



Abstract

Georgia is a very interesting country in respect of the biological and landscape diversity. There are two classes, 20 types, 40 sub-types, and 71 genera of landscapes in Georgia. The distribution of the landscapes in different regions of Georgia is also extremely uneven. General overview of basic landscape types, landscape diversity, virgin landscapes, phytoresources of the landscapes, and anthropogenic transformation of the landscapes are discussed in this chapter.

15.1 Georgia on the World Background

Georgia is a small country and with its social-economic or physical-geographical properties, is not much remarkable in the world arena. Georgia occupies only 0.02% of the total land area of the world. Due to its small area, Georgia does not outstand either with great areas of forests, agricultural lands (38%), protected areas, or great number of flora or fauna species (Nikolaishvili and Matchavariani 2011); however, on the other

hand, the country is diversified, specific and even unique in many respects. The major reason for the outstanding nature and uniqueness of Georgia is its geographical location and versatile natural conditions.

Georgia is a very interesting country in respect of the biological and landscape diversity. As a part of the Caucasus, the country is on the lists of: (1) 25 biologically richest and endangered “hot spots” of the world (CI, CEPF), (2) 200 sensitive and vulnerable eco-regions of the world, (3) locations of endemic bird habitats (BirdLife International), (4) one of the world centers of agro-bio-diversity, (5) “hot spots” of large herbivores (WWF) (An Ecoregional Conservation... 2006; Bio Diversity of the Caucasus... 2001). This list can be made longer if considering such factors as well-preserved diversity of species and ecosystems in the country, richness of Georgia in endemic, relict, medicinal, and decorative plant species, forests occupying over 40% of the territory of the country on the one hand and the environment of the country not subject to major changes like many regions of the world on the other hand. Therefore, in an environmental respect, Georgia looks a much “cleaner” region in the world (Beruchashvili et al. 2002). Besides, Georgia is one of the outstanding countries in the world in respect of landscape diversity, and with the rich biodiversity, Georgia is ahead of many countries (Beruchashvili 2000a, b). These natural values are still less studied and the ecological function

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Georgia can play on a global scale is not thoroughly realized yet.

15.2 Principal Landscapes of Georgia

According to N. Beruchashvili’s Landscape map of the Caucasus, there are two classes, 20 types, 40 sub-types, and 71 genera of landscapes in Georgia (Beruchashvili 1979, 1980, 2009). Mountain and plain landscapes on the territory of the country are distributed very unevenly. Mountain landscapes occupy 53.1 thousand km² making 76% of the country area. Even according to the altitudinal zoning, the landscapes are distributed too unevenly in the mountains (Fig. 15.1): the low-mountain landscapes occupy 3% of the total territory of Georgia, mountain depressions occupy 1%, lower-mountain landscapes occupy 12%, middle-mountain landscapes occupy 24%, upper-mountain landscapes occupy 7% and High Mountain subnival and nival landscapes occupy 1% of the total territory of Georgia (Nikolaishvili and Matchavariani 2015). The landscapes of meadows and meadows-and-steppes occupy almost equal areas in the plains, lowlands, and mountains. These landscapes are most common in the mountain depressions of the Great Caucasus and high plateaus of South Georgia. Karst and volcanic landscapes occupy

little areas, with 8% and 6% of the total territory of Georgia, respectively (Nikolaishvili and Chikhradze 2017).

The distribution of the landscapes in different regions of Georgia is also extremely uneven (Table 15.1). Plain landscapes occupy largest areas in Kakheti region (5.4 thousand km² making over 40% of the total territory of the region) (Nikolaishvili and Chikhradze 2017). Kakheti is also outstanding with the areas of low-mountain and upper-mountain forest landscapes. Mtskheta-Mtianeti region falls little back with the area of the upper-mountain forest landscapes. The middle-mountain forest landscapes occupy the largest area on the territory of Apkhazeti amounting to almost 30% of the total territory of the region. The high mountain subalpine landscapes occupy the largest areas in Imereti and Samegrelo-Zemo Svaneti, while high mountain alpine landscapes occupy the largest area in Mtskheta-Mtianeti (Nikolaishvili and Chikhradze 2017). Middle-mountain forest landscapes and high mountain subalpine landscapes occupy larger areas in West Georgia (Abkhazeti, Samegrelo-Zemo Svaneti, Imereti, Adjara, Guria, Racha-Lechkhumi -Kvemo Svaneti), while lower- and upper-mountain landscapes are mostly spread in the east of the country. As for the alpine landscapes, they occupy almost equal areas in the both regions of Georgia (Nikolaishvili and Matchavariani 2015).

Fig. 15.1 Distribution of landscapes according to altitude

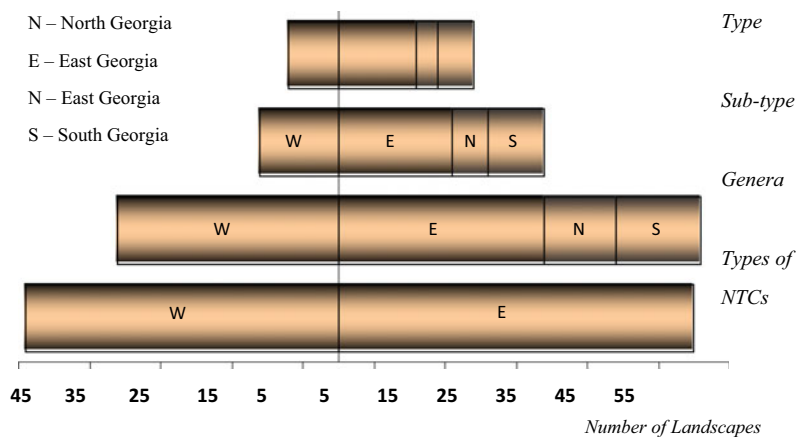


Table 15.1 Area of landscapes of Georgia according to the regions (thousand square km)

Regions of Georgia	Plain	Mountain depression	Middle mountain				High mountain subalpine, High plateau	High mountain alpine	Other	Sum
			Low mountain	Middle-mountain	Upper mountain	Sum				
Abkhazeti	2.959	0.000	0.876	2.506	0.237	3.619	0.990	0.191	0.667	8.426
Samegrelo-Zemo Svaneti	2.624	0.010	0.126	1.800	0.144	2.070	2.474	0.456	0.809	8.443
Imereti	2.865	0.144	0.195	2.427	0.143	2.765	2.564	0.092	0.000	8.430
Adjara	0.768	0.000	0.709	0.718	0.272	1.699	0.219	0.046	0.000	2.732
Guria	1.443	0.000	0.043	0.444	0.156	0.643	0.387	0.600	0.000	3.073
Racha-Lechkhumi-Kvemo Svaneti	0.000	0.055	0.000	1.106	0.618	1.724	0.564	0.351	0.088	2.782
West Georgia	10.659	0.209	1.949	9.001	1.570	12.520	7.198	1.736	1.564	33.886
Kakheti	5.396	2.571	0.756	1.846	0.963	3.565	0.982	0.165	0.287	12.966
Shida Kartli	1.045	0.000	1.137	0.328	0.078	1.543	0.336	0.203	0.087	3.214
Mtskheta-Mtianeti	0.371	0.000	0.614	1.640	0.920	3.174	1.056	1.247	0.642	6.490
Samtskhe-Javakheti	0.144	0.901	1.626	0.856	0.253	2.735	1.923	0.671	0.161	6.535
Kvemo Kartli	1.814	0.193	0.867	2.162	0.000	3.029	1.615	0.099	0.000	6.750
East Georgia	8.770	3.665	5.000	6.832	2.214	14.046	5.912	2.385	1.177	35.955
Total	19.429	3.874	6.949	15.833	3.784	26.566	13.110	4.121	2.741	69.8

Source Nikolaishvili and Chikhradze (2017)

Bold / Italic express the sum of West and East Georgia

The Major Landscapes of Georgia Are Plain and Piedmont hilly subtropical humid (Kolkhish forest) landscapes are spread in West Georgia—on Kolkheti Lowland and in the zone of its adjacent piedmont, mostly at 0–600 m asl and at 0–800 m asl in the eastern part of Kolkheti—Imereti Plateau. These landscapes occupy 9.64 thousand km², making almost 14% of the total territory of Georgia. Their original natural appearance is strongly changed and agricultural plots of field cover vast areas. Virgin NTCs have survived only in the reserves and bogged areas of Kolkheti.

Plain and Piedmont hilly sub-Mediterranean semi-humid landscapes with forest and shibliak (dry shrubs) are spread mostly within the limits of plains of Shida Kartli and Kvemo Kartli and on the adjacent hilly piedmont, as well as Bichvinta Cape and Kovaluki upland. In West Georgia, they occupy 0–300 (600) m asl, and 400–800 (900) m asl in East Georgia (Kakheti, Shida Kartli, Mtskheta-Mtianeti, Samtskhe-Javakheti, Kvemo Kartli). In the vegetation period, due to relatively less atmospheric

precipitations, the effect of sub-Mediterranean climate occurs, and as a result, they are attributed to the sub-Mediterranean type. The largest area is occupied by steppe vegetation, as well as shibliak, phrygana, and sparse arid forests. The areas of mixed-hardwood forests are limited and they are mostly found in West Georgia. The landscapes are intensely modified as a result of economic activities. The landscapes found on Kovaluki Plateau have maintained their original natural appearance better.

Plain and piedmont hilly subtropical semi-arid landscapes with steppe, shibliak, and semi-desert vegetation are spread within the limits of plains in East Georgia, at 200–600 (800) m asl. They cover the plains of Shida Kartli and Kvemo Kartli and Iori Plateau. Steppes and shibliak dominate with dominant semi-desert vegetation at some locations. Almost the whole areas of the landscapes are modified: they are intensely crossed with the irrigation systems and are covered with agricultural plots of field (vegetables, fruit, winter pastures). Due to the near location of roadsides and settled areas, the ecological

situation with these landscapes is very severe. These landscapes have maintained their original appearance a little better within the limits of Iori Plateau.

Plain and piedmont hilly subtropical arid desert and semi-desert landscapes spread in the south part of Iori Plateau, in the zone bordering Azerbaijan. They are more vastly spread on the territory of Azerbaijan. They occupy 0.09 thousand km² making only 1.2% of the whole territory of Georgia. Despite being unpopulated, these landscapes are subject to a strong impact due to intense grazing. The amount of phytomasses here is one of the least in Georgia. The phytomass reserve makes 0.054 mln. t (0.01% of the total phytomass reserve of Georgia), productivity is 2.5–3.0 t/ha annually.

Moderately warm plain semi-humid forest landscapes transient to the subtropical type are spread within the limits of Alazani Plain, at 200–600 m asl. They occupy an area of 1.27 thousand km² making only 1.8% of the total area of Georgia. The landscapes of the plains in East Georgia receive the most amounts of atmospheric precipitations. This is why the natural vegetation has more or less Kolkhish appearance. A significant part of the territory is modified owing to the human's economic activities.

Hydromorphic and sub-hydromorphic marsh, meadow and tugai landscapes are spread at the locations with high humidity—in the central part of Kolkheti Lowland and along the gorges of the rivers in East Georgia. They occupy 1.74 thousand km², making only 2.5% of the total area of Georgia. The vegetation cover is hydromorphic, with dominating marshes and floodplain forests. The degree of anthropogenic transformation is particularly high along the gorges of the rivers.

Mountain subtropical semiarid steppe, shibliak, arid sparse forest landscapes are spread in East Georgia, in the eastern part of Iori Plateau, and in Azerbaijan beyond the borders of Georgia. Hypsometrically, they occupy 300 (400)—900 (1100) m asl and 2.31 thousand km², making only 3.3% of the total area of Georgia. Their original appearance is well preserved.

Mountain subtropical arid semi-desert and desert landscape spreads in East Georgia, on the northern edge of Eldari Lowland, over the southern slope of Eldari Ridge. It occupies much larger area on the territory of Azerbaijan within 200–700 m asl altitudinal range, covering 0.05 thousand km². Its original natural appearance is well preserved.

Mountain moderately warm humid landscapes are spread both, in west and East Georgia—over the Great Caucasus and the Lesser Caucasus, at 300 (600)–1500 (1700) m asl in East Georgia and 700–1800 (2000) m asl in West Georgia. They occupy 19.36 thousand km², what is almost 28% of the total area of Georgia. They are less modified due to human's economic activities. This is particularly true with the middle-mountain forest landscapes. Within the limits of the lower-mountain forest landscapes, the agricultural plots of field (vineyard, orchards, watermelons, melons and gourds, plantations) occupy vast areas.

Moderate mountain semi-humid middle-mountain shibliak, arid sparse forest, phrygana, meadow-steppe landscapes are spread in South Georgia—over the northern and eastern slopes of Erusheti mountainous area, at 1600–1900 m asl. They occupy 0.19 thousand km², making 0.3% of the total area of Georgia. They occupy vast areas in Armenia. They are mostly used as pastures. They partly occupy the agricultural plots of fields, mostly cereals.

Moderate mountain semiarid landscapes transient to the moderately warm type with steppes, meadow-steppes, phrygana, and shibliak are spread in South Georgia, within the limits of larger areas within the limits of Armenian Plateau. They occupy 1.85 thousand km² what is 2.7% of the total area of Georgia. Their original natural appearance is strongly changed. They are mostly used as pastures, and partly as agricultural plots of field (cereals, vegetables, potatoes).

Moderately cold mountain landscapes are spread over the southern slopes of the Great Caucasus and northern slopes of the Lesser Caucasus, mostly in West Georgia. They are

spread at (1000) 1400–2000 (2200) m asl altitude and occupy 9.73 thousand km² what is 13.9% of the total area of Georgia. Their original natural appearance is well preserved. Hypsometrically, dark coniferous and beech forest-dark-coniferous forests are spread at lower altitudes, while pine forests and birch forests grow at higher locations. The areas with dark-coniferous forests are less modified what is hardly true with pine or birch forests.

High mountain meadow subalpine forest-shrub-meadow and alpine shrub-meadow landscapes are spread over the southern slopes of the Great Caucasus and northern slopes of the Lesser Caucasus. They are spread at (1500) 1800–3000 (3200) m asl altitude and occupy 14.7 thousand km² what is 21% of the total area of Georgia. Their vast areas are occupied by summer pastures and hay-meadows.

High mountain subnival landscapes are spread mostly in the Great Caucasus Mountains and as fragments over Abul-Samsara and Javakheti Ridges. They are spread at 3000–4000 m asl altitude and occupy 14.7 thousand km², what is approximately 2.1% of the total area of Georgia. These landscapes are unsettled and in fact, are not under the impact of any economic activity. Their original appearance is well preserved.

High mountain glacial-nival landscapes are spread in the ridge zone of the Great Caucasus and as fragments over its southern slope. They cover the territories of the mountainous areas of Apkhazeti, Svaneti, Racha, and East Georgia. They are stretched as an almost continuous strip from Bzipi Valley to Mamisoni Pass. They are the area of eternal snow and glaciers. They occupy 3.47 thousand km² what is almost 5% of the total area of Georgia.

15.3 Landscape Diversity in Georgia

“Every corner of Georgia and nature of this country generally, is the most beautiful on earth”, —wrote Arthur Leist, a German write,

publicists, and translator. The nature of Georgia is indeed rich and diversified, and it is fairly called the country of contrasts. The Kolkhish forests are extremely rich in species, high-productive fir and pine forests, virgin forest massifs, bulk of mineral sources, rare, endemic and relict flora and fauna species, fruitful soils of East Georgia, unique red soils (krasnozems), buried rare monuments of flora and fauna, natural nutrition areas, high hydroelectric potential, great biological and landscape diversity—are an incomplete list of the natural riches of Georgia, which are so much in the country. It should also be noted that the specific weight of the areas, which are under intense anthropogenic impact, is little. The ecological problems of Georgia have a more local nature and with their severity fall much back many regions of the world. This is why they say that Georgia has high environmental potential, which can be used to further develop recreation and tourism in the country.

Georgia is located in the Alpine-Himalayas geotectonic zone of Eurasia, which is stretched for almost 12 thousand km between the coastlines of the Atlantic and Pacific Oceans. In addition to the Great Caucasus and Lesser Caucasus, there are the Pyrenees, the Alps, the Apennines, the Carpathians, Elbrus, Kopet Dag, the Pamirs, Tian Shan, the Himalayas and other mountain ranges stretched here. The mountain ranges on the territory of the Caucasus form a kind of group, with Georgia located in its key section. Such state of affairs has had a peculiar impact on the geological structure and relief of Georgia.

High, average and low mountains, upland regions and plateaus at different altitudes, plains and lowlands, mountain depressions, and dissected and fractured deep gorges are all found on the territory of the country. Georgia is fairly referred to as a mountainous country. $\frac{3}{4}$ of the territory of Georgia is occupied by mountains. In an economic respect, the plain and lowland zones are most important, with over 80% of the country population living there and with almost all cities and towns, settlements, and agricultural plots of field: plantations, orchards, vineyards, and arable lands found here.

With the types of relief, there are four large units identified on the territory of Georgia: the Great Caucasus, intermontane plain, the Lesser Caucasus, and Javakheti Plateau. North of the country, there are the Great Caucasus Mountains with eternal snow and glaciers stretched for almost 900 km. Its tallest and most cliffy part is its central section (the tallest mountain is Shkhara (5203 m)).

In the southern part of the country, there stretches volcanic Javakheti Plateau, a flattened surface at 1500–2100 m above sea level filled with lava flows. Javakheti, Samsara, Erusheti, and Nialiskure Ridges are found only in the extreme zone of it. The Lesser Caucasus—high ridges of Ajara-Trialeti, Arsiani, and Shavsheti and average-mountain massif of Khrami border Javakheti Mountains as an arch. The highest peak is mount Kanlismta (3307 m) on Arsiani Ridge.

Georgian intermontane plain stretches between the Great Caucasus and the Lesser Caucasus and creates a kind of a corridor between the eastern and western parts of the country. Its highest location is Likhi Ridge, the watershed of the Black and Caspian Seas.

The mountain rivers of Georgia, which are quite narrow and flow through steep-sided gorges, often form ravines, passes, and canyons. Some rarest monuments of inorganic nature are: Enguri ravine, Dashbashi and Okatse Canyons, Dariali, Khidikari, and Akhatskhi passes. Some of them, as the objects protected by the state, are included on the Red List of Georgia.

Despite the small territory, the landscape spectrum in Georgia is extremely diversified under the influence of various factors: the history of geological development, complex orographic conditions, great hypsometric amplitude, and location on the brink of floristic zones (Mediterranean, Central European Plains, Iran Mountains, and Central Asia). In Georgia, there are landscapes ranging from coastline dunes, beaches, and marshes in West Georgia and semi-deserts and steppes in East Georgia and through high mountain subnival and nival landscapes. The landscapes typical to various soils and grounds with calcific, psammophyte,

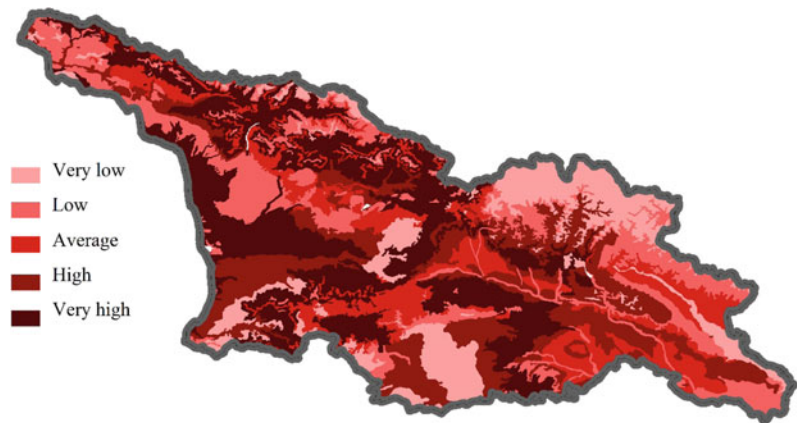
petrophilous, hydrophilic, and other types of vegetation spread locally.

With the number of landscape groups, Georgian ranks the 14th in the world, and with the types of landscapes, it ranks the 12th (Isachenko and Shliapnikov 1989). With these features, Georgia is among the leading regions of Europe. As for the landscape diversity per unit area, with this indicator, Georgia ranks the first not only in Europe but all over the world. As the scientists have estimated, average of two types of landscapes is spread per 90 thousand km² of land in the world, while 22 types of landscapes are seen on 69.7 thousand km² of the territory of Georgia. This is why Georgia was named “the world landscape laboratory” (Beruchashvili 2000a, b). With its landscape diversity, Georgia is much ahead of other, even bigger countries, such as Germany, Italy, Spain, Greece, Ukraine, Peru, Columbia, Venezuela, etc.

It is known that mountainous areas commonly have more diversified natural conditions than lowlands. This is also true with the landscape diversity of Georgia—the diversity gets richer from plains toward the mountains. With the total number of the types of the vertical structures of the natural-territorial complexes (NTCs), mountain landscapes twice exceed the plain landscapes. In addition, an increase in the landscape diversity as the absolute altitude increases mostly occurs from plains to piedmont and lower-mountain landscapes, and from middle-mountain to the upper- and high mountain landscapes at higher altitudes. However, at a certain classification grade of landscapes (e.g., genera), in some cases, plains show more diversity than mountain landscapes (Fig. 15.2).

The greatest diversity is observed in Kakheti, and this is not surprising, as this region has absolutely different physical-geographical units: (1) Iori Plateau and Eldari Lowland with steppe and semi-desert vegetation, (2) Alazani Valley and Great Caucasus of Kakheti with mesophytic humid NTCs, and sometimes with NTCs typical to Kolkheti (partly, Hyrcanian), (3) Tusheti depression with closed barrier ridges and high mountain subnival and nival landscapes. Such a contrast in natural conditions cannot be found in

Fig. 15.2 Landscape diversity of Georgia



any other region of Georgia (Beruchashvili 2000a, b; Nikolaishvili 2008a, b). With the landscape diversity, the second outstanding region is Apkhazeti with the landscapes from Sub-Mediterranean NTCs and those typical to Kolkheti through high mountain subnival and nival NTCs. The least number of the types of vertical structures of NTCs is fixed in Samtskhe-Javakheti, while in other regions, this indicator is average.

Among mountain landscapes, the most diversified are lower-mountain forest landscapes. Such diversity is associated with the fact that these landscapes are located between the piedmont and middle-mountain landscapes. Consequently, the NTCs typical to different hydrothermal conditions can be seen there. The highest diversity is observed with the lower-mountain forest landscapes in Shida Kartli, which are stretched on the southern slope of the Great Caucasus and northern slope of the Lesser Caucasus. These landscapes are located between the semi-humid piedmont and middle-mountain moderately warm humid landscapes (Nikolaishvili and Matchavariani 2015). The near location of the piedmont semi-humid landscapes results in the presence of semi-humid NTCs near its lower limits, while the near location of the middle-mountain forest landscapes results in the presence of humid NTCs at its upper limit (Nikolaishvili, 2009).

The middle-mountain forest landscapes are more homogenous. However, the difference

between the landscape genera is seen even with them. In particular, the greatest diversity can be observed with the middle-mountain forest landscapes spread on the northern slope of the Lesser Caucasus. The least diversified landscapes are observed along Adjara-Guria section, with dominant beech forest ecosystems with Kolkhic sub-forest or hemihiles. A bit more diversified are the middle-mountain forest landscapes located on the boundary between the areas of beech and dark-coniferous forests (Nikolaishvili and Matchavariani 2015).

15.4 Virgin Landscapes

For the history of mankind, owing to the anthropogenic impact, the areas, structure, process of functioning, natural potential, social-economic functions, and degree of anthropogenic transformation of different landscapes have been changed significantly. The same is true with the landscapes of Georgia. However, the anthropogenic changes of the environment in Georgia had no such large scales as in many regions of the world—in Eastern Europe, Central America, South-East Asia, etc. This is also evidenced by the fact that the specific weight of the virgin landscapes in Georgia is high. It is estimated that the proportion of virgin forests is 10% of the whole territory of the country (Beruchashvili 2000a, b). This is quite a high indicator making Georgia look quite solid in the world without an

analog in Europe. The greatest proportions of the Georgian forests are preserved in the mountains and they have soil protection, water regulation, environmental protection, resource-production, and recreational functions.

Under the aegis of the World Bank, the results of the study accomplished to estimate the dynamics of the forest cover in the central part of the Caucasus (the comparison of Landsat imagery of 1989 and 2000) identified no major changes. Relatively intense changes were observed in the environs of Bakuriani, Adigeni, and Khaishi. In other areas, some minor changes in the forest cover were fixed. It is interesting to note that due to the population migration from the mountainous areas to the lowland, the areas of the upper-mountain landscapes and partially, middle-mountain landscapes have increased at certain locations. For instance, the area of the pine forest on the Great Caucasus of Racha increased by 5–10% (Beruchashvili et al. 2002).

15.5 Phytoresources of the Landscapes

The landscapes of Georgia much differ **with the amounts of phytomasses**. The maximum amount of phytomass (500 t/ha) is typical to the average-mountain beech-dark-coniferous forests, while the minimum amount (1–2 t/ha or less) is typically found in the semi-desert and high mountain subnival landscapes. A particularly large interval of variation of the amount of phytomass is seen in the landscapes with dominant forest NTCs. The primary reason is that there are NTCs without forests (degraded forests massifs, secondary meadows) beyond the forests, as well. Therefore, these landscapes are characterized by a great variation in the amounts of phytomass. The greatest range of the phytomass amounts is typical to the lower-mountain and upper-mountain forest landscapes. The natural-territorial complexes with less than 50 t/ha and more than 600 t/ha amounts of phytomass are typical to the lower-mountain forest landscapes what can be explained by the fact that these landscapes border the landscapes with little forest

or no forest at all (Nikolaishvili and Matchavariani 2015). With the amount of phytomass, middle-mountain forest landscapes with abundant beech forests (300–500 t/ha) rank the second (Nikolaishvili 2009), and the lower-mountain Kolkhish landscapes rank the third (with 250–300 t/ha of phytomass) (Beruchashvili 1995; Tediashvili 1984).

The highest *productivity of phytomass* is common in the middle-mountain forest landscapes of West Georgia with dominating beech-dark-coniferous forests (Landscapes Nos. 125, 126) with average amount of 15–20 t/ha annually. This is caused by long productive conditions with active functioning of needles phytomass (Tediashvili 1984). The beech-dark-coniferous forests of East Georgia fall somewhat back. The productivity of phytomass is also high in the middle-mountain forest landscapes with dominating beech forests. With this indicator, west and East Georgia do not differ much. This can be explained by the almost equal duration of productive daily conditions for middle-mountain forest landscapes. The productivity of phytomass is the lowest in the arid landscapes of East Georgia with semi-desert vegetation (2.5–3.0 t/ha on average). The duration of productive daily conditions here amounts to only 40–45% of the total annual duration. The duration of these stexes is also small in the high mountain subalpine and alpine landscapes (approximately 40% and 30–35% of the total annual duration, respectively). The productivity of phytomass is accordingly low here.

15.6 Anthropogenic Transformation of Landscapes

Due to the anthropogenic impact, the landscapes of Georgia were subject to significant changes. Some critical sites were formed in some landscapes—the fragmented and degraded sites. On the background of extinction of a number of species of flora and fauna, degradation of landscapes, and reduction of their areas, the landscapes get more and more fragmented and diversified. High level of fragmentation is typical

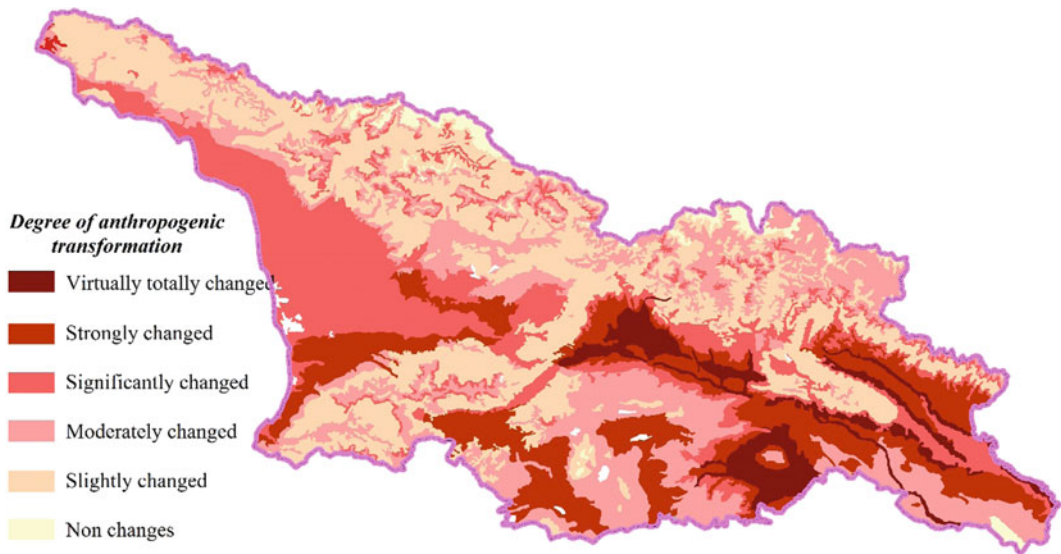


Fig. 15.3 Anthropogenic transformation of landscapes of Georgia

to the plain landscapes, which are transformed significantly as a result of economic activity and are fragmented with a complex network of infrastructure. In the mountains, the most fragmented are lower-mountain forest landscapes rather than middle-mountain forest or high mountain subalpine landscapes located at higher hypsometric altitudes.

The identification of critical sites, particularly, NTCs in the landscapes, is based on several criteria: (1) the condition, which will cause undesirable ecological trends in the landscape. This means the sensitivity of the landscape and its instability to the natural or anthropogenic impact, (2) uniqueness/rarity necessitating its special protection (Beruchashvili et al. 2006a, b; (3) the territories with conservative value—the ability to maintain stable structure and ecological stability of the landscape, and (4) green plants in the urban area and in urban environs.

The indicator of critical NTCs is quite high in Georgia. They cover over 70% of the total territory of Georgia with 90% of the supply of phytomass of the country. This is quite a high indicator resulting from the large areas of vulnerable NTCs.

The major proportion of critical NTCs (over 90%) is found in mountain landscapes.

Particularly high proportions are found in middle-, upper- and high mountain subalpine landscapes. The primary reason for this is instable NTCs found here, with typical trans-elluvial migration regimes and high surface inclination. Besides, the largest areas in the middle-mountain forest landscapes are occupied by virgin NTCs and NTCs with a particularly high conservative value. The number of critical sites in the landscapes with large areas modified by the human activity is relatively less. Such are plain landscapes in the first instance with 25–27% of their total area as the critical areas.

The degree of anthropogenic transformation of the landscapes much depends on the population density, agricultural plots of field, number of industrial enterprises, and density of the transport network (Nikolaishvili et al 2010). Based on the analysis of these factors, one can identify six categories of the degree of anthropogenic transformation of the landscapes of Georgia (Fig. 15.3) (Nikolaishvili 2009).

I. *Virtually totally changed landscapes* with high population density (300 men or more per 1 km²), high specific gravity of the agricultural plots of field (over 80% of the total landscape area) and with 18% of the industrial enterprises of Georgia (Nikolaishvili and Matchavariani

Table 15.2 Some demographical parameters of landscapes of Georgia

Landscape types	Area, thous. km ²	Size of population, thousand	Percent of the population	Population density, 1 per km ²	Number of settlements
Subtropical humid	9.64	2087.1 1712.8	38.6 36.2	292 266.8	1572 1150
Sub-mediterranean semi-humid	2.58	1603.3	29.7	929	495
Subtropical semiarid with steppe, dry shrubs and semi-deserts	2.24	814.1	15.1	363.4	219
Subtropical arid with deserts and semi-deserts	0,09	–	–	–	–
Thermo-moderate, transitional to subtropical forest	1.27	137.5	2.5	108.3	107
Plains Landscapes	17.56	4642	86	323.4	2393
Hidromorphic and subhidromorphic with swamp, meadow, and tugai	1.74	–	–	–	–
Subtropical semiarid with steppe, dry shrubs, and open woodlands	2.31	–	–	–	–
Subtropical arid with deserts and semi-deserts	0.05	–	–	–	–
Low-mountain forest with hornbeam-oak and polydominant forests	8.14	314	5.8	30.4	895
Middle-mountain with beech and hornbeam-beech forest, partially with evergreen understory	11.22	115.3	2.1	10.2	589
Semi-humid, transitional thermo-moderate with open woodland, dry shrubs and meadow-steppes	0.19	4,6	0,1	24,2	12
High plateau with steppe and meadow-steppes	1.85	246.3	4.5	128.3	256
Thermo-moderate with beech-dark coniferous and birch, partially with pine and oak forest	9.73	59.3	1.1	11.9	189
High mountain meadows	15.19	19,3	0,4	1,8	92
Glacial-nival	3,47	–	–	–	–
Mountain Landscapes	52.15	758.8	14	36.9	2033
Total	69.71	5400.8 4371.5	100	77.5	4426

Source Nikolaishvili et al. (2010)

2015). 2 genera of landscapes are such landscapes and they are presented by plains and hills of Shida Kartli and Kvemo Kartli. These landscapes occupy small areas amounting to 1% of the total territory of Georgia; however, a significant number of the population of Georgia (13%) is concentrated on them (Table 15.2). The landscapes are intensely fragmented with agricultural plots of field and transport networks.

II. *Strongly changed landscapes* with high population density (150–200 men per 1 km²), high specific gravity of the agricultural plots of

field (60–80% of the total landscape area), and with the majority of the industrial enterprises of Georgia (63%). 15 genera of landscapes are such landscapes occupying quite large areas (19% of the total territory of Georgia): a major part of plain and piedmont landscapes—Kolkheti Lowland (without hydromorphic landscapes), a part of Shida Kartli and Kvemo Kartli and piedmont and Javakheti Plateau, as well as the territories of Alazani Valley and Iori Plateau adjacent to Gombori Ridge. The floodplain landscapes of East Georgia (unsettled, but intensely exploited

by agricultural plots of field) are also such landscapes. These landscapes are significantly fragmented with agricultural plots of field and transport networks.

III. *Significantly changed landscapes* with average population density (100–150 men per 1 km²) and high specific gravity of the agricultural plots of field (40–60% of the total landscape area). 5 genera of landscapes are such landscapes occupying almost 8% of the total territory of Georgia. 12% of the population of Georgia is concentrated on such landscapes. It covers Racha depression, Zemo Imereti Plateau, Odishi Plateau, and Apkhazeti Piedmont. 9% of the total number of industrial enterprises of Georgia and over 5% of extremely polluting plants of all plants of the country is found on such landscapes. The number of enterprises per 10 km² is insignificant and is 0.4, and the number of extremely polluting plants is as little as 0.1.

IV. *Moderately changed landscapes* with low population density (50–100 person per 1 km²) and 20–40% of the agricultural plots of field of the total landscape area. 10 genera of landscapes are such landscapes. Such landscapes cover mostly low-mountain forest landscapes and house only 6% of the total population of Georgia. The number of enterprises is also little.

V. *Slightly changed landscapes* with low population density (less than 50 persons per 1 km²) and less than 20% of the agricultural plots of field of the total landscape area (Nikolaishvili and Matchavariani 2015). Most landscapes (36) are such landscapes, in particular, Eldari Valley semi-desert landscapes, a major territory of Iori Plateau where there are winter pastures, as well as middle-mountain forest and high mountain forest landscapes. The great proportion of high mountain subalpine and alpine landscapes used as winter pastures also belong to this category.

Thus, virtually totally changed landscapes occupy only 1% of the territory of Georgia, while strongly changed landscapes occupy 19% of the territory of the country; the shares of the significantly and moderately changed landscapes are the same and equal to 8%. Most territory of Georgia, over half of it (58%) is occupied by slightly changed landscapes.

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