birch and pine forests dominate in the forest and subalpine belts at the height of 1850 m high and above (2200–2500 m) on the northern slopes (Khevi, Khevsureti, and Tusheti) of the Central and Eastern Caucasus. The beech forests are not spread in these regions, while the beeches are preserved in the neighboring region of Tusheti—Dagestan.

The subalpine belt (1800–1850–2500 m) in eastern Georgia is created by subalpine forests with maples (*Acer trautwetteri*), high mountain oaks (*Quercus macranthera*), birches, rowan-birches (*Sorbus caucasigena*, *Betula litwinowii*, *B. raddeana*) and beech forests; in Tusheti—pine and bitch forests, as well as the poor in Colchis species high herbs, floristically diverse meadows, rhododendrons, cranberries and willows Fig. (13.2).

Fig. 13.2 **a** Tusheti, mountain forest (Pinus Kochiana, Betula Litwinowii, B. Raddeana, Acer Trautvtteri, etc.); **b** Kazbek, mountain crook-strem of Krumholz (Betula Litwinowii) (Photos by Sh. Shetekauri)

Alpine belt is represented in the mountain ranges of eastern Georgia at the altitudes of 2500–3200 m, which is made of graminaceous matgrasses (on the inclined slopes and plain areas) and fescues (on the southern steep dry slopes), in addition, kobresias and sedges (on the crests of the mountain ranges, where the winter winds prevail and snow is blown off), stretched fescues (on the crests of mountain ranges and northern exposition slopes). Rhododendrons are also spread on the northern exposition slopes.

Subnival belt is located in the Eastern and Central Caucasus from 2900 to 3300 m above sea level to the permanent snow line. In eastern Georgia, the rock-scree detritus is rich in endemic species. The subnival ultraoreophytes of the Caucasus endemic genus are the pseudovesicaria and pseudobetkea. There are lot of representatives of the genus of chickweeds, minuartsia, and veronica. The dense vegetation cover is not developed. The fragments of alpine meadows ca be found here and there. They are created by species of *Taraxacum*, *Campanula,* and *Alchemilla*.

The water and wetland vegetation in eastern Georgia is also azonal. The groves of *Phragmites* and *Typha* form the cenoses in the plains and swampy shores of water bodies, and in semi-deserts—halophytes, the salt-resistant vegettion.

In the mountainous regions, water and wetland vegetation is found in small areas in flatlands and lava plateaus. The Keli volcanic Plateau and Javakheti are especially rich. Sphagnum-scheuchzeria (Svaneti) and sphagnum wetlands are interesting that contains the interesting history of Holocene vegetation. Along the increase in altitude above sea level, the vegetations of water, lakes and wetland gradually become poor. The most characteristic vegetation of the mountain wetlands are: sedge, *Deschampsia caespitosa, Caltha palustris*, *Primula auriculata*, *P. algida,* and others.

The **vegetation of the highland of southern Georgia** is unique. Here are distinguished three zones of vegetation: the middle mountain zone—from 1400 to 1800–1900 m above sea level, subalpine zone—from 1800–1900 to 2500 m and alpine zone—from 2500 m. The narrow strip of the subnival zone is at the Abuli-Samsari Range. The middle mountain zone is a volcanic plateau-like area. It is almost completely utilized and is covered by field crops. Javakheti is distinguished by endemic species of Tetrobi-Chobareti limestone massif, feathergrass steppe formations, pine forests, and thorny astragalous xerophilic vegetation. Fragments of pine, birch, and spruce-pine forests are preserved from the forest vegetation (Javakheti and Tsalka). The former forest spaces are covered with bluestem, feathergrass, and fescue steppes. The subalpine zone of Javakheti Upland is characterized by peculiar mountain steppes. These are the turned into steppe meadows with various herbs and graminaceous formations, composed of different species of steppe, as well as the feathergrass species; from various herbs—Javakheti alfalfa, filipendula, thimes, clover, and sedge species (Fig. 13.3).

Fig. 13.3 **a** Javakheti high mountain meadow, **b** Pirikita Khevsureti, Subulpine Meadow (photos by Sh. Shetekauri)

Among the graminaceous meadows, fescues are notable. Unlike the Caucasus, they are associated with southern dry slopes. On the banks of the rivers, the species of *Agrostis karsensis* = *A. stolonifera* are developed. The mountain xerophile vegetation is widespread among rockfills in the rocky-detritus ecotopes. Alpine vegetation occypies small areas. As a result of grazing, here are presented the secondary meadows of Dwarf lady's mantle, matgrass, etc. On the mountain slopes prevail sedge and kobresia meadows. Alpine meadows hold the detritus slopes in the alpine and subalpine zones. The widely spread wetland and water vegetations are rich in boreal species, especially with the sedges; some of its species form marshes with dry hard clods of earth on large areas (Nakhutsrishvili 1966).

The diversity of vegetation cover is reflected in various types and variants of vegetation vertical zoning systems. The vegetation of western Georgia forms the **Colchis type** of vertical zoning and the vegetation of eastern Georgia—the **Transcaucasian type** of vertical zoning. The transition version between Colchis and Transcaucasian types is represented in Kartli and Trialeti regions. It is true that a complete system of vertical zoning is not represented along the Caucasus, but the high mountainous zones (subalpine, alpine, subnival, and nival) are well expressed. The **central Ciscaucasian type** of vertical zoning is characteristic of Khevi; on the contrary, the **eastern Ciscaucasian type** of vertical zoning—of Pirikita Khevsureti and Tusheti. There is a completely different system in the southern Transcaucasia (Meskheti and Javakheti), where the mountain steppe belt is developed in wide strips—the **southern Transcaucasian**, or the Western Asian type. Here the alpine belt is limited or the subnival belt is rarely expressed.

13.3 Botanical-Geographical Zoning of Georgia

On the basis of the diversity of flora and vegetation, the territory of Georgia is divided into botanical-geographical provinces and okrugs that are different from each other by the structure of vertical zoning of vegetation, floristic complexes, and composition of endemic genus and species (Gagnidze 1974, 1996, 1999, 2000; Gagnidze et al. 2002).

I. Kolkheti or Eastern Euxin Province includes western Georgia. From the north it is bordered by the crestal part of the main range of the Caucasus from Aibga to Mamisoni, from the east and from the south-east—by Likhi, Meskheti, Arsiani and Shavsheti Ranges, and from the west—by the Black Sea.

The province is stretched in the territory of Turkey up to the Melet-Ordu watershed. Due to humid climate and hilly relief, several vertical belts of vegetation are developed here, such as: coastal, summer-green subtropical, mixed broad-leaved, dark coniferous forests, subalpine, alpine, subnival, and nival. This province is

characterized by rich complexes of mesophile flora, in which dominate the endemic species of Kolkheti, Caucasus, and Caucasia.

There are also Mediterranean, Eurasian, East Asian, and other species, as well as several endemic genus of Caucasus and Caucasia, such as: *Charesia*, *Sredinskya*, *Symphyoloma*, etc. The endemic genus of the Kolkheti Province is *Woronowia*, *Alboviodoxa* and *Chymsydia*. Ecological structure of flora is diverse. Lithophytes, especially the calcephytes are infound there (e.g., in the okrug of limestone ranges and massifs of Apkhazeti-Samegrelo and okrug of limestone massif of Racha-Lechkhumi and Imereti). In the limestone ecotopes the endemic florocenotype of subalpine meadow is unique, which is created by *Woronowia speciosa—Carex pontica* and local calcephyte endemic species, such as: *Campanula mirabilis*, *Betula megrelica*, *Potentilla imerethica*, *Campanula radchensis,* etc. The meadow-high-herbs, forest mesophile, and hemixerophile florist complexes, as well as the dendroflora (cherry laurel, common rhododrndron, and Colchis holly) of the evergreen subforest, are rich in composition of species.

The Kolkheti Province is divided into seven okrugs in the territory of Georgia.

II. Elbrus-Kazbeg or Central Ciscaucasus Province includes the Tergi River basin on the southern slope of the Caucasus in the territory of Georgia. It is represented by one okrug. In the west, it extends to the peak of the Adai-Khokhi in North Ossetia; in the east—to the Mount of Borbalo. There are subalpine, alpine, subnival, and nival zones developed.

High mountain area is rich in species of rock-scree-detritus and moraines, meadows, various herbs, and graminaceous floristic complexes; the western and northern slopes are covered with birch trees (Litvinov's and Radde's birches) and rhododendrone shrubs. The characteristic species of high mountains is the mountain is *Cerastium kazbek,* and from the Caucasus monotype genus —*Symphyoloma* and *Triganocaryum.*

As above mentioned, the province is represented as one okrug in the territory of Georgia.

III. Tusheti-Dagestan or Eeastern Ciscaucasian Province is also represented as one okrug in the territory of Georgia. From the west, it is bordered by the watershed range of the rivers of Asa and Arghuni. In the east, the province is spread in Dagestan. Due to the medium and high mountainous relief, here are developed the forest, subalpine, alpine, subnival, and nival belts. For the forest belt (especially in Tusheti), a pine forest is common that is found in the subalpine zone too together with birch trees.

In the landscape, rhododendron's role is reduced. In the scree-detritus floristic complex of the subnival belt, the monotype endemic genus of the Cebtral Eastern Caucasus is found, such as *Pseudovesicaria*, *Symphyoloma,* and *Trigonocaryum* and rare, endemic genus of *Pseudobetckea*, characteristic of slate Dagestan. There are also found many xerophile species.

The province is represented as one okrug in the territory of Georgia.

IV. In the Iveria or eastern Transcaucasian Province, in the territory of Georgia are united the southern slopes of the Caucasus in the east of the Likhi Range, southern subranges of the Caucasus, and Kartli and Kakheti plain—lowlands. The province is characterized by semi-desert, arid forests, shibliak and mountain xerophile vegetation, summer-green deciduous and dark coniferous forests, subalpine and alpine belts.

In the western part of the province, the complexes of mesophile flora enriched in the Colchis species (Colchis holly, Cherry laurel, and common rhododendron) dominate. The florist complexes of arid forests (Mt. Atlas mastic tree and, juniper) are characteristic of the province; Caucasian endemic species prevail in forest and highland meadows and scree-detritus florocenotypes. The number of Colchis endems decreases; in the eastern part, e.g., in Kakheti Caucasus Okrug, there are found yew, wingnut, chestnut, etc. Some of the hirkani species reach this okrug. Among the rare species the *Iris iberica*, *Gentiana lagodechiana*, Kakheti endemic species—*Gymnospermium smirnowii,* and others are common. Akhaltsikhe hollow is rich in endemic species, where the species of Asia Minor xerophile complexes are also in big amount.

Due to the flora diversity, the province is divided into four okrugs.

V. **The Lesser Caucasus Province** includes the Trialeti and Somkhiti or Loki Ranges, as well as the mountain systems of Shua Khrami in the territory of Georgia. The latter is composed of Bedena massif, which is a watershed of the rivers of Khrami and Algeti, Belindag Barehead and Gomeri Ranges, Iragvi flatland, and Kviriketi and Shindlar massifs. The province continues in Armenia and Azerbaijan.

The province is represented by steppe, hemixerophile vegetation, semi-desert, and arid forests, broad-leaved (600–1400 m above sea level), and dark coniferous forests (1400–1800 m above sea level) and subalpine (up to 1800–2500 m above sea level) belts. The hemixerophile and xerophile floristic complexes are intruded in the broad-leaved and, sometimes, in the dark coniferous forest belts. The western part of the province is under the influence of the Kolkheti Province.

Climate is continental in the central and eastern directions of the Lesser Caucasus province; Climate and relatively low altitudes of this region of the province greatly influenced on vertical distribution of vegetation and floristic; the broad-leaved and subalpine belts are basic; the dark coniferous forest belt is limited, and in the east is completely dropped out. Original look of natural floristic complexes has been modified by the influence of anthropogenic factors. The steppe and shrub (hemixerophile) complexes with domination of Oriental hornbeams and black buckthorn prevailed at their stead. Subalps are mainly formed by the graminaceous-various herbs in secondary meadows. In the province, pine forest fragments are found as well.

The province includes two okrugs.

VI. **The Southern Georgia's highland and Western Asian Province** comprises the Javakheti Upland, Akhaltsikhe hollow and Eruzeti hill in the territory of Georgia,. The remnants of the florocenotype complexes of mountain steppe and steppe meadows are preserved here, which are composed of bridal veil, fescue, koeleria, bromes, alfalfa and sainfoin. The narrow strip of the subnival belt is expressed in the Abuli and the Samari Ranges. On the volcanic relief (in the lakes and marshes), the rich floristic complexes are developed.

Tetrobi limestone massif is rich in endemic species, such as *Scorzonera dzhavakhetica* and *S. ketzkhovelii,* etc. In this province, the species of Armenian highland and Western Asia are also grown.

There are two okrugs in the province.

VII. The Mtkvari-Aras province includes the Kvemo Kartli Lowlands and Eldari Plain-lowland in the territory of Georgia. The zonal type of vegetation is semi-desert fragments (mugworts, salsolas, and others).

The province includes one okrug.

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