



Abstract

The protection of nature has a long history in Georgia. Its natural environment is now substantially modified, which was conditioned by the development of production, by increase of cities, industrial centers, means of transport, and population, which in its turn caused the violation of environmental regularities and relation between the environmental factors and natural resources established for centuries—variation of natural environmental components, quantitative and qualitative changes of its individual factors: soil, air, and water basin pollution, forest fires, floods, activation of erosive processes, landslides, mudflows and, etc.

The environmental protection and the reasonable use of natural resources are of particular importance to such a mountainous country like Geor-

gia. Its natural environment is now substantially modified, which was conditioned by the development of production, by increase of cities, industrial centers, means of transport, and population, which in its turn caused the violation of environmental regularities and relation between the environmental factors and natural resources established for centuries—variation of natural environmental components, quantitative and qualitative changes of its individual factors: soil, air, and water basin pollution, forest fires, floods, activation of erosive processes, landslides, mudflows and, etc.

Today, the implementation of environment protection measures in the country is directed to ensure stabilization of the components of nature and entire environment, during which the normal conditions will be established for human health, labor, and life. Climate, water resources, soils, mineral resources, vegetation cover, animal world, etc. are the main natural treasures of Georgia and their protection is of great economic and nationwide importance.

Considering the factor of urbanization is important in environmental protection. Urbanization and its related processes (concentration of population and industry in big cities, car park growth, etc.) have certain negative impact on the environment.

The separate components of the environment (climate, water, soil, etc.) are closely linked with the exchange of substances and energy, so that

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imbalance of any of them, e.g., contamination, causes the degradation of another one.

Atmospheric air pollution source is a thermal power plant, industrial enterprises (metallurgical, chemical, oil processing, cement (Fig. 18.1), and other plants), and transport. As a result of their functioning, a large number of substances are released, such as: CO, CO₂, SO₂, O₂, NO, NO₂, O₂, Pb, soot, etc., as well as more toxic substances (phenol, formaldehyde, etc.).

The main air pollution of atmospheric air is the emission by the transport, which is 80–90% of total pollution. The rate of industrial and transport contamination reached its peak at the end of the 80s of the last century, and in the 90s—it has been gradually reduced due to economic decline, and now in the conditions of relative economic stability, it has increased again. In this respect, it should be specially noted so-called “Hot Spots”—urban territories (with high density of population, industry, and transport concentration)—the capital and industrial towns: Rustavi, Zestaponi, Kaspi, and others (Fig. 18.2).

Protection of water resources and their rational use is one of the most important problems in the overall environmental protection complex and is considered the main direction of

our country's economic strategy. The current law on “Water in Georgia” (1997) determines water economy activities and ensures water protection.

Due to the influence of anthropogenic factors, the physical and chemical compositions of underground and surface waters, especially within the settlements, are substantially modified. The following rivers are most contaminated: Mtkvari, Mashavera, Vere, and Debeda. In the water of Mtkvari, organic compounds and heavy metals (copper, zinc, and molybdenum) dominate, and in the area of Rustavi city—oil products, phenols, and caprolactam; index of bacteriological pollution is high as well.

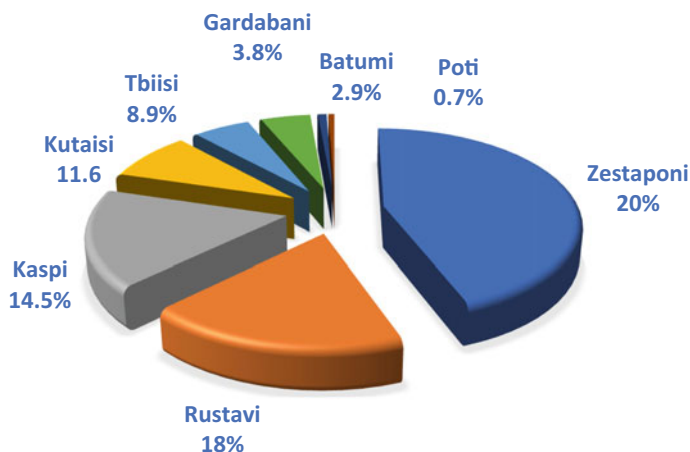
Level of surface water pollution by heavy metals is high in the Kazreti ore zone (concentration of copper is increased by 50–70 times, of iron—by 18–20 times, and of zinc—by 110–130 times).

The Black seawater is also significantly polluted by anthropogenic influence, which leads to a number of negative consequences, some of which have an irreversible character. Bacteriological contamination of seawater has become a common occurrence. Petroleum products were considered to be the main pollutant of seawater and now remain so. The influx of alien species of warty comb jelly (*Mnemiopsis leidye*; its total



Fig. 18.1 Asphalt plant

Fig. 18.2 The share of individual cities in the pollution of atmospheric air



biomass reached 900 million tons) and the alien species of jellyfish (Atlantic Ocean inhabitant) have destroyed the most share of zooplankton that affects the flora and fauna of the sea. However, now their number is reduced. The transportation of Caspian oil and oil products provided by the “TRACECA” program also has a significant effect on the contamination of the Black Sea water by oil.

For Georgia, as a mountainous and land-poor country, soil protection is of great importance. The area of arable lands is 0.14 ha per capita in Georgia. The area of arable lands has been significantly reduced; the reasons for this include: erosion, concession of farmlands to the industry, construction, etc. Arable lands are lost by cultivating perennial crops on them, as well as turning them into fallow lands, etc.

Erosion rates are especially high in mountainous areas. In Georgia, in the agricultural zone, 308.2 thousand hectares are under erosion, including 205.7 thousand hectares—underwater erosion and 102.5 thousand hectares—under wind erosion; eroded pastures are 496.6 thousand ha and hay lands—50.2 thousand ha (Nakaizde and Makharadze 1999). Nowadays this indicator has increased significantly because of the activation of erosive processes caused by “accelerated anthropogenic” impact.

With the development of water and wind erosions, powerful landslides and mudflows are generated in mountainous regions, causing harm

to Georgia’s environment and economy. Soil salinization and solonetzization have increased in Georgia. If in 1928 such soil area was 8.7 thousand ha, in 1966 it was 33.7 thousand ha, and in 1980—205 thousand hectares, i.e.,—22 times and more. This is 7.4% of the total area of agricultural lands, i.e., 3.0% of the entire territory of the country (Gogoberidze 1984). Therefore, the fight against the salinization of soils is a special task.

Nowadays soil contamination with heavy metals and other inorganic pollutants is one of the serious ecological problems. The influence of the Zestaponi ferroalloy plant and the Madneuli ore-dressing and processing enterprise is significant on region’s pollution by heavy metals: Cd, Cu, Mn, Ni, Pb, Zn. The residual quantity of mineral fertilizers and toxic chemicals is recorded in many regions of the country on the lands intensively used in agriculture.

Industrial and household wastes cause environmental pollution and worsening of ecological conditions. Three thousand tons of wasted (garbage) were taken from Tbilisi daily. In the past century, the polygons were allocated for wastes without taking into account the geological, hydrological, and landscape-geochemical conditions. Currently, these polygons are officially sealed, but their negative impact on the environment continues.

In Tbilisi, pollution of surface waters and underground waters is high at the polygons of

Gldani solid household wastes. Concentrations of some heavy metals (Pb, Cu, Co) exceed the maximum allowable concentration, a high concentration of aromatic hydrocarbons is observed, among which the carcinogenic and toxic compounds exceed the maximum permissible concentration (Dvalishvili 2011). Sometimes the landfills are **spontaneously** arranged directly in the river floodplains (Figs. 18.3 and 18.4) that further increasing the technogenic impact on surface waters.

Mineral resources need a stable protection and care because it belongs to the category of exhaustible resources. One of the strong land destructive activities is the extraction of minerals in open quarries; the area of such lands exceeds 6 thousand ha. Only a small part of them (0, 08%) are recultivated.

Vegetation, as an important component of the environment, is greatly changed and its current look reflects the influence of both the natural development and anthropogenic factors. 56 species are included in the “Red List” of Georgia; among them, 36 species are granted vulnerability status, 18 species are endangered, and 2 species are critically endangered (Ordinance of the Government of Georgia on approval of “Red List” 2014, <https://matsne.gov.ge/ka/document/view/2256983>).

The present situation of the animal world has been greatly conditioned by the influence of spontaneous household activity of humans in the past and the facts of poaching; and this component of the environment has been modified the most than other ones. 135 species of fauna are included in the “Red List”, 87 species of which are vulnerable, 32 species—endangered, 11 species—critically endangered and 5 species are extinct at the national level (Ordinance of the Government of Georgia on approval of “Red List” 2014, HTS: <https://matsne.gov.ge/ka/document/view/2256983>).

About 40% of the territory of Georgia is covered by forest. The forests of Georgia have a specific nature, which is expressed in their special purpose. Almost all forests of Georgia or 98.3% belong to the first group of forests located on the slopes of the mountains and have soil protection, water protection, resort, sanitary-hygienic, aesthetic, and other social-protective functions. The remaining 0.7% of the forest belongs to the second group and is mainly located in the Kolkheti Lowland.

The total forest fund of Georgia includes forest and non-forest areas with the total area of 3005 thousand ha, including 1738 thousand ha or 57.89% in western Georgia, and 1267 thousand ha—in eastern Georgia. Most of the forest areas



Fig. 18.3 Landfill on the Mtkvari Riverbank (Photo by E. Salukvadze)



Fig. 18.4 Landfill in the area of the Gldani Lake (Photo by E. Salukvadze)

are in Apkhazeti—507 thousand ha or 16.9%, followed by Kakheti—384 thousand ha or 12.8%, Imereti—344 thousand ha or 11.8% and, etc. Out of entire forest fund, the 2770 thousand ha or 92.3% is covered by forest. The highest indicator of regional forest rate (65.5%) (relation of the forestland area with the whole territory of the region) is in Achara, where the 188.96 thousand ha is covered by forest; 57.8% (265.63 thousand ha)—in Racha-Lechkhumi-Kvemo Svaneti, 55.7% (479.9 thousand ha)—in Apkhazeti, etc. (Kandelaki 2013).

The reserve of timber is 418.6 m³; the average increase of timber is 3.8 million m³, including 0.9 million m³ for coniferous forest, 2.3 million m³—for strong leaved forest, 0.4 million m³—for soft-leaved forest, and 0.2 million m³—for the remaining varieties. Although the rate of decrease in the area has been reduced in the recent years and the activities of forest restoration have increased, they still can not achieve the desired level.

During the last 10–15 years the forest was planted on more than 20 hectares, but it is still 5–6 times behind the forest areas to be restored. Recently the forest areas have been significantly reduced due to uncontrolled exploitation, cutting, and forest fires.

Especially intense deforestation took place around towns and transport highways during energy crises in the 90s of the twentieth century. In 1990–2008, timber was mostly exported to Iran (37.8%), Armenia (26.6%), Turkey (21.3%), and Italy (9.7%) (Kandelaki 2013).

As the main part of the forests of Georgia have a nature-protective function, the deforestation is strictly limited by law; though the illegal cuts of forests are common. (Table 18.1; Fig. 18.5).

Not only the old and over-aged trees are being cut, but also the young precious species that result in the violation of biodiversity of species, among which the endemic and relic species are particularly vulnerable.

In some regions (Racha, Lechkhumi, Svaneti, and Guria) decrease in the number of population (last 20–30 years) and their depopulation is observed, which is why forest areas began to increase. The area of the former farmlands was replaced by pine, hornbeam, lime, and others. In this respect, forest areas have increased by 5–6% (Beruchashvili 2002).

Forest fires have increased in the last decade (2000–2010). During the war with Russia, the fire was spread over the 950 hectares of land in Borjomi municipality and 70% of the forest was

Table 18.1 Illegal deforestation

Year	1990	1995	2000	2001	2002	3003	2004	2005	2006	2007	2008
Amount of deforested wood, m ³	4506	47,562	43,021	43,278	53,212	57,733	47,484	47,345	45,432	42,255	32,356

**Fig. 18.5** Deforested young spruce-fir forest, resort Bakhmaro (Photo by E. Salukvadze)

destroyed in 700 hectares. The endemic and relict forest massifs were destroyed, including the untouched forest sections, as well as the fertile soil layer, restoration of which requires hundreds of years. Many animals were also killed, including the ones listed in Red Book of Georgia. Their habitat environment was destroyed. The fire was spread even in the nature reserve

territories of Borjomi-Kharagauli National Park, where the 4 centers of fire were reported (Amiranashvili et al. 2008) (Fig. 18.6).

In February 2010, 150 ha forests were burned in Gonio (Achara), 30 hectares—in Kvareli, and 25 hectares—in Baghdati municipalities. Particularly frequent cases of forest fires (23) were recorded in 2017. Especially extensive was a fire



Fig. 18.6 Forest in Borjomi after fire, 2008 (Photo by N. Bolashvili)

in 2017 in Borjomi municipality—at more than 100 hectares (<https://sputnik-georgia.com/georgia/20170907/237228448/>) (Table 18.2).

The new Forest Code and the National Strategy are adopted, which will regulate forest use in the state forests.

Protection of natural hay lands and pastures that provide the main part of the food for cattle breeding is of great importance. The hay lands and pastures occupy about 1638.4 thousand ha in Georgia. Among them, 159.1 thousand ha or 7.9% are hay lands and 1479.3 ha or—90.2%—

pastures, 310.6 thousand ha or 21% occupy winter pastures, and 1168.7 thousand ha or 79%—summer pastures (high mountains).

Georgia is distinguished by diversity of landscapes; as a result of anthropogenic impact, they are significantly transformed (natural-agricultural areas, recreational-territorial complexes, complexes related to industry, transport). In spite of this, there are still preserved the untouched (potentially possible) primitive landscapes in Georgia with a total area of 7024 km², which is 10% of the entire area of Georgia

Table 18.2 Forest fires in Georgia

Years	1995	2000	2005	2008	2011	2012	2013	2014
Number of fire cases, unite	1	34	16	32	4	11	35	69
Forest area in fire, ha	7	85	26	126	7	199	88	705
Damage caused by fire, thousand GEL	0.3	11.3	0.6	170.4	–	–	–	–

(Beruchashvili 2000). They are natural wealth of Georgia and their rational use will give the country a significant economic benefit.

Different types of protected areas are distinguished on the territory of Georgia to protect individual representatives of landscapes, flora, and fauna. These territories and main activities carried out there, are defined by the “Law on Protected Areas” (1996), according to which the Georgian protected areas were adapted with the categories established by the International Union of Nature Conservation (IUCN). For the protection of nature, the first area was allocated in 1912—the Lagodekhi Nature Reserve was established, and in later period the nature reserve became the main form of protection of natural territories in Georgia.

Today there are 14 Strict Nature Reserves in Georgia with the total area of 139, 048.80 ha, which is 2.4% of the territory of Georgia. Except for Strict Nature Reserves, there are other types of protected areas in Georgia: National Parks, Managed Reserves, Nature Monuments, and Protected Landscapes.

Currently, the total area of Protected Areas of Georgia is 593.063 ha, which is 8.55% of the country’s territory (<http://apa.gov.ge/ge/protected-areas/reserve>). In addition, there are other types of areas in Georgia, where the certain regime of protection is being implemented; these are the recreational forests (395.90 ha) including the resort forests (119.40 ha), and green zones (276.50 ha) (Kajaia 1999).

For the preservation of natural diversity in the Caucasus, including Georgia, the World Wildlife Fund (WWF) implements the works supported both by international and regional organizations. The first national park in the Caucasus region—the Borjomi-Kharagauli National Park (Area 60,576.4 ha) was created in 1995 with the help of the WWF and the Government of Germany, which made a basis for establishment of national parks in the Caucasus region.

Environmental protection and restoration are reflected in special legislation, which includes the legal bases for the use of natural components

and resources. The public demand for healthy environment is strengthened by the Clause 3 of the Article 34 of the Constitution of Georgia, which states that “everyone has the right to live in a healthy environment, enjoy the natural and cultural environment; all are obliged to take care of the natural and cultural environment.”

The law on “Environmental Protection” (1996) is the main document regulating the protection of natural resources and their effective use, thus protecting the soil, forest, water, water resources (rivers, lakes, underground waters, etc.), living and non-living nature monuments (rare plants, waterfalls, unique geological formations, etc.), unique landscapes, etc. The law proves the basic ecological requirements of agricultural activities carried out in various fields and determines the role of the public during the implementation of ecological monitoring and control.

Georgia is actively involved in the international projects on global ecological safety of environment protection, maintenance of ecological balance, protection of ecosystems, and providing sustainable development principles. Our country is joined to the world’s important international conventions on environmental protection (UN, Ramsar, Kyoto, Basel, Stockholm, Europe, etc.) (Chikhradze 2002).

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