ISET

REVIEW OF THE CONDITION OF THE ENVIRONMENT AND STOCKS OF NATURAL RESOURCES IN GEORGIA

Authors:

Norberto Pignatti, Mariam Chachava, Erekle Shubitidze
Dachi Kiziria, Marika Mesiridze

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Acronyms

AA	Association Agreement
APA	Agency of Protected Areas
AR	Autonomous Republic
CENN	Caucasus Environmental Non-Governmental Organization Network
IRSWR	Internal Renewable Surface Water Resources
IRWR	Internal Renewable Water Resources
ISET-PI	International School of Economics at TSU Policy Institute
EPA	Environment Protection Agency
EPR	Extended Producer Responsibility
EU	European Union
FAO	Food and Agriculture Organization
FSU	Former Soviet Union
GA	Georgian Amelioration
GDP	Gross Domestic Product
Geostat	National Statistics Office of Georgia
GEL	Georgian Lari
GoG	Government of Georgia
LEPL	Legal Entity of Public Law
LLC	Limited Liability Company
MEPA	Ministry of Environment Protection and Agriculture of Georgia
Mln	Million
MRDI	Ministry of Regional Development and Infrastructure of Georgia
MW	Megawatt
NAM	National Agency of Mines
NAPR	National Agency of Public Registry
NEA	National Environment Agency
NMVOC	Non-Methane Volatile Organic Compounds
No	Nobelium
NRM	Natural Resource Management
OECD	Organization for Economic Co-operation and Development
Pb	Lead
Pm	Promethium
SIDA	Swedish International Development Cooperation Agency
Ths	Thousand
TJ	Terajoule
TSP	Total Suspended Particulates
UNECE	United Nations Economic Commission for Europe
USAID	United States Agency for International Development
USD	United States Dollar
WHO	World Health Organization
WMTR	Waste Management Technologies in Georgia
WWTP	Waste Water Treatment Plant

Preface

Natural resources, such as land, water, air, minerals, forests, and fisheries, all provide fundamental life support, in the form of both public-good and consumptive services, which also greatly affect the quality of human life. As such, a proper Natural Resource Management (NRM) allows for the sustainable utilization of resources and moreover ensures that the services provided continue to be accessible over time.

Managing natural resources adequately requires a clear understanding into the existing condition of the main resources, and into their quantitative and qualitative evolution over time. At times, choices must be made between the alternate uses of natural resources, those with vastly different short and long-term outcomes. Such choices could ultimately lead to fundamentally different levels of societal well-being. Consequently, it is desirable for the decision-making process to be as inclusive and transparent as possible, and for all individuals and institutions interested in contributing to the discussion to have access to the relevant information.

However, gathering the necessary data is not always easy, or even feasible. Thus in order to support the broadest participation of public debate on the management of natural resources in Georgia, with thanks to support from the Swedish International Development Cooperation Agency (SIDA), ISET Policy Institute (ISET-PI) has compiled all the publicly available information regarding Georgian National Resources into this single report.

Our hope is that this research will help improve the inclusiveness, the transparency, and the quality of the decision-making processes associated with the management of natural resources in the Republic of Georgia, leading to better informed choices and higher levels of well-being for Georgian society.

1. Land Resources in Georgia

Land is vitally important for both human life and economic activities, it is moreover considered the primary factor of production for all sectors, especially agriculture. In Georgia, it has been estimated that almost half of the natural wealth of the country is associated with the soil (Phkhakadze, 2020). Where the lowland zone[1] encompasses only 46% of territory (Geostat, 2020), with the remainder covered by hills and mountains.

1.1 Overview of the legal and institutional arrangement

Land reforms have been carried out in Georgia across different periods, and these have generally had more social than economic purposes. The Republic of Georgia was among the fastest Former Soviet Union (FSU) countries to implement a large-scale land reform and land redistribution plan, starting in 1992. In doing so, it managed to limit declining agricultural output (Lerman et al., 2003) during a period – the early 1990s – in which it experienced one of the sharpest declines in economic activity of recent history; the per capita Gross Domestic Product (GDP) fell by more than 70 percent between 1990 and 1994.

The land registration process began in the late 1990s and continued until 2004; with the state's Department of Land Management providing these services. However, in 2004 the department was replaced by the National Agency of Public Registry (NAPR) that provides registry services for immovable and movable property, as well as a real estate cadaster. The formal registration of agricultural land began again in 2008, based on existing village and municipal maps. Thereafter in 2010, the Georgian parliament passed a law on state property, which set new regulations on the privatization of state-owned agricultural land. In 2016 another phase of land registration reform commenced with the goal of clarifying cadastral data for plots of land. The land registration process is currently still ongoing in two ways: the systematic implementation of cadastral work on land plots in selected pilot regions (under which the government registers each plot at its own expense) and sporadic attempts (working throughout the country, based on the willingness of a landowner to register land). Land registration is still underway, therefore the final data regarding land ownership is not yet publicly available. Therefore, most of the data currently accessible on land registry is likely outdated (the available data is represented below in the following sub-chapter).

In 2019, the Ministry of Environment Protection and Agriculture of Georgia (MEPA) issued an order,[2] by which the National Agency for Sustainable Land Management and Land Use Monitoring was established. This agency is responsible for land balance,[3] the registration of

[1] An area where the land is at, near, or below sea level and where there are not usually mountains or large hills.
[2] On approval of the Statute of a Legal Entity under Public Law: entitled the National Agency for Sustainable Land Management and Land Use Monitoring, N2-1258, 26 December 2019.
[3] Consolidated information reflecting the legal and factual status of the Land Fund of Georgia. *Source*: "On Approval of the Rules for Compiling the Land Balance and Accounting for Agricultural Land Resources," Resolution of the Georgian government N166.

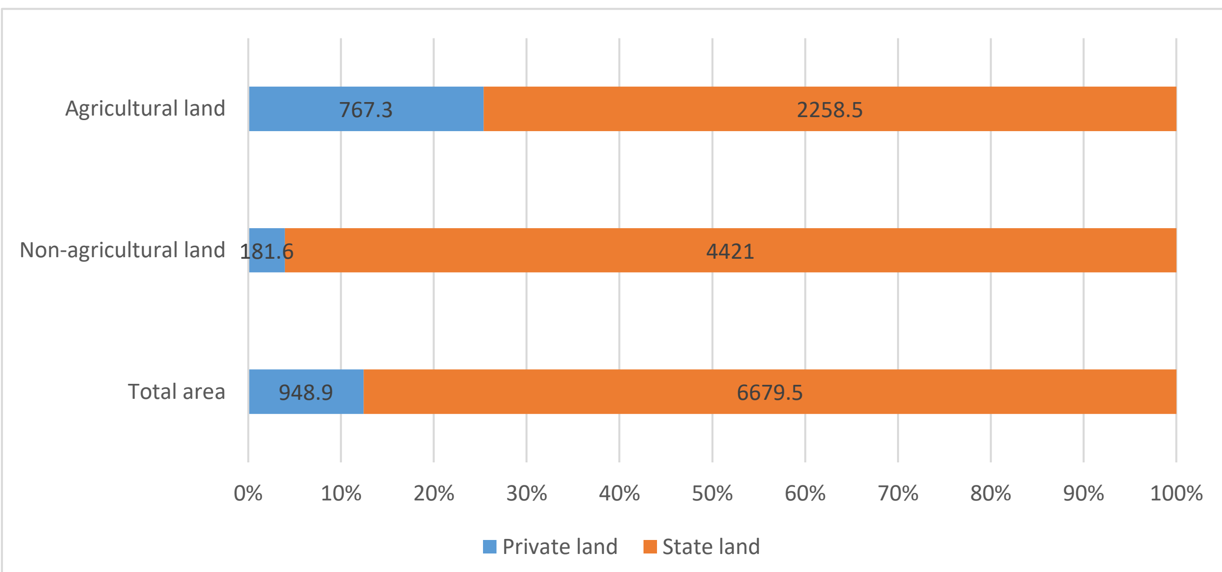
agricultural land resources, and the creation of a unified database, which monitors land use and provides access to relevant information.

1.2 Land ownership

The total area of Georgia is 7,628.4 thousand hectares, including Abkhazian territorial waters, and the Tskhinvali region. The available land can be divided in two general categories: 39.7% of the total area is agricultural land,[4] and the remaining 60.3% is non-agricultural land[5] (State Department for Land Management of Georgia, 2004).

A significant part of the population has not yet registered the land at their disposal. The most recent publicly available data regarding land ownership is derived from the State Department for Land Management and dates from 2004. According to this data, around 12.4% of the total area was owned by the private sector in 2004, while the remaining 87.6% was state land (see Figure 1.1). The difference was even greater for non-agricultural lands, where only 3.9% belonged to the private sector, and 96.1% to the state. As for agricultural lands – 25.4% were private and 74.6% were state-owned.

Figure 1.1 Distribution of agricultural and non-agricultural lands by ownership (kha)



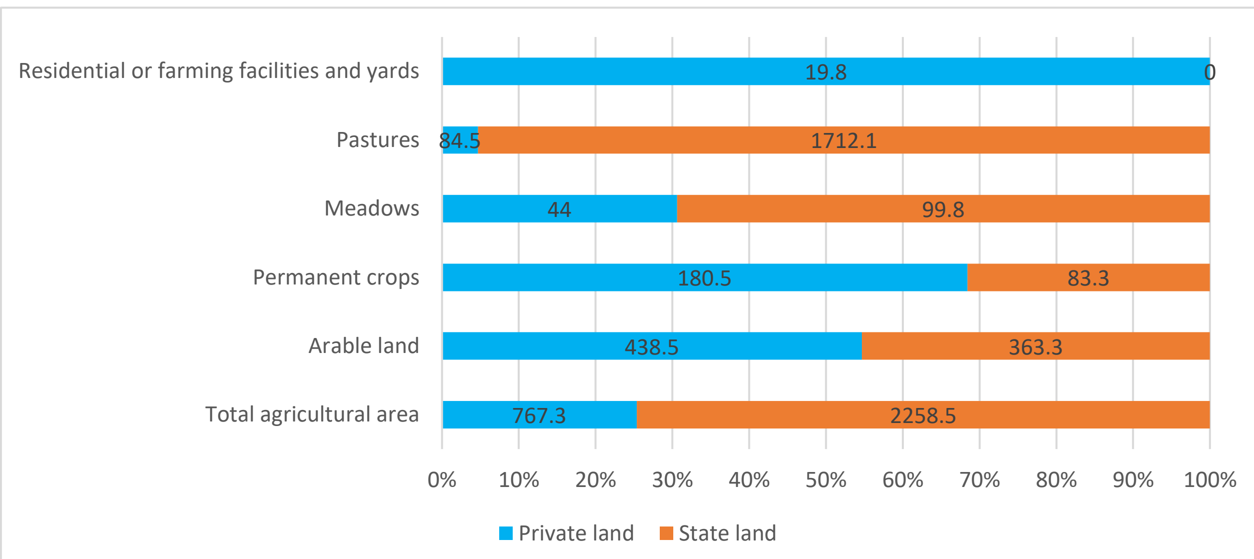
Source: The State Department for Land Management of Georgia, 2004

[4] Agricultural land is typically that devoted to agriculture, and the systematic and controlled use of other forms of life – particularly the rearing of livestock and production of crops.
[5] Non-agricultural land is that upon which no agricultural activities are conducted and from which no agricultural products are derived.

Figure 1.2 shows the various categories of agricultural land and the distribution between the state and private sector in 2004. Residential or farming facilities and yards were solely within the private sector. However, the total area in this category was relatively small – only 19.8 thousand hectares. Permanent crops, grown on 8.7% of the total agricultural area, were also found mostly under private sector ownership – 68.4% on private land and 31.6% on state land. The greatest part of Georgia's agricultural land was used for pastures – 59.4% of the total agricultural area – and was predominantly owned by the state; only 4.7% of pastures were controlled by the private sector, with the remaining 95.3% registered as state land. This contrast in the ownership of pastureland is one of the main contributors to the difference in total land ownership between the private and public sector.

Agricultural land is typically owned by agricultural holdings (companies, individuals, or households that produce agricultural products, excluding the state), whereas non-agricultural land is largely possessed by non-agricultural holdings (namely, companies that do not produce agricultural products, including residential facilities).

Figure 1.2 Land cover by tenure and agricultural land categories (kha)



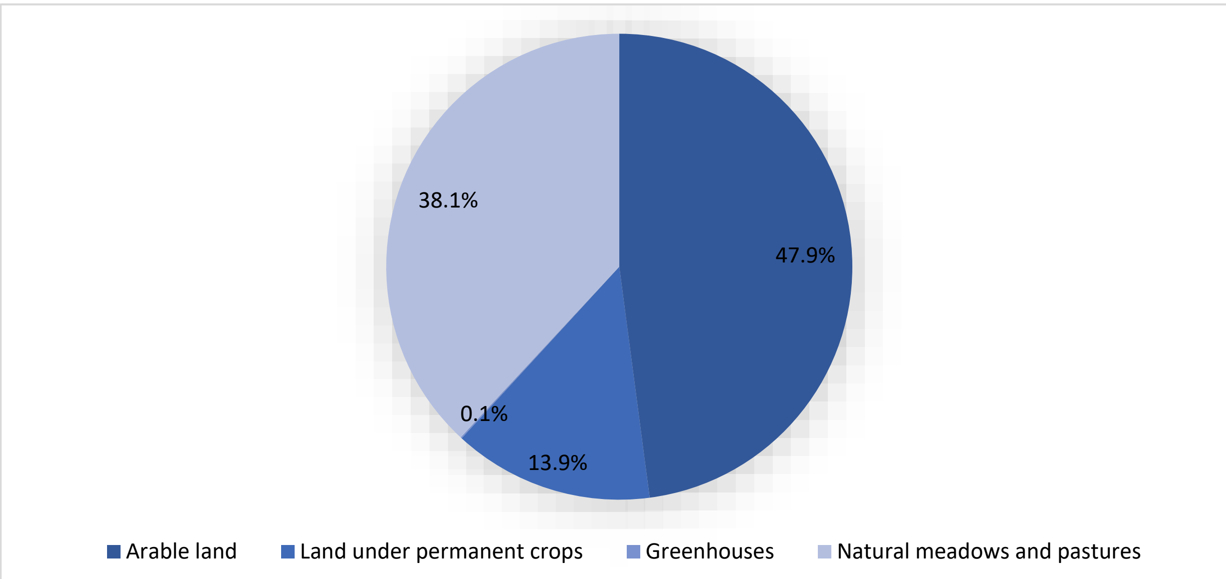
Source: State Department for Land Management of Georgia, 2004

In 2004, 77% of agricultural holdings' possessions were agricultural lands – predominantly pastures (58% of that total) and arable lands (12.7%) – while only 23% was non-agricultural land. Concerning non-agricultural holdings, 97.8% of their assets were non-agricultural and only 2.2% agricultural lands – mostly pastures, which comprised 1.8% of their total possessions. A substantial part of state-owned non-agricultural lands were forests, water (including inland waters), and protected areas – forests amounted to 54.3%, water 18.9%, while the share of protected areas was 6.4%.

Agricultural holdings

Comparable to land ownership data, the information on the land possessed by various agricultural holdings is also not fully up to date. The latest available data is from Georgia's agricultural census of 2014. This reveals that arable lands amounted to 47.9% of the total agricultural territory owned by agricultural holdings, while natural meadows and pastures consisted of 38.1%, while 13.9% was permanent crop area, and only 0.1% was made up of greenhouses (see Figure 1.3).

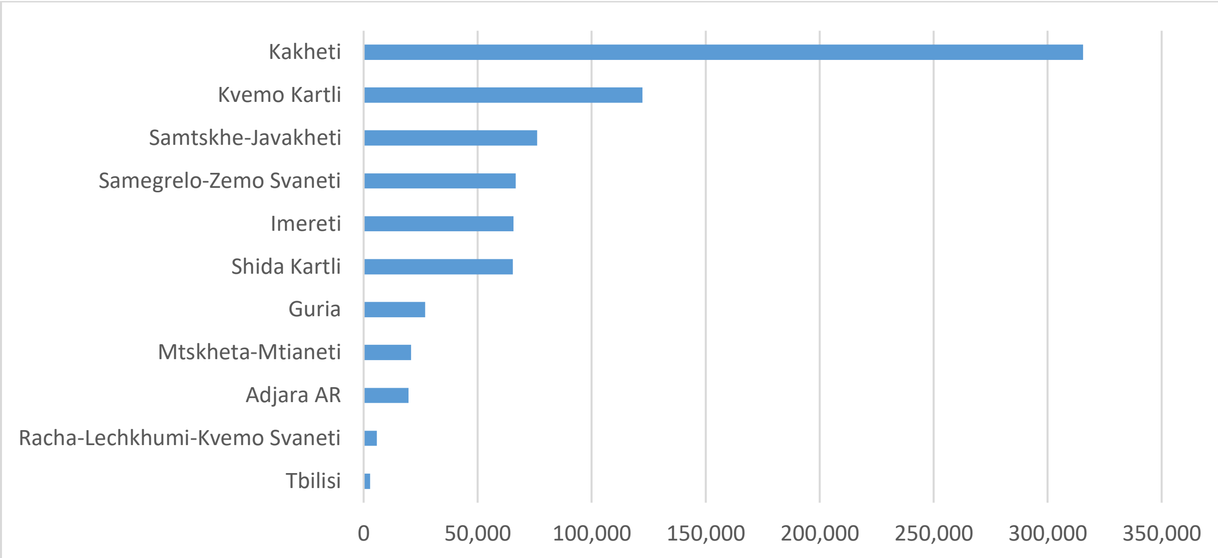
Figure 1.3 Agricultural land operated by agricultural holdings by land use (2014)



Source: Agricultural Census of Georgia 2014, Geostat

The land held by agricultural holdings is mostly concentrated across six regions, which combined encompass over 90% of the total agricultural land these holdings possess. The most notable region being Kakheti, with 40% of such land (see Figure 1.4), mostly including arable lands, natural meadows, and pastures (amounting to 89.5% of Kakheti's total agricultural land). Kvemo Kartli and Samtskhe-Javakheti contain 15.5% and 9.7% agricultural land, respectively. In both regions, like Kakheti, there is mostly arable land, natural meadows, and pastures. Samegrelo-Zemo Svaneti, on the other hand, contains 8.5% of the agricultural land operated by agricultural holdings in Georgia; primarily with arable plots and land under permanent crops, 55% and 41%, respectively.

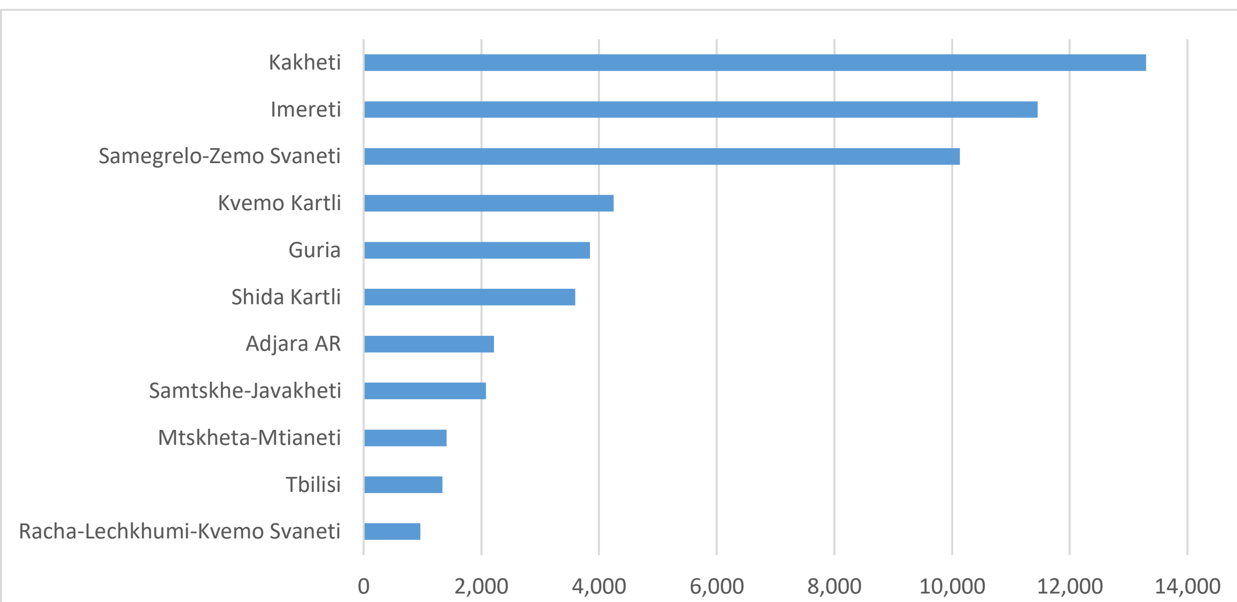
Figure 1.4 Agricultural land operated by agricultural holdings (Ha)



Source: Agricultural Census of Georgia 2014, Geostat

Regarding the non-agricultural land owned by agricultural holdings, the largest share is also located in Kakheti; however, this only accounts for 24.4% of total non-agricultural lands (see Figure 1.5). Kakheti's non-agricultural land predominantly consist of woodlands (40% of Kakheti's non-agricultural land), alongside buildings and yards (50.8%).

Figure 1.5 Non-agricultural land operated by agricultural holdings (Ha)



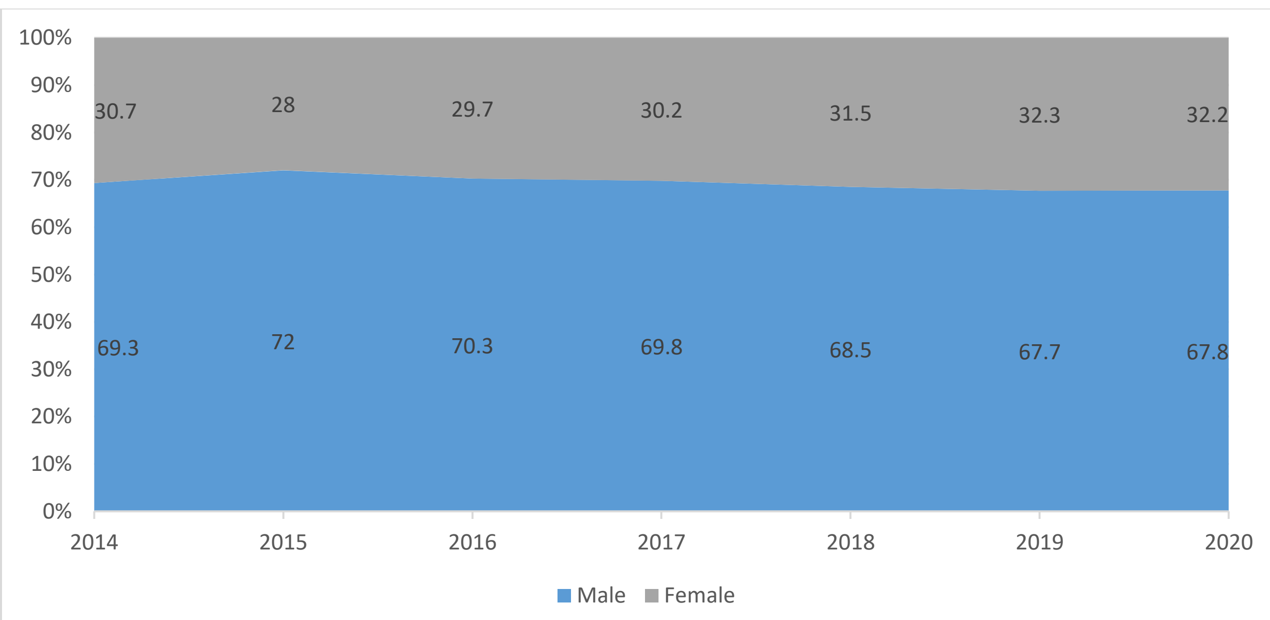
Source: Agricultural Census of Georgia 2014, Geostat

After Kakheti, the regions of Imereti and Samegrelo-Zemo Svaneti contain the most non-agricultural land held by agricultural holdings – 21% and 18.6% of the Georgian total, respectively. Comparable to Kakheti, woodlands, buildings, and yards also constitute most of the non-agricultural land in the ownership of agricultural holdings in these regions. In Imereti, woodlands represent 12% of the non-agricultural land operated by these holdings, with the corresponding share for buildings and yards amounting to 86%. While the equivalent shares for Samegrelo-Zemo Svaneti are 11.4% for woodlands and 85.8% for buildings and yards. Whereas Kvemo Kartli, Guria, and Shida Kartli contain, respectively, 7.8%, 7%, and 6.6% of Georgia's non-agricultural lands operated by agricultural holdings, also mostly buildings and yards.

The age and gender structure of agricultural land ownership

Although there is no available data on land ownership by gender (according to the National Agency for Sustainable Land Management and Land Use Monitoring this information will be available when the land registration reform is complete), there are details on agricultural holdings' distribution by the gender of their owners. The existing data shows that there is a substantial difference between genders in the distribution of agricultural holdings. In 2014, male holders held 69.3%, with females at 30.7% (see Figure 1.6). The ratio of male to female shares has not notably shifted throughout the years, although since 2015 the proportion of female holders has been increasing slightly; reaching 32.3% in 2019 and decreasing in the following year to 32.2%.

Figure 1.6 Distribution of agricultural holdings' ownership by gender



Source: Geostat

By the gender, the distribution of land operated by agricultural holdings is even more distinctive; women's ownership varied between 17-19% from 2014-2018, and only reached 20.7% in 2020.[6]

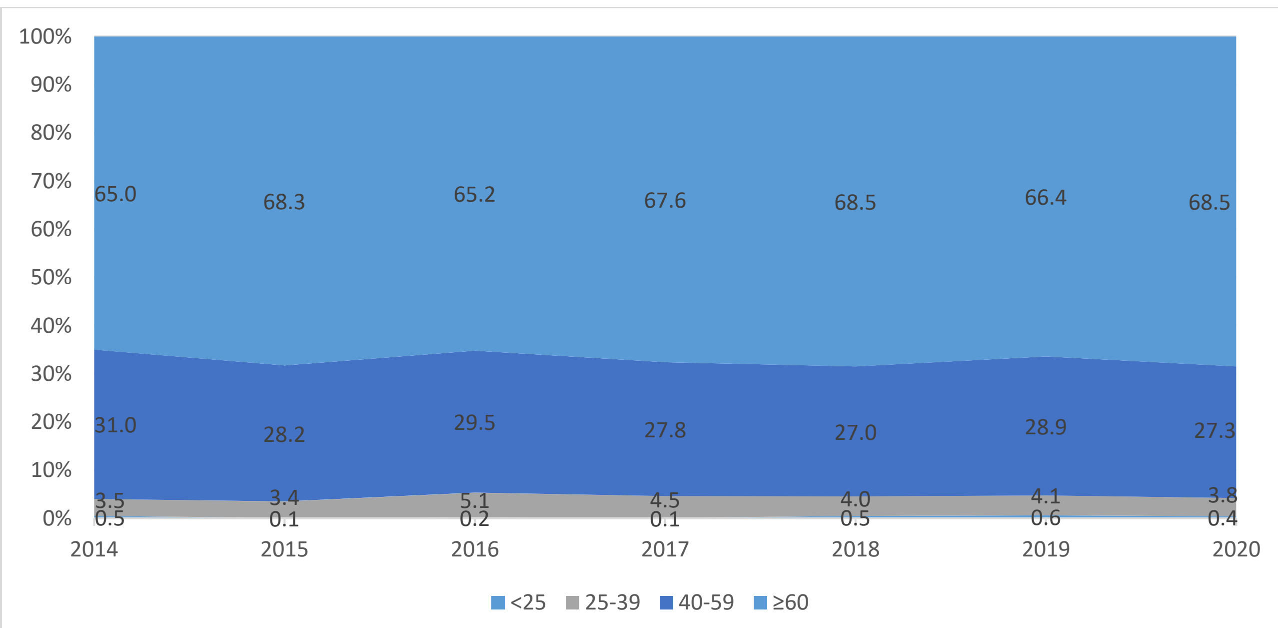
[6] The National Statistics Office of Georgia.

The share of holdings owned by those aged 60+, as well as the area in which they operate, has been increasing since 2016 and reached its maximum in 2020 (with 54.2% of holdings and a 48.4% proportion of land area). Whereas the share of holdings and the area owned by people aged between 40-59 declined in the same period; in 2016 the share of holdings was 41%, which decreased to 38.9% in 2020. Similarly, the land area operated by holders aged 40-59 was 46.4% and fell to 44.4% by 2020.[7]

These statistics highlight that by age the distribution of holdings is noticeably different for male and female owners. Over 65% of female holders were over 60 years old in 2014, which even increased slightly in subsequent years – the share of 60+ holders in 2020 was 68.5% (see Figure 1.7). The second largest share of female-owned (aged between 40-59) agricultural holdings fluctuated between 27% and 31% between 2014-2020. Therefore, around 95% of women who owned agricultural holdings between 2014 and 2020 were over 40 years old. While for younger holders, from 2014 to 2020, only between 0.1% and 0.6% of female-owned agricultural holdings were retained by women under 25. Over the same period, the proportion owned by female holders aged 25-39 fluctuated between 3.4% and 5.1%.

The picture hardly changes for the land area operated by women-owned holdings, where the largest land areas is held by women aged 60+; however, it did decline slightly over time (in 2016 the share was 65.1%, and 64.2% in 2020). Similarly, the share for female holders aged 40-59 also fell marginally between 2016 (30.7%) and 2020 (30.4%).

Figure 1.7 Distribution of female holders' agricultural assets by age



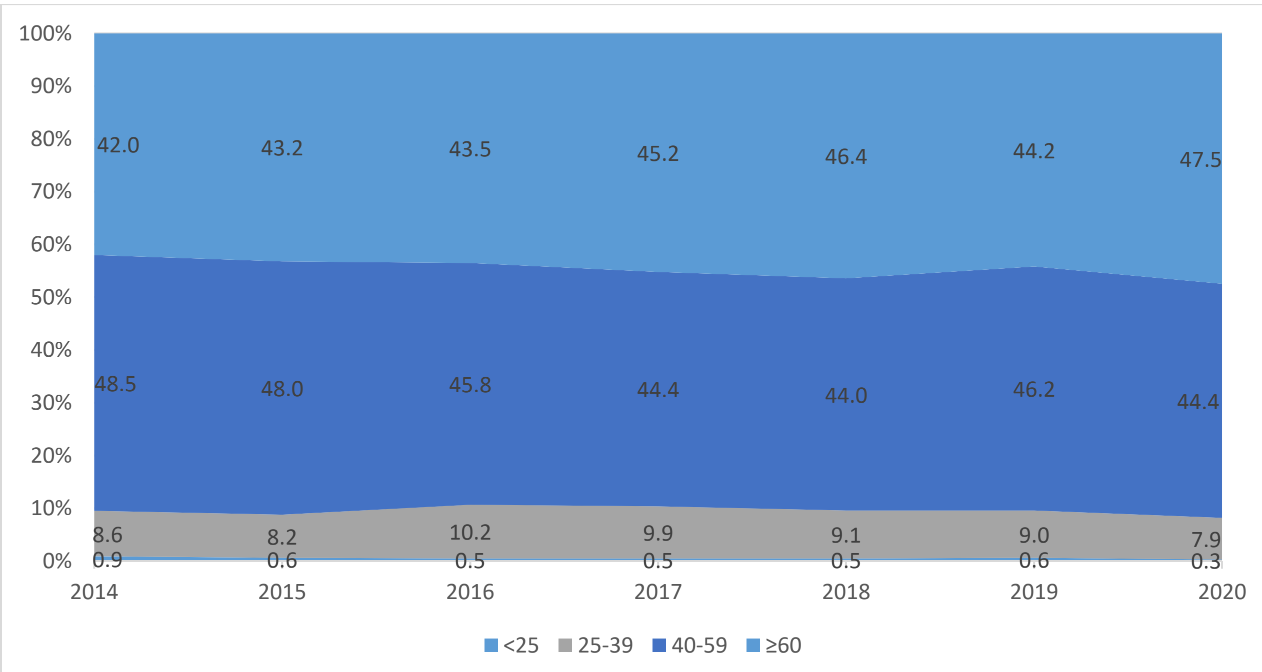
Source: Geostat

The picture however differs notably for male owners, as over the years the largest share of agricultural land belonged to men aged between 40-59; fluctuating between 44% and 48.5% over the 2014-2020 period (with a share of 44.4% in 2020). The proportion of agricultural land

[7] The National Statistics Office of Georgia.

owned by men over 65 was also substantial, fluctuating between 42% and 47.5% over the same period (with a share of 47.5% in 2020) (see Figure 1.8). Overall, these two groups have always retained possession of over 89% of the male-owned agricultural holdings. The share of landholdings owned by men aged 25 and 39 fluctuated over the years between 8.2% and 10.2%. Finally, the share of agricultural landholdings owned by men younger than 25 fluctuated between 0.3% and 0.9%. Considering land area, over time it increased for males aged 60+ (39.5% in 2016 to 44.2% in 2020). Whereas the shares for male holders aged 40-59 decreased between 2016-2020, from 49.6% to 48.1%.

Figure 1.8 Distribution of male holders' agricultural assets by age



Source: Geostat

1.3 Agricultural production

Agriculture is one of the most important sectors for Georgia; the National Statistics Office of Georgia (Geostat) reveal that agriculture, forestry, and fishing generated 7.4% of the GDP in 2019. Moreover, 19.1% of all employed people were occupied within this sector.[8]

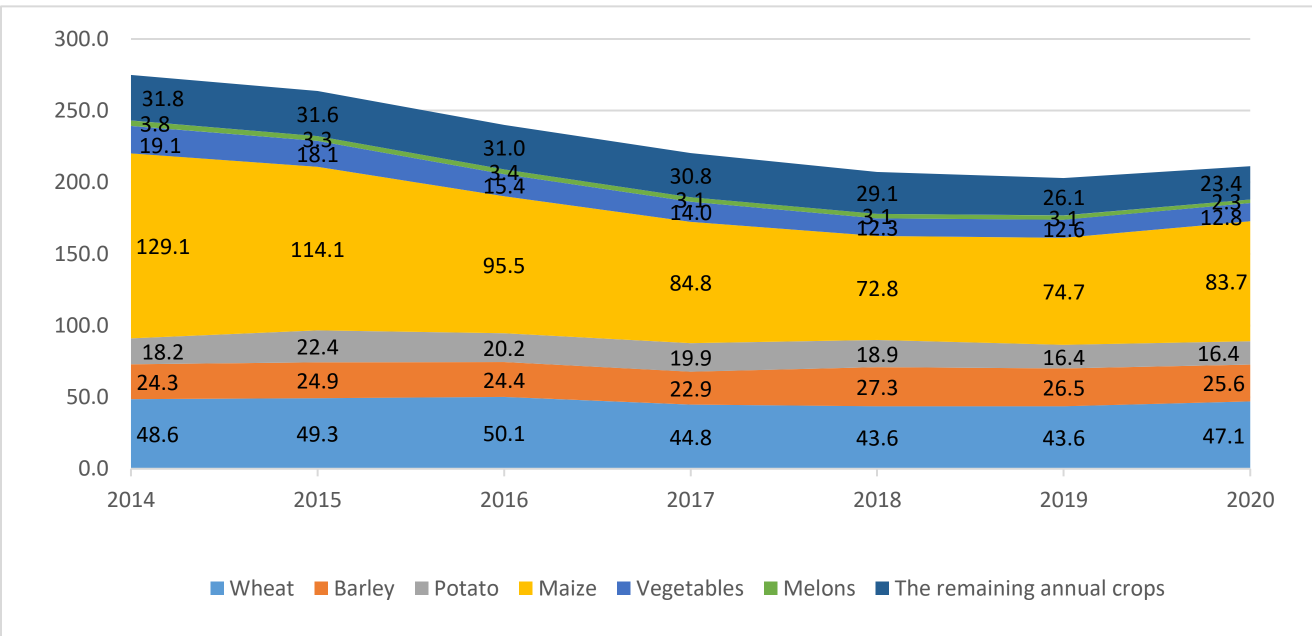
Agricultural production can be divided into two broad categories – annual (like grains, potatoes, vegetables) and permanent crops (fruit, tea leaves, citrus).

[8] This figure also underestimates the number of individuals working in the agricultural sector. Geostat has recently re-classified the self-employed in agriculture who do not sell the majority of their production into not officially being employed.

Annual crops

Within the period of 2014-2019, the sown area of annual crops constantly decreased (see Figure 1.9). This cumulative decline amounts to 26.2%, from 275 to 203 kha. The most drastic reduction occurred in 2015-2016, when the total sown area fell by 9%. However, this trend changed in 2020 and there was an increase in the sown area of annual crops; the area increased by 4% in 2019-2020. Almost all crops followed the same trend throughout the period – from 2014-2019 there was a decrease and in 2020 the sown area increased slightly. For example, the sown area of maize, which amounts to more than 35% of all annual crops every year, decreased by 44% in total between 2014-2018, and from 2018-2020 it increased by 15%. The sown area of wheat, amounting to more than 17% during the period, on the other hand, did not change significantly. In total, the sown area of wheat decreased by 3% from 2014-2020. While the sown areas for potatoes, vegetables, and melons experienced a 22% total decrease over these seven years.

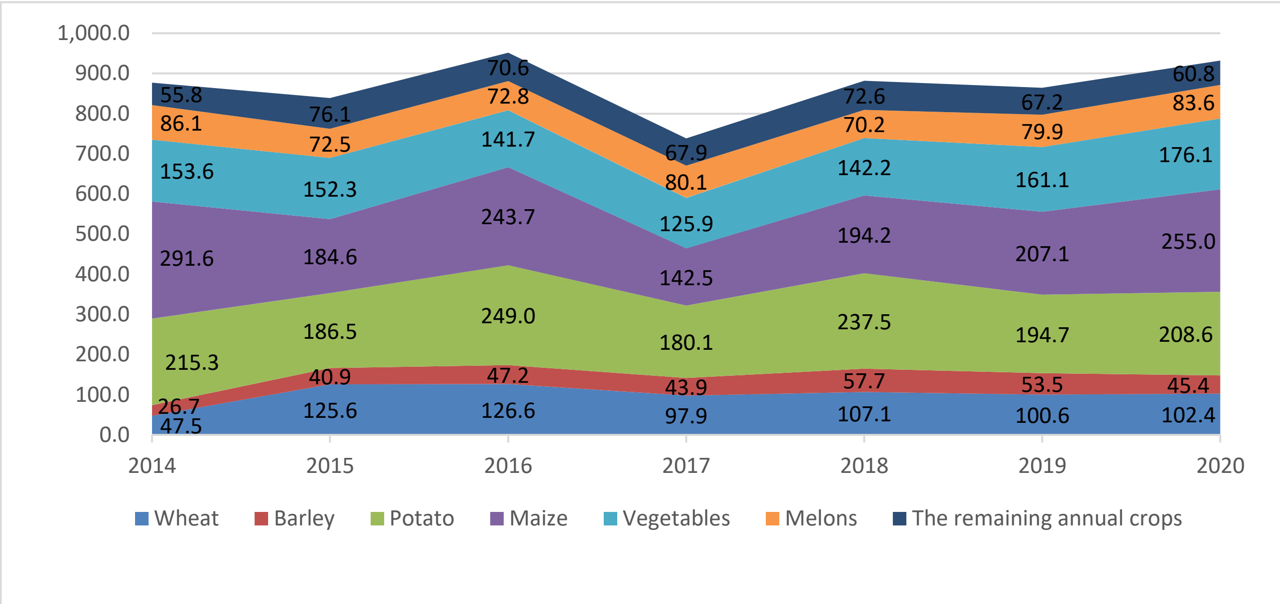
Figure 1.9 Sown area of annual crops (kha)



Source: Geostat

In terms of annual crop production, the trend is not as monotonic as with annual cropping areas. The production changes every year from 2014-2020 (see Figure 1.10). For example, in 2014-2015 the total production of annual crops decreased by 4%, however it increased by 13% the following year. Similarly, in 2016-2017 it shrank by 22%, but expanded by 19% in 2017-2018. In total, production of annual crops increased by 6% over the 2014-2020 period. Given the reduction in sown area, this must have been achieved due to average productivity increases. Trends, however, differed between crops. The two major contributors to the production of annual crops were maize (over 20% of total production almost every year) and potatoes (more than 22% of total production from 2014-2020). Production also fluctuated over time, where in total the production of maize decreased by 13% and potato production dropped by 3% over the seven years. The largest change in the period was observed with wheat and barley; in total, wheat production increased by 116% and barley by 70% between 2014-2020.

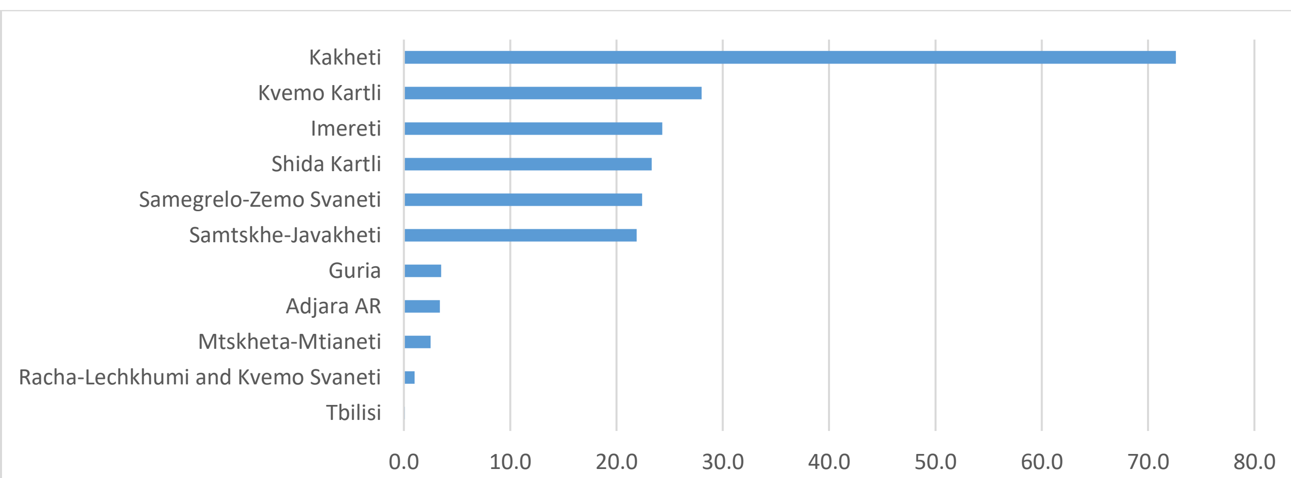
Figure 1.10 Production of annual crops (ths. tons)



Source: Geostat

As previously noted, the sown area of annual crops amounted to 203 kha in 2019. Almost 36% of this area is within Kakheti, where the farmers largely produce wheat, barley, and corn. A substantial share of the sown area is also in Kvemo Kartli (13.8%), Imereti (12%), Shida Kartli (11.5%), Samegrelo-Zemo Svaneti (11%), and Samtskhe-Javakheti (10.8%) (see Figure 1.11).

Figure 1.11 Annual crop sown area by region (kha), 2019



Source: Agriculture of Georgia 2019, Geostat

Permanent crops

The data for the land area of permanent crops is extremely limited, and there is only information available for 2014 and 2017. Nevertheless, as permanent crops are not planted annually, the area sown changes little over the years, and as such Geostat defines the data every three years (information for 2020 will be available at the end of 2021). Between 2014 to 2017, the area covered by permanent crops grew from 109.5 to 120.8 kha (+10%). For instance, land under orchards amounted to 54% of the total permanent crop area in 2014 to 62% in 2017, and vineyards covered 30% of the total area in 2014, while by 2017 they had increased 9% during the period (see Table 1.1).

Table 1.1 Land area under permanent crops (kha)

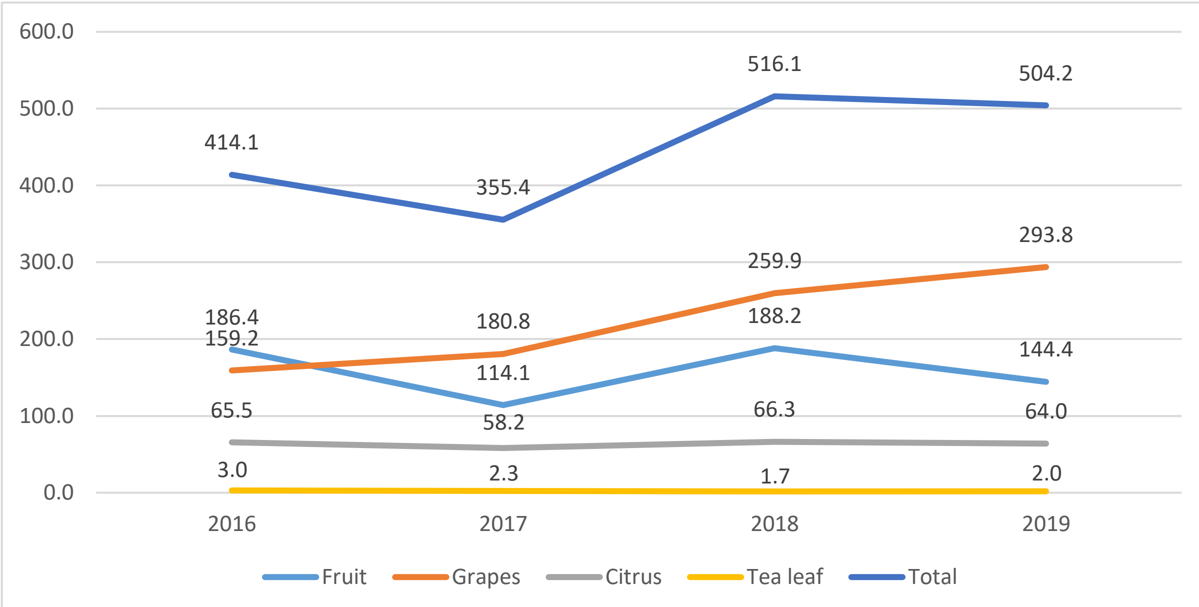
	2014	2017
Land under orchards	59.4	74.8
Land under berries	-	1.0
Land under vineyards	33	36.1
Land under citrus plantations	7.4	8.9
Land under tea plantations	4.6	-
Land under other permanent crops	5.1	-

Source: Geostat, Agricultural Census of Georgia 2014

Compared to annual plants, permanent crops are characterized by more visible increasing production trends (see Figure 1.12), although individual crops did also experience significant fluctuations. Over time, due to steadily increasing production, grapes came to constitute more than half the total permanent crops, with their total reaching 58% in 2019. This rising trend in grape production is due to an increased demand for Georgian wine (on local and international markets) – in 2016 the total grape harvest was 159.2 ths. tons, while in 2019 it reached 293.8 ths. tons (an 84.5% increase).

In terms of fruit production (excluding grapes, citrus and tea leaves), harvests amounted to 114.1 ths. tons in 2017, which is 38.8% lower than in 2016. This recession was largely caused by a stink bug infestation, which mostly damaged the hazelnut harvest though other crops were also affected. However 2018 was an abundant year with 188.2 ths. tons of fruit produced – 64.9% greater than 2017. It thereafter dropped once again and in total between 2016-2019 fruit production decreased by 22.5%.

Figure 1.12 Production of permanent crops (ths. tons)



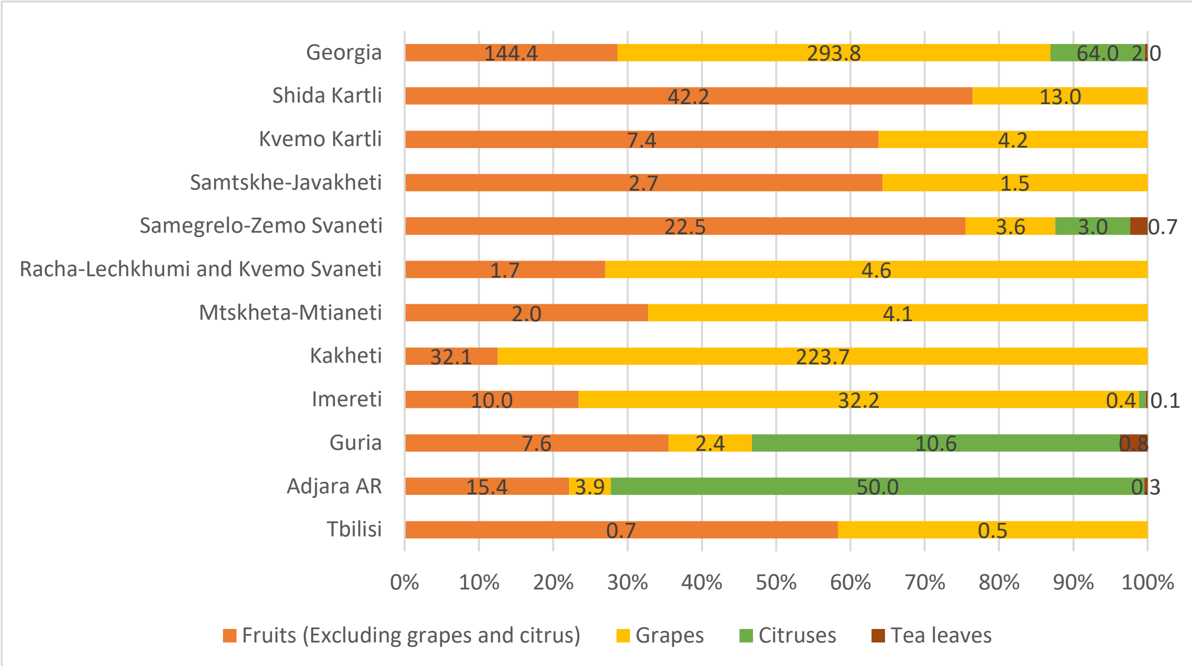
Source: Agriculture of Georgia 2019, Geostat

Citrus and tea production were also in decline over the past four years. The production of citrus went down from 65.5 ths. tons to 64 (a 2.3% total decrease), and tea leaves from 3 to 2 ths. tons between 2016-2019 (down 33%).

The total production of permanent crops amounted to 504.2 ths. tons in 2019, and over 50% of this originated from Kakheti. Most of this production was from vineyards – 87.5% of Kakheti's production is in grapes – see Figure 1.13. Furthermore, Kakheti is a major contributor to the fruit harvest (22.2% of total fruit production comes from the region). Unsurprisingly, Kakheti is the region with the greatest production of grapes – 76 % of total grape production came from Kakheti in 2019, followed by Imereti at 11%.

From the total production of permanent crops in 2019, 28.6% was in fruit (excluding grapes and citruses). Shida Kartli was the main contributor to fruit production (29.2%), though a significant portion came from Kakheti (22.2%), Samegrelo-Zemo Svaneti (15.6%), and Adjara (10.7%). Geostat also identifies Adjara as a major contributor to the citrus harvest. Farmers in Adjara cultivate 78.1% of all the citruses in Georgia. As citruses need high moisture soil, found in western Georgia, farmers grow citruses only in Adjara, Guria (16.6% of production), Samegrelo (4.7%), and Imereti (0.6%). While tea leaves are cultivated in only four Georgian regions: Guria, Samegrelo-Zemo Svaneti, Adjara, and Imereti.

Figure 1.13 Production of permanent crops by region (ths. tons)

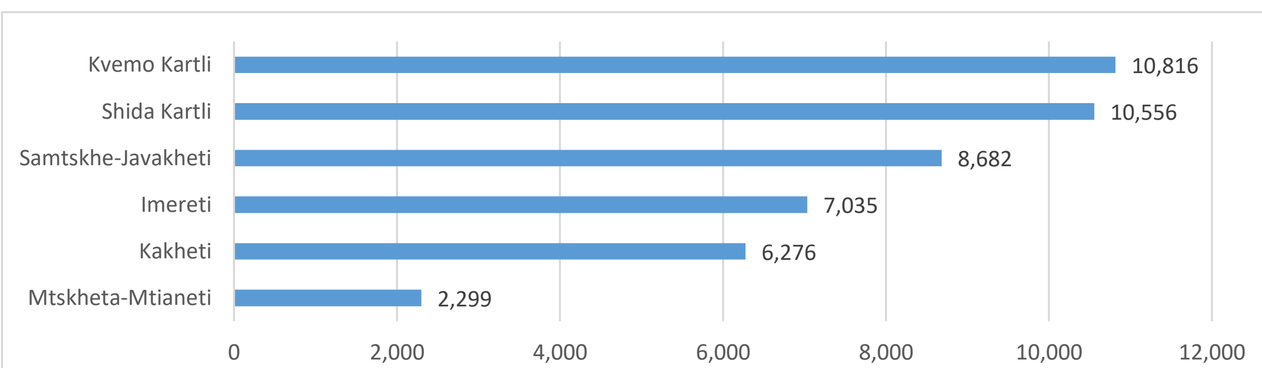


Source: Agriculture of Georgia 2019, Geostat

1.4 Irrigated and drained areas

Since 2012 Georgian Amelioration Ltd. (GA) has been responsible for irrigation and drainage in Georgia. In the last six years, the irrigated area has increased by 45,664 ha (see Figure 1.14). The largest increase in irrigated area during this period was in Kvemo Kartli (23.7% of the newly irrigated area) and Shida Kartli (23.1%). In Samtskhe-Javakheti, Imereti, and Kakheti the share of irrigated land area also increased significantly, with 19%, 15.4%, and 13.7%, respectively, of newly irrigated area being developed in these regions. The least growth occurred in Mtskheta-Mtianeti where the irrigated area only rose by 2,299 ha from 2015-2020.

Figure 1.14 Increase in irrigated land area between by region (ha), 2015-2020[9]

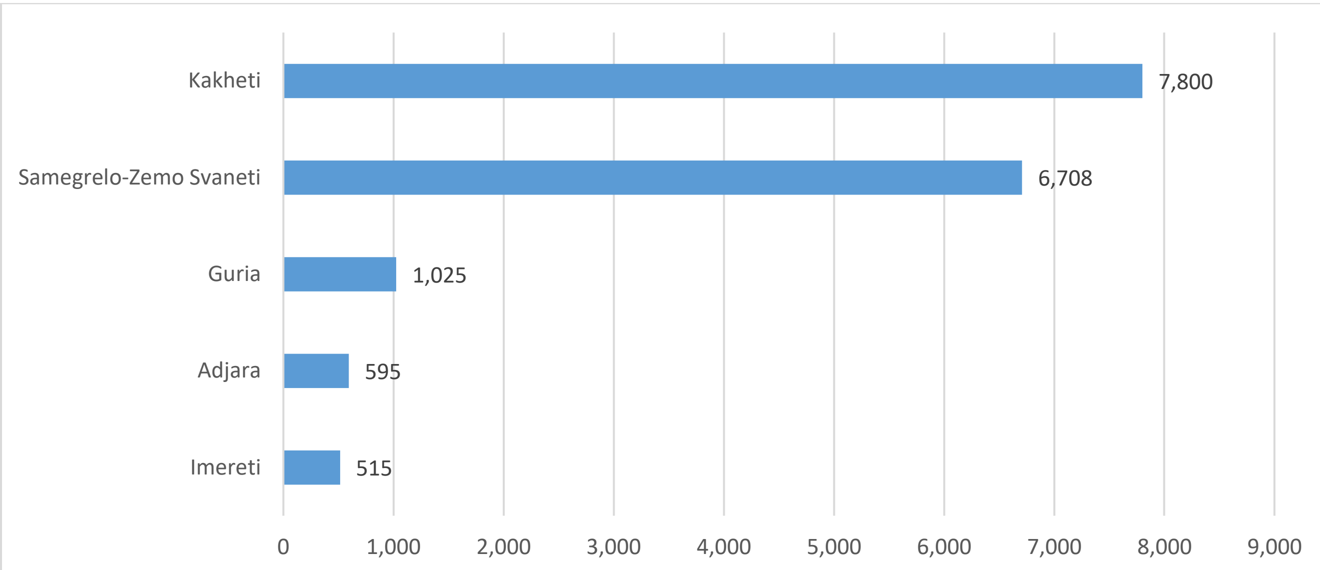


Source: GA

[9] Note: this information is on an aggregated level, not a yearly basis.

In comparison drained land area increased by a total of 16,643 ha in 2015-2020, mostly in Kakheti and Samegrelo-Zemo Svaneti. The increase in these regions amounted to 46.9% and 40.3%, respectively, of the newly drained area over this period. The least growth was found in Adjara and Imereti where the increase constituted only 3.6% and 3.1% of the newly drained area, respectively (see Figure 1.15).

Figure 1.15 Increase in drained land area by region (ha), 2015-2020

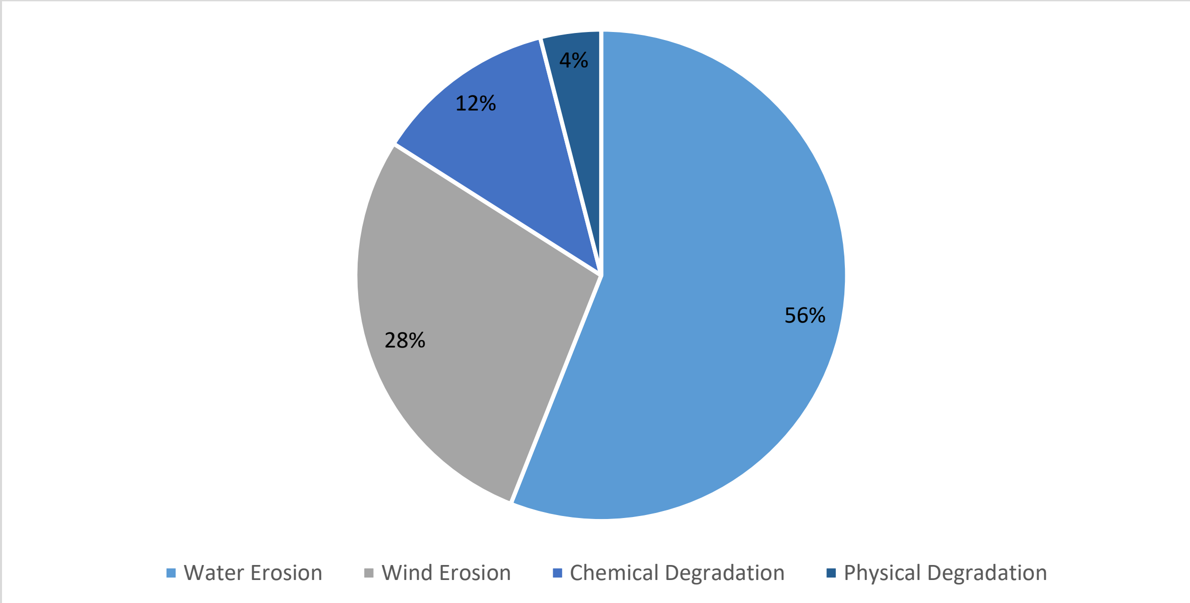


Source: GA

1.5 Soil degradation

Over the last 200 years, Georgian soil has been degraded by human impact, largely as a result of intensive agricultural production and industrial activity (Gokhelashvili, Janelidze, & Akhalaia, 2018, p. 106). Soil degradation moreover has a negative effect on socio-economic activities, such as agriculture, forestry, tourism, etc. While the intensive use of chemical fertilizers, pesticides, the frequent and improper cultivation of soils, unstable grazing on pastures, water and wind erosions, etc., have all led to physical and biological degradation and pollution of the environment (MEPA, 2017, p. 3). As a result of these impacts on the soil, its structure has been disrupted, the content of humus and nutrients have worsened, a lower hardened layer of arable land has formed, and its physical properties, such as water permeability, tensile capacity, aeration, etc., have also deteriorated. It is estimated that the reduced yield is an average of 55-65% on degraded, 'tired' soil. Furthermore, soil erosion, which causes 84% of degradation, is one of the most significant ecological problems Georgia faces (see Figure 1.16).

Figure 1.16 Soil degradation



Source: MEPA, 2017

Georgian meadows with an incline of 7-11% have approximately 60-70 t/ha of brown earth soil[10] moved every year by erosion and landslides, while 11-12% incline land has 110-120 tons/ha shifted (MEPA, 2017). In addition, a layer of soil, around 2.5-3 cm, is lost every year due to wind erosion.

Approximately 35% of all agricultural lands have been degraded because of erosion; in the western part of the country water erosion is typical, whereas erosion it is generally caused by the wind in the east, primarily resulting from the destruction of windbreaks and human activities (Gokhelashvili, Janelidze, & Akhalaia, 2018, p. 106).

The situation is worse still for arable terrain, with more than 46% of Georgian arable land subject to erosion, with the total area of eroded land growing every year. Such arable land is negatively affected by both water (205.7 thousand ha) and wind (106.5 thousand ha) (MEPA, 2017, p. 39). Wind erosion manifests in particularly strong forms in eastern Georgia (Shiraki, Kakheti plateau, Kartli plain, Alazani lowland, etc.). By destroying the upper layers of soil, erosion destroys large masses of arable land. Alongside any soil particles, the wind carries away freshly sown seeds, exposes plant roots, and damages both annuals and perennials. Irrigated canals, reservoirs, covered roads, windbreaks, etc. are then filled with eroded soil mass, the cleaning of which proves costly (MEPA, 2017, p. 40).

Soil erosion in Georgia has been heightened by human activity and overgrazing; for example, the pastures of the Shirak Valley (a total area of 57,000 hectares) are used for the grazing of

[10] Brown Earth soils have equal amounts of silt, sand, and clay particles giving them a loamy texture. As there is space between the particles for air and water to pass through, Brown Earth soils drain well making them extremely fertile and ideal for agricultural purposes.

more than 400,000 sheep (over half the sheep in the country) for over seven months every year (Gokhelashvili, Janelidze, & Akhalaia, 2018, p. 106). Such high concentrations of cattle and the intensive use of pastureland leads to overgrazing, which in turn causes soil degradation.

Soil salinization and contamination with hazardous chemicals also cause deterioration of soil quality and reduced usability. Soil salinization is problematic in some eastern regions – Kvemo Kartli, Gare Kakheti, and the Alazani valleys – due to arid and semiarid climatic conditions (MEPA, 2017, p. 35).[11] For example, in the Gardabani municipality (in Kvemo Kartli) most soils are arable. However, due to high levels of salinization, these areas are not currently being cultivated, where the population have not plowed for several years, and the area is now principally used for grazing (MEPA, 2017, p. 36). This problem is further aggravated by improper anthropogenic activity, such as soil exploitation or unregulated irrigation (MEPA, 2017, p. 35).[12]

Soil contamination from various chemicals is also observable in industrial regions of the country (Gokhelashvili, Janelidze, & Akhalaia, 2018, p. 107). For example, in the Ambrolauri municipality (in Racha-Lechkhumi and Kvemo Svaneti) there is a high content of arsenic in the soil; in Chiatura (in Imereti) the content of manganese in the soil has increased; in Bolnisi (in Kvemo Kartli) the amount of heavy metals in the soil, caused by the discharge of copper deposits and waste tailings, exceeds the maximum allowable norms.

The improper use of mineral and organic fertilizers and those chemicals that protect plants in agricultural production has also significantly contributed to environmental pollution, which eventually leads to contamination of the soil and atmosphere, plant and animal products, and drinking and irrigation water with various toxic substances (MEPA, 2017, p. 52). Crucially, these chemicals can accumulate in the human body and can cause chronic poisoning, even in small amounts. In addition, local populations know little about persistent organic pollutants and do not take safety precautions, such as preventing the use of contaminated areas for pastureland or avoiding expired and damaged containers. A thorough study of Georgian territories revealed that an estimated 60 thousand tons of soil have been polluted and need to be restored, with 230 tons of pesticides within the soil that must be removed and destroyed (MEPA, 2017, p. 54).[13]

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[11] Salinization occurs mainly due to the accumulation of salt on the soil surface, which occurs as a result of evaporation of groundwater from the surface. While arid and semiarid climates are characterized by a lack of moisture, as the soil is dry there is no water to dissolve the salt.

[12] For example, farmers in Kakheti suggest that they water plants with salty water as they have no other choice. Moreover, drip watering systems are very costly, thus they use hoses and certain plants then get overwatered; therefore land productivity is reduced.

[13] There are various methods of removing pesticides from soil: 1) Do Nothing – this is the easiest, and the least time and money intensive option; eventually pesticides will breakdown within the soil, however it can take years; 2) Increase the breakdown of pesticide via microbial degradation – pesticides can be destroyed by tilling (adding oxygen) and adding water and non-contaminated organic matter to the soil. This will proliferate microorganisms that are use the pesticides as soil; 3) Use a cover crop – used to bioaccumulate pesticides and then these plants must be completely removed and disposed of where they will not cause additional soil contamination; 4) Use a carbon-rich soil additive – when applied to soil, it binds particles of the pesticide, making them inactive. However, it can increase soil pH and may also contain varying amounts of organic pollutants which could be hazardous to human health; and 5) Remove the soil – removing contaminated soil is the most expensive and labor-intensive option. All contaminated soil must be removed and disposed of. Thereafter the area must be refilled with clean topsoil and replanted (Tharp, 2019).

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2. Forest Resources

Georgian forests, covering about 40% of the territory, are a common good and a natural resource with special value to the country. They also have great national, regional, and global significance. Forests not only preserve unique biodiversity, but also continuously ensure direct or indirect benefits and vitally important resources to the population (MEPA, 2019). Crucially, forests determine the level of oxygen and the carbon balance. One hectare of mixed forest absorbs approximately 13-17 tons of carbon dioxide and generates around 10-15 tons of oxygen per year (Geostat, 2020, p. 17). They moreover have a significant influence on climate formation, water turnover in nature, and air circulation in the atmosphere. Woodlands additionally clean the air from dust, where one hectare of forest filters 50-70 tons of dust annually; consequently, Georgian forests filter around 135-190 million tons of dust (Geostat, 2020, p. 17). Furthermore, Georgian forests supply the population and the local economy with timber, firewood, and non-timber products, like medicinal plants (USAID, 2017, p. 1). As such, forests provide many of the conditions necessary for human life.

2.1 Overview of the legal and institutional arrangement

The Ministry of Environment and Natural Resources Protection is the national body that holds the highest executive power, and it is responsible for the development of national forest policy, alongside its implementation and enforcement via its subordinate structural units (USAID, 2017). In particular, the Biodiversity and Forestry department is responsible for the development of forest policy at the national level, while the implementation of functions within the ministry is the responsibility of the following bodies:

- Legal Entity of Public Law (LEPL) the National Forestry Agency and the Territorial Services of the Agency (nine Forestry Services);
- LEPL the Agency of Protected Areas and the Territorial Administrations of the Agency (20 administrations);
- Forests in the territory of the Autonomous Republic of Adjara, except protected areas, are managed by the legal entity of public law included within the system of the Department of Environmental Protection and Natural Resources of Adjara – LEPL the Forestry Agency of Adjara.

Forests in the Autonomous Republic of Abkhazia and the region of South Ossetia are not currently managed by Georgian authorities.

For many years the main regulatory document for the sector was the Forest Code of Georgia,[14] adopted by parliament in 1999. As a consequence of the approval of the document, forestry lost its agricultural function and the right to produce timber was transferred to the private sector (USAID, 2017, p. 8). Throughout this period ongoing processes in the forestry sector have been characterized by frequent institutional and legislative changes:

[14] https://matsne.gov.ge/ka/document/view/16228?publication=0

- In the second half of 2010, a new phase of forestry reform began, and a legal entity of public law – the Forestry Agency – replaced the Forestry Department of the Ministry of Environment and Natural Resources;[15]
- On 20 August 2010, the Government of Georgia (GoG) adopted ordinance N242, On the Approval of the Forest Use Rule, which regulated the implementation of special felling (timber production) on the areas designated for special use[16] by the State Forest Fund. Rules for timber resource, wood waste, and forest fund accounting were also approved.[17] This ordinance (N242) was invalidated as soon as ordinance N221 entered into force on 18 May 2021;[18]
- In 2010, LEPL the Forestry Agency of Adjara was established in the administrative territory of the Autonomous Republic of Adjara to ensure forest management;[19]
- On 17 May 2011, as a result of amendments[20] to the Forest Code, the definition of Social Felling[21] was added to the Code;
- In 2011, the Ministry of Environment and Natural Resources and the Ministry of Energy were restructured and transformed into the newly established Ministry of Environment and Ministry of Energy and Natural Resources; the latter were transferred to the Forestry Agency and Environmental Inspection. These units were later abolished and LEPL the Natural Resources Agency was established;[22]
- On 4 August 2011, the government adopted ordinance N299,[23] which established the boundaries of the State Forest Fund;
- In 2012, the Ministry of Environment and Natural Resources was restored;
- On 10 May 2013, LEPL the Agency of Protected Areas was created;[24]
- In December 2013, the parliament of Georgia adopted the National Forest Concept,[25] which defines state attitude towards forests, considering their main functional purpose and values. As a result, the agency authorized for forest management was returned to the Ministry of Environment and Natural Resources Protection of Georgia, and the National Forest Agency, a legal entity under public law, was established;
- In 2014, the Georgian government adopted an ordinance[26] that regulates the rules of timber movement in Georgian territory.

Many adaptations and amendments were made to the Forest Code over the years, and it was finally declared invalid on 28 May 2020 when the government adopted the new Forest Code.[27]

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[15] https://matsne.gov.ge/ka/document/view/1030045?publication=0
[16] Forest Code of Georgia, Art. 37.
[17] https://matsne.gov.ge/ka/document/view/1025889?publication=0
[18] Ordinance of the Government of Georgia on the Approval of the Regulation "On Forest Use Rules", N221, 18.05.2021.
[19] https://matsne.gov.ge/ka/document/view/4443289?publication=0
[20] https://matsne.gov.ge/ka/document/view/16228?publication=16
[21] Implementation of measures to provide the population, budgetary organisations, legal entities under public law (including legal entities recognized by the Constitutional Agreement), and other persons determined by the Georgian government, forest products for non-commercial purposes in cases provided for by the legislation of Georgia.
[22] https://matsne.gov.ge/ka/document/view/1243477?publication=0
[23] https://matsne.gov.ge/ka/document/view/1455480?publication=0
[24] https://matsne.gov.ge/ka/document/view/1916850?publication=0
[25] https://matsne.gov.ge/ka/document/view/2157869?publication=0
[26] https://matsne.gov.ge/ka/document/view/2193366?publication=0
[27] https://matsne.gov.ge/en/document/view/4874066?publication=0

This code is based on precautionary measures in maintaining protection functions and the ecological balance, and aims to take into account the functional purpose of a forest within the forest management planning process, as such receiving one type of forest benefit should not lead to the degradation of other functions (MEPA, 2019, p. 4). Within the new Forest Code, the concept of Social Felling was abolished and replaced by Sustainable and Multi-purpose Usage.[28] Another significant innovation in the code is the classification of forests by ownership. Currently, forests – and the resources that they contain – are classified as either state,[29] municipal,[30] or private,[31] though beforehand, all forests were considered state-owned.

The Forest Code regulates forest protection and forest use issues; therefore it is important to classify Georgian forests along various dimensions, besides the potential ownership structure. Due to the multifunctionality of forests, the purpose of categorization is to promote the protection of ecological functions, the conservation of biodiversity, and the sustainable use of the economic potential of forests alongside the implementation of their social functions (USAID, 2017, p. 16). Georgian forests are placed within four categories by the Forest Code, according to their ecological, social, and economic functions, and their main management objectives:

1. Protected Forest[32] – The management objective is to conserve biodiversity and protect rare and endangered species and vulnerable forest ecosystems;
2. Protection Forest[33] – The management objective is to preserve and enhance the protective function (regulatory ecosystem services) of such forests;
3. Resort and Recreational Forest[34] – The management objective is to preserve and improve the recreational function, landscape, and natural elements of these forests;
4. Commercial Forest[35] – The management objective is to ensure the sustainable use of forest resources and preserve their protective function.

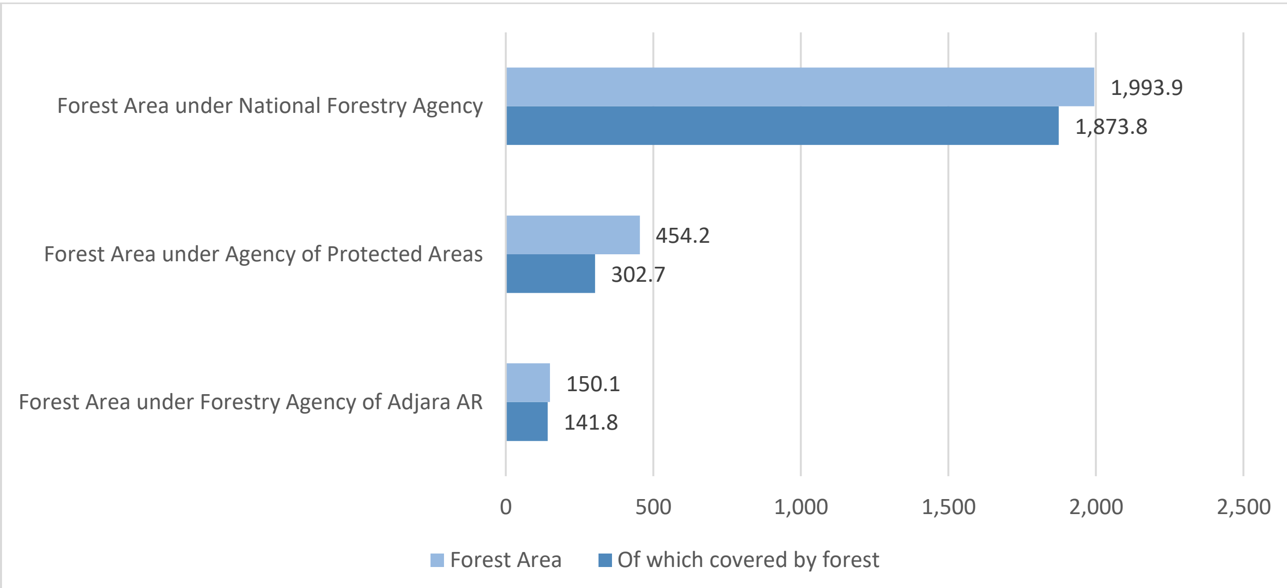
2.2 Forest area

In 2019, there were 2,967.2 kha[36] of forest area in Georgia,[37] of which 2,664.3 kha were covered by forests.[38] This data has not varied significantly; from 2010-2019 the forested area increased by only 2.7%, and the area covered by forests grew by 2.3%. Much of this territory is managed

[28] The management and use of forests in a manner and extent that maintains biodiversity, productivity, regeneration capacity, vitality, and potential, such that the environmental, social, and economic functions of forests are performed at local, national, and global levels, both in the present and the future, and whereby other ecosystems are not damaged.
[29] Georgian forests which are not under municipal or private ownership.
[30] Forests of local importance under municipal ownership, in which managerial authority is exercised by the representative and executive bodies of a municipality, in accordance with the Code and other legislative and subordinate acts.
[31] Forests located on land under the ownership of a natural or legal person. However, this does not imply that forests will be sold or privatized. It only refers to privately owned or naturally afforested areas, which, if they meet Code requirements for the definition of the term 'forest', may be granted forest status.
[32] Forest Code of Georgia, Art. 8.
[33] Forest Code of Georgia, Art. 9.
[34] Forest Code of Georgia, Art. 10.
[35] Forest Code of Georgia, Art. 11.
[36] Thousand hectares.
[37] Part of the geographic landscape which consists of trees, land, bushes, grass, animals, and others that belong to forests, according to the legislation, and that are biologically connected and have an impact on one another and the environment.
[38] An area of 0.5 hectare and more, at least 10-meter-wide covered with trees. Their canopy should cover 10 percent or more of the total area.

by the National Forestry Agency[39] – including 70% of total forest area and 67% of the areas covered by forest (see Figure 2.1). While in protected territories there was 11% of forested area and 15% of the areas covered by forests. As the information could not be updated, the data on the region of Abkhazia is dated from 2003. At that time, the forested area was 369 kha and 346 kha of this was covered by forest.

Figure 2.1 Forest area distribution (kha), 2019

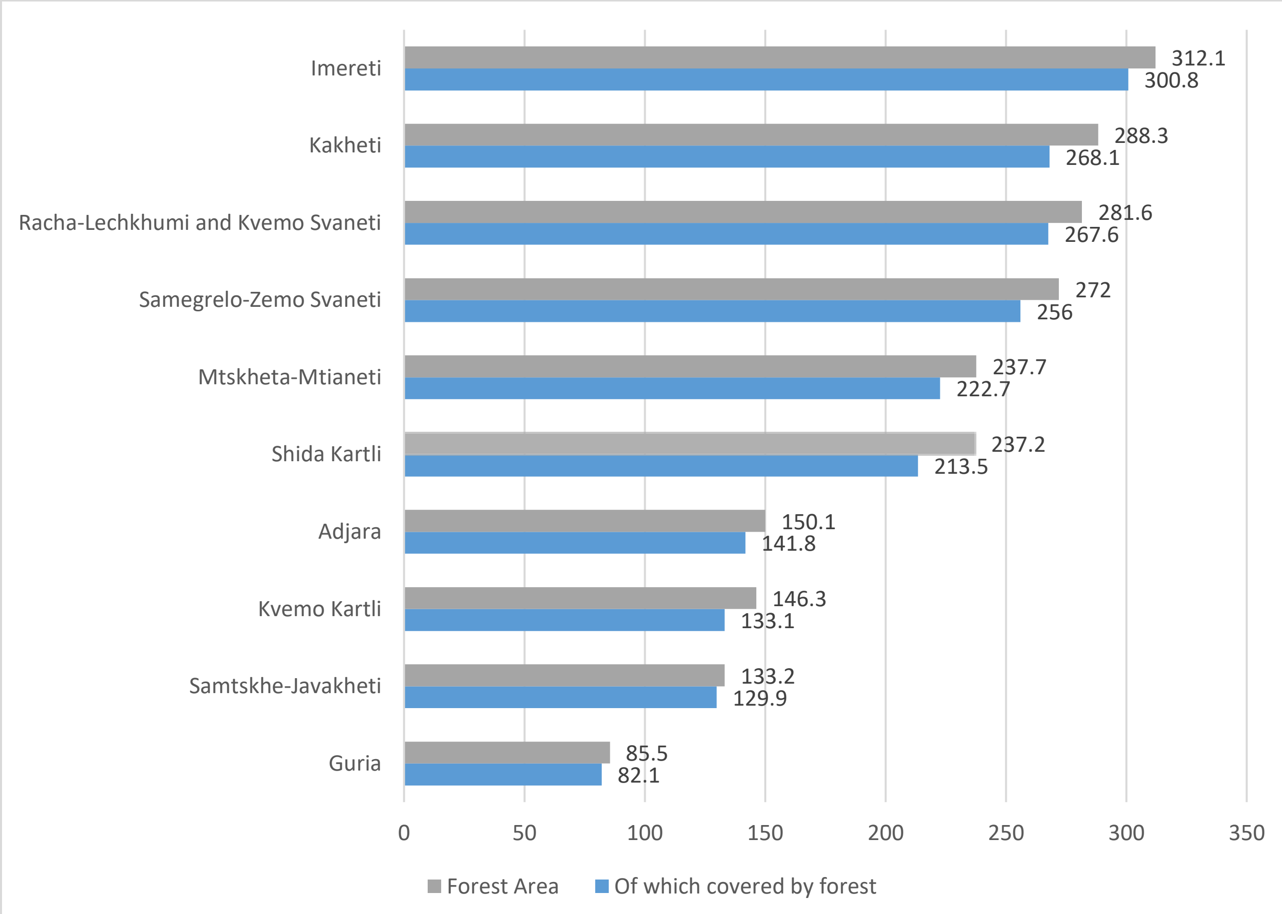


Sources: Ministry of Environment Protection and Agriculture of Georgia; Forestry Agency of Adjara; Agency of Protected Areas; National Forestry Agency

Forests in Abkhazia are not managed by the National Forest Agency, nor are Adjara's forests, which are managed by the Forestry Agency of the Adjara Autonomous Republic (AR). Forests in all other Georgian regions are managed by the National Forest Agency. According to the 2019 data, excluding Abkhazia, the largest forest area is in Imereti – 11.3% of the total forest area and 10.5% of areas covered by forests (see Figure 2.2).

[39] Including the Tskhinvali region.

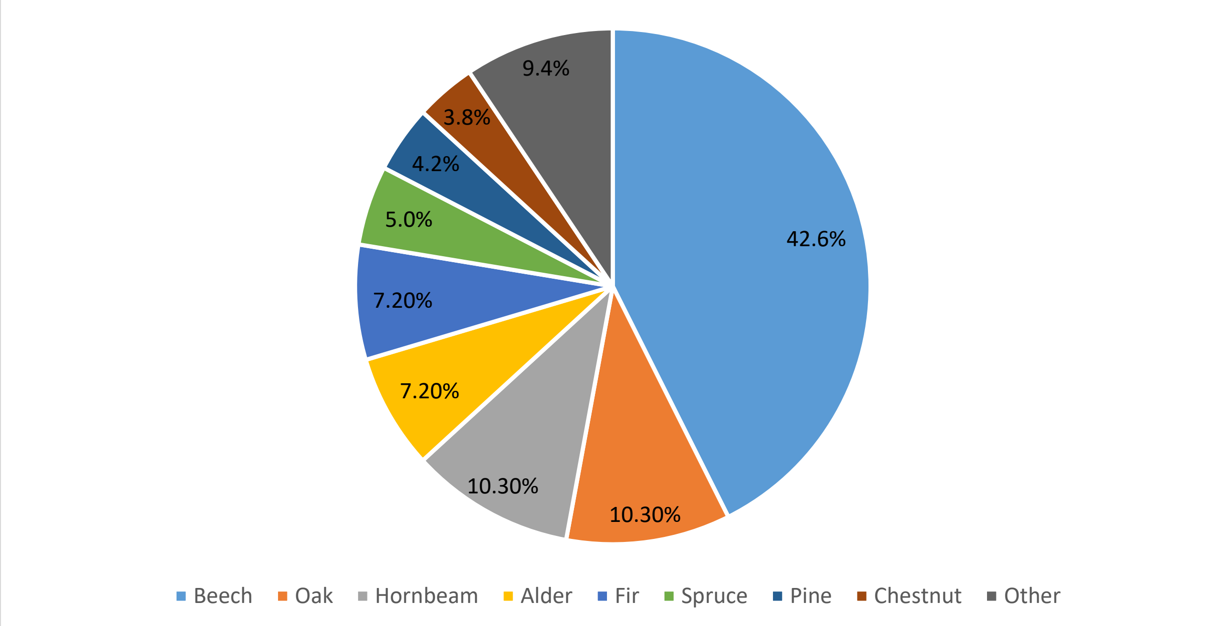
Figure 2.2 Forest area by region (kha), 2019



Sources: Ministry of Environment Protection and Agriculture of Georgia; Forestry Agency of Adjara; National Forestry Agency

Kakheti is the second largest forested region, followed by Racha-Lechkhumi and Kvemo Svaneti and Samegrelo-Zemo Svaneti. Throughout Georgia 42.4% of all forests and 41.5% of the areas covered by forest are located in eastern Georgia. Western Georgia is the most forested part of the country – with 57.6% of forestland and 58.5% of areas covered with forest.

Figure 2.3 Types of tree[40]



Source: National Forestry Agency

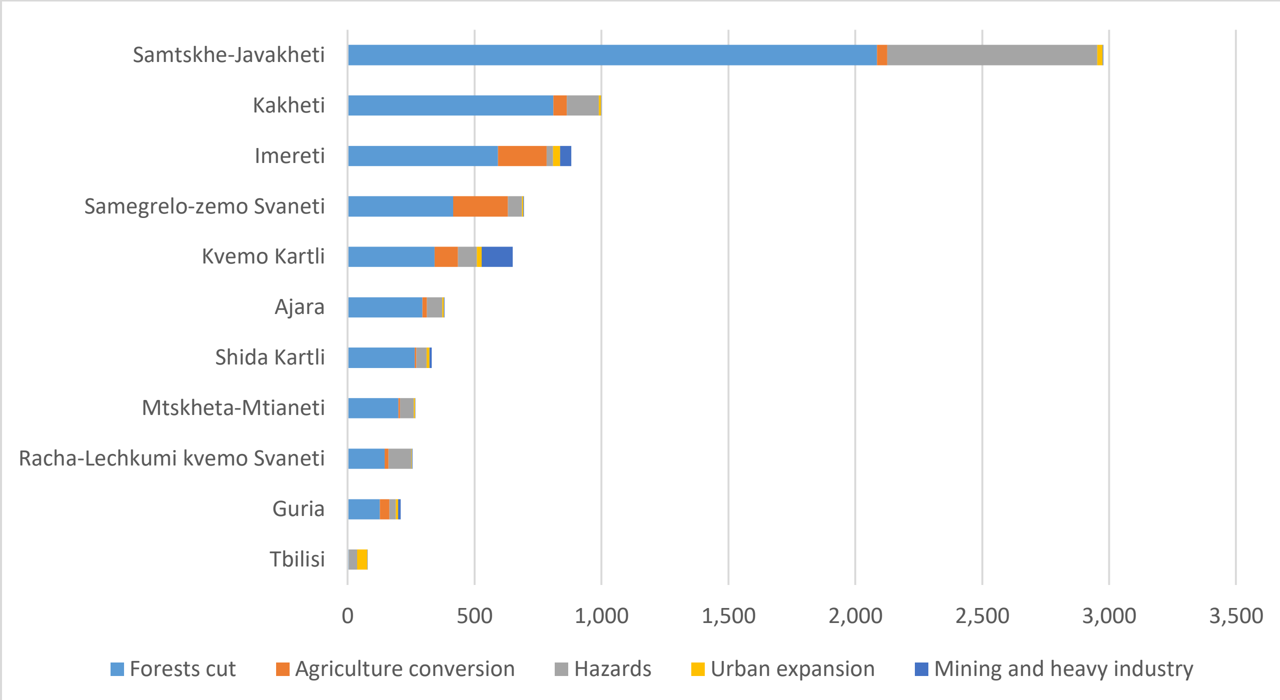
The most common tree across Georgian forests is the beech, which covers 42.6% of the forested area (see Figure 2.3). It can be found throughout the country: in the West, it is mostly located on foothills, while within Colchian forests and to the East it is mostly grows around 900-1,600 meters, but also in certain higher regions (Geostat, 2020, pp. 19-20). Oak and hornbeams each amount to 10.3% of Georgian forests, and they are both found in western and eastern Georgia. Oaks alongside hornbeams are widespread on lime soil to the west and in dry districts in the east, but, unlike hornbeams, oaks are also found in swampy areas and in lower mountainous zones (from 500-1,000 m) (Geostat, 2020, pp. 19-20).

2.3 Tree cover loss

According to Global Forest Watch, 7,726.1 ha of tree cover was lost (excluding Abkhazia) in Georgia throughout 2019. Of this, 38.5% of the loss occurred in Samtskhe-Javakheti, where deforestation was the main cause for cover loss. Hazards were also a significant contributor to the problem, with fire and wind erosion driving the largest losses (see Figure 2.4).

[40] Note: The data is from 2010 based on the 1980-90s census and updated with imperfect changes. Updated and more detailed information was requested from the National Forestry Agency, though we received no response.

Figure 2.4 Drivers of tree cover loss by region[41]



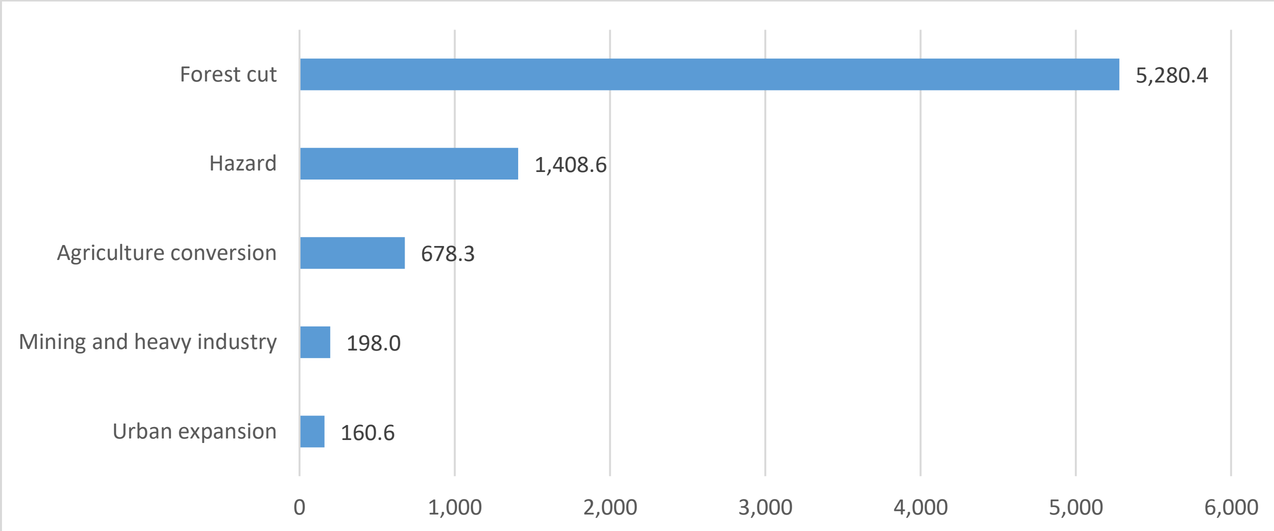
Source: Global Forest Watch

Kakheti, where almost 1,000 ha of tree cover was lost, was the second most affected region. Similar to Samtskhe-Javakheti, the felling of forestland was the main concern in Kakheti (81% of its tree cover loss was due to deforestation), followed by losses from hazards. In Imereti the most significant issue was also logging, with the second core reason for this being agricultural conversion;[42] in total, 191.4 ha of tree cover was lost due to such conversion. The same can be observed in Samegrelo-Zemo Svaneti, where the two most significant contributors to tree cover loss were logging (59.8% of the total tree loss in the region) and agricultural conversion (31.1% of the loss). In the region of Abkhazia, Global Forest Watch estimate a tree cover loss of 753.6 ha in 2019, however, there is no official data about the drivers behind this loss or whether, and to what extent, this has led to the loss of forest area.

As the data reveals, 68.3% of the tree cover loss was due to logging, mostly in Samtskhe-Javakheti and Kakheti; in total, 5280.4 ha of tree cover was lost (see Figure 2.5). Previous studies suggest most of these trees were likely cut down for social reasons, with rural populations using trees for fuel (USAID, 2017, p. 29). Moreover, Global Forest Watch data suggests that in 2019 almost 94% of such logging was due to social causes and approximately 6% of the deforestation was commercial.

[41] There is no data for drivers of tree cover loss for the region of Abkhazia.
[42] Forest use for agricultural purposes, such as mowing, grazing, or arranging temporary beehives.

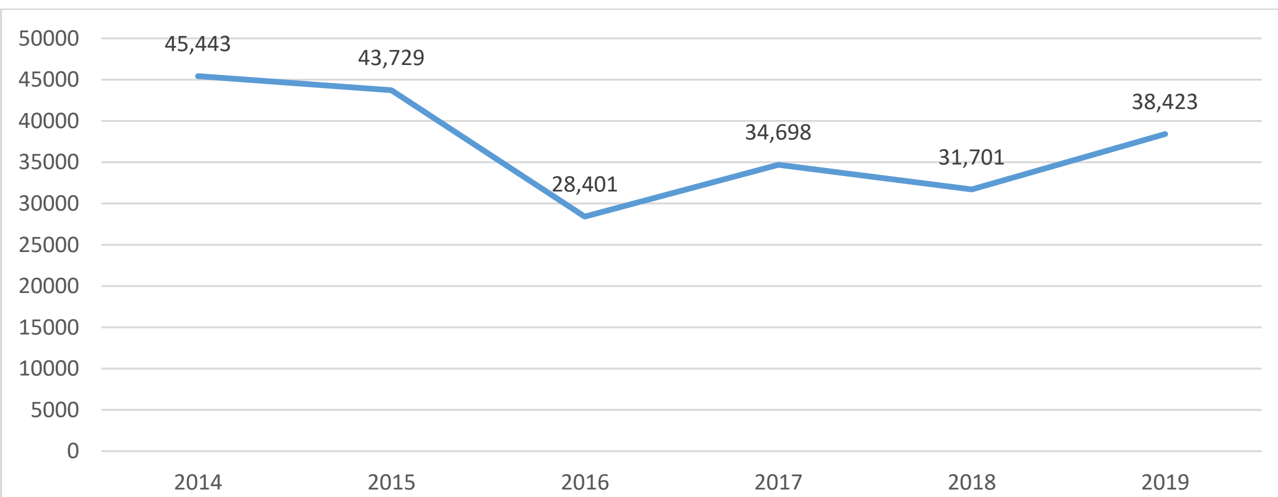
Figure 2.5 Drivers of tree cover loss, 2019 (ha)



Source: Global Forest Watch

Not all deforestation was legal, and every year a significant number of trees are lost to illegal logging. Between 2014 and 2016 the volume of illegally felled timber kept decreasing (see Figure 2.6), with the most significant drop in 2015-2016 when it decreased by 35%. The main reason behind this decline was the reduction in illegal logging in Kakheti; the number almost halved in 2016 – decreasing by 9,118 cubic meters. However, after 2016 the volume of illegally felled timber again rose, reaching 38,423 cubic meters by 2019. The most significant contributors to this upsurge were Shida and Kvemo Kartli, where the volume of illegal logging increased by a total 21,238 cubic meters from 2016-2019.

Figure 2.6 Illegal logging (cubic meters)

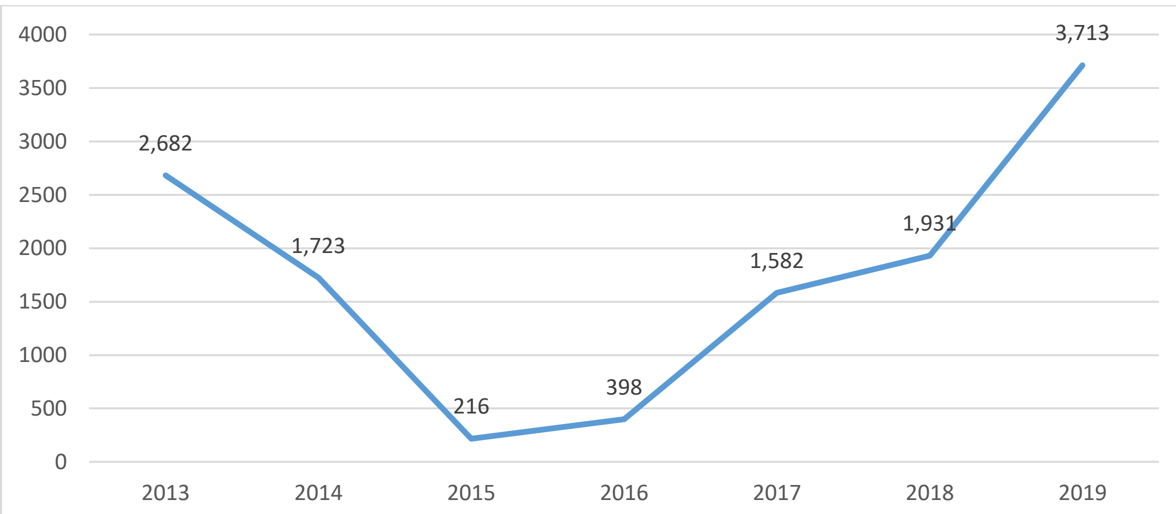


Sources: Ministry of Environment Protection and Agriculture of Georgia; Forestry Agency of Adjara; National Forestry Agency

One additional reason behind tree cover loss is hazards – mostly fire, as well as wind, landslides, and floods. In total, 1,408.6 ha of tree cover was lost in 2019 due to such risks. As previously mentioned, Samtskhe-Javakheti leads Georgian territory in this respect, with 58.7% of their tree cover lost from hazards, much of this was due to fire and wind erosion. Kakheti, the second most notable region, lost 126.3 ha of tree cover in 2019 due to hazards. The main drivers of hazard-related loss in Kakheti were floods and landslides, causing the loss of 122.5 ha in total.

Fire is one of the greatest causes behind the loss of tree cover. In the period of 2013-2015, the area affected by fire decreased continuously and reached 216 ha by 2015. However, between 2015-2019 the number increased every year, reaching 3,713 ha in 2019. In those last five years the area covered by fires thus increased by more than 17 times (see Figure 2.7).

Figure 2.7 Forest and field fires (ha)



Sources: Ministry of Environment Protection and Agriculture of Georgia; Forestry Agency of Adjara; Agency of Protected Areas; National Forestry Agency

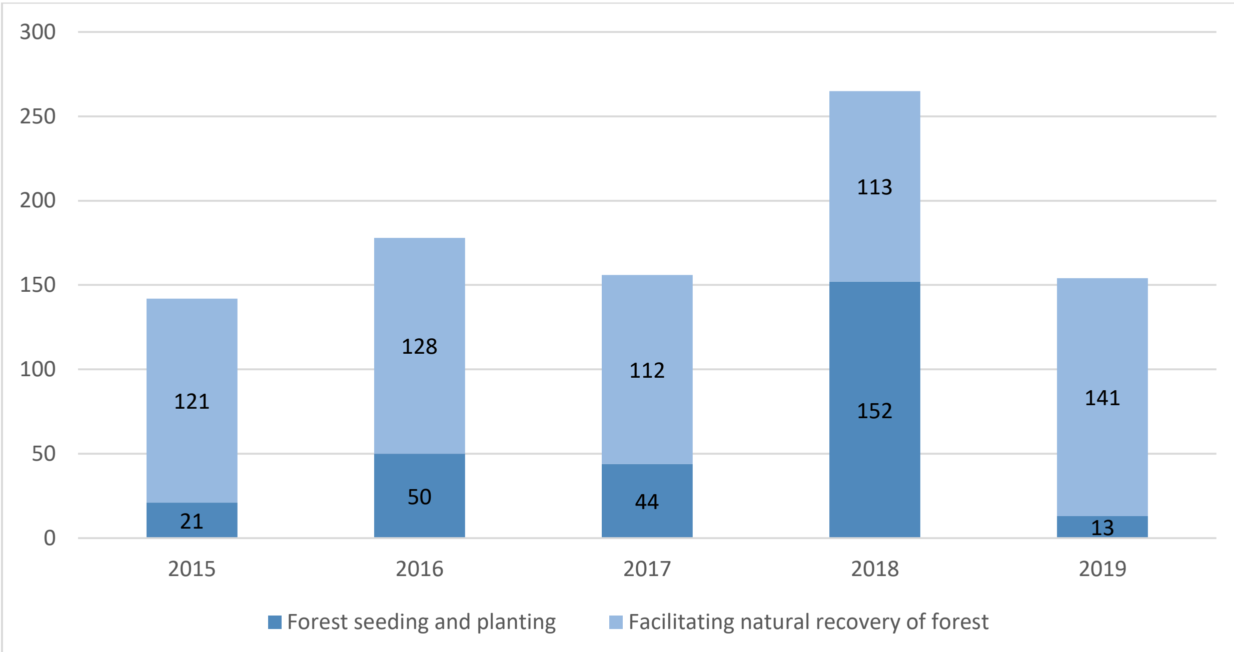
2.4 Forest restoration

The aim of forest restoration and maintenance is to establish sustainable, highly productive forest groves, and to improve useful natural properties and sanitary conditions (USAID, 2017, p. 30). As a result of the improper use of forest resources,[43] as well as negligent behavior,[44] a significant part of Georgian forests has been degraded or burnt. Though, concurrently, forest maintenance and restoration measures have been implemented on a small scale for years (USAID, 2017, p. 31). According to the available data, from 2015-2019, forest restoration through seeding and planting was less common, in all years bar 2018, than restoration via the facilitation of natural forest recovery (see Figure 2.8). The only exception being 2018, when 152 hectares of forest were planted compared to the facilitation of 114 hectares of naturally recovered forest. In 2017, 943 hectares of forest were destroyed by a fire in Borjomi gorge (Samtskhe-Javakheti), therefore

[43] According to the National Forestry Agency, within the framework of "Social Felling", through timber production tickets, 357,147 cubic meters of timber were sold in 2019. In total, 577,902 cubic meter of timber was felled in 2019 (Agency, 2020).
[44] According to USAID, most forest fires are caused by human negligence (USAID, 2017, p. 33).

the National Forestry Agency, within the Forest Restoration Project, planted 400,000 seedlings across 144 hectares. This was the main trigger behind the significant increase in 2018.

Figure 2.8 Forest restoration (ha)



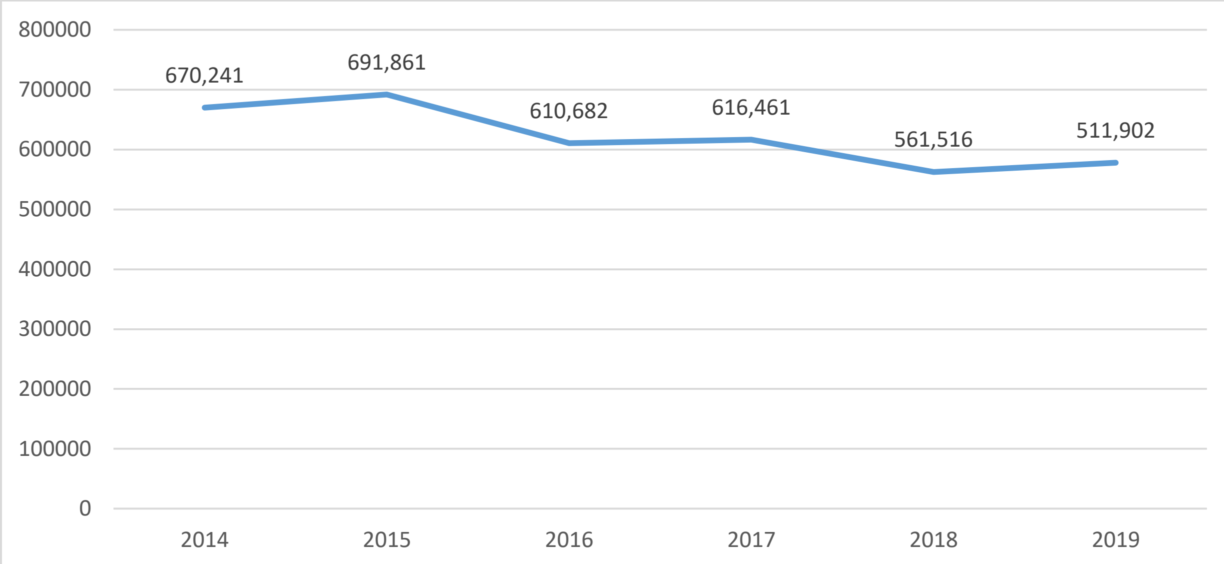
Sources: Ministry of Environment Protection and Agriculture of Georgia; Forestry Agency of Adjara; National Forestry Agency

The area subject to the natural recovery of forests followed a slight growth trend between 2015 and 2019, with some fluctuations, and it increased by 16.5%. One major contribution came from the “Forestry-related services (natural reforestation: fencing/cultivation)” project in Adjara, which aims to restore degraded forest land, protect forests from natural and anthropogenic impacts, and to conserve biodiversity.

2.5 Forest use

The Department of Forest Use of the Forestry Agency is responsible for planning and regulating forest use, preparing right to use issuances, and organizing timber resource provision activities (except that acquired through auction). Historically most felled timber was used by the population as a fuel, but the volume of logging has gradually been decreasing (see Figure 2.9). From 2014 to 2019 the volume of felled timber decreased by 13.8% in total. While in 2019, the National Forest Agency estimates that 577,902 cubic meters of timber was felled in total, of which almost 70% was used by the population (excluding Adjara and Abkhazia AR) as part of Social Felling.

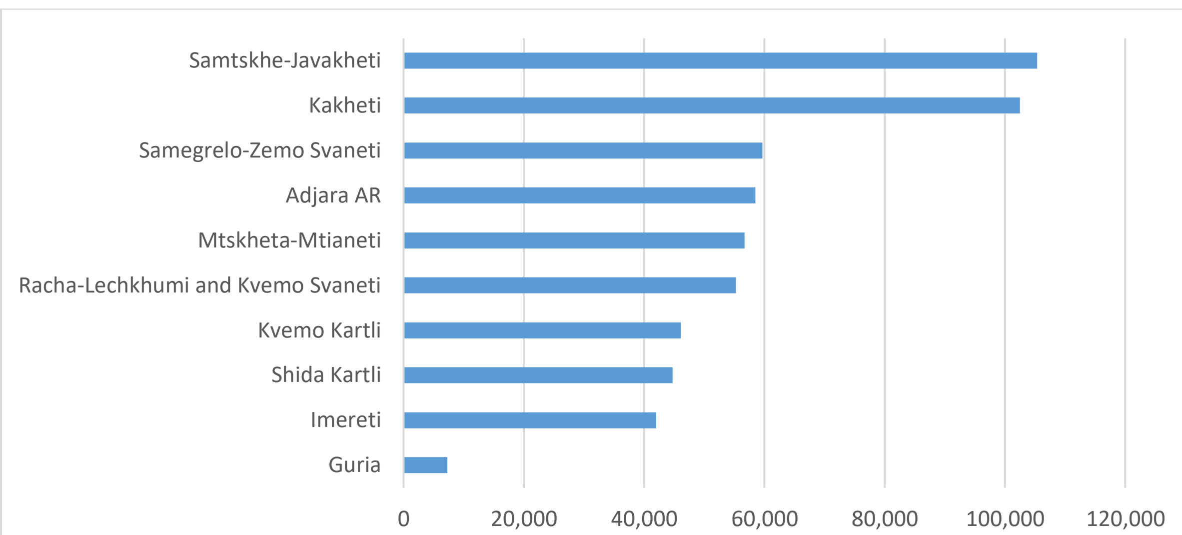
Figure 2.9 Volume of felled timber (cubic meters)[45]



Sources: Ministry of Environment Protection and Agriculture of Georgia; Forestry Agency of Adjara; National Forestry Agency

Among all Georgian regions, Samtskhe-Javakheti and Kakheti led in forest use in 2019, with 18.2% and 17.7% of the entire volume of felled timber, respectively (see Figure 2.10). In Samtskhe-Javakheti logging has been constantly increasing in recent years; between 2014 and 2019 the volume of felled timber rose by 22,607 cubic meters. In Kakheti, on the other hand, it decreased by 21,616 cubic meters over the same period.

Figure 2.10 Volume of felled timber by region, 2019 (cubic meters)



Sources: Ministry of Environment Protection and Agriculture of Georgia; Forestry Agency of Adjara; National Forestry Agency

[45] Excluding protected territories and Abkhazia AR.

Samegrelo-Zemo Svaneti, Adjara, and Mtskheta-Mtianeti were also significant contributors to deforestation. The volume of felled timber in Samegrelo-Zemo Svaneti increased by 21% between 2014 and 2019. While in Adjara and Mtskheta-Mtianeti logging decreased over the period. In total, the volume of felled timber decreased by 26,730 cubic meters between 2014-2019.

The amount of non-processed timber exported to foreign countries has been extremely limited in recent years (see Table 2.1). In 2019, Georgia did not export any timber, and in 2018 only 1 cubic meter of timber was exported to Iran; in comparison to the 200 cubic meters exported to China in 2017.

Table 2.1 Export of non-processed timber

	2015	2016	2017	2018	2019
	Thousand dollars				
Export total	**15.1**	**11.9**	**15.9**	**0.5**	-
Germany	0.2	-	-	-	-
Turkey	-	11.9	-	-	-
Iran	-	-	-	0.5	-
Senegal	9	-	-	-	-
Armenia	5.9	-	-	-	-
China	-	-	15.9	-	-
	Cubic meters				
Export total	**126**	**15**	**200**	**1**	-
Germany	3	-	-	-	-
Turkey	-	15	-	-	-
Iran	-	-	-	1	-
Senegal	90	-	-	-	-
Armenia	33	-	-	-	-
China	-	-	200	-	-

Source: Geostat

Regarding imports, in 2015-2016 Georgia received its non-processed timber mostly from Ukraine. Since 2016, however, the amount of imported non-processed timber has been constantly growing (see Table 2.2), with timber increasingly being imported from Turkey, who became the main exporting country for non-processed timber by 2018 and 2019, while imports from Ukraine dropped to zero.

Table 2.2 Import of non-processed timber

	2015	2016	2017	2018	2019
Thousand dollars					
Import total	**4,058.3**	**3,043.1**	**4,019.4**	**5,448.1**	**5,015.9**
Belarus	-	-	198.2	144.9	-
Bulgaria	-	-	199	246.4	-
UK	-	20.2	-	-	100.2
Germany	1.8	-	-	0.4	-
Turkey	-	221.3	815.9	2,624.4	3,781.4
Canada	-	-	18.9	31.1	-
Latvia	-	-	764.9	712.7	53.5
Lithuania	-	-	1,094.8	1,463.8	582.6
Poland	-	-	-	172.7	86.1
Russia	12.8	-	21	-	-
Slovakia	-	15.8	-	40.7	412.1
Ukraine	4,043.8	2,785.8	906.7	10.9	-
Cubic meters					
Import total	**27,052**	**23,114**	**25,377**	**30,901**	**37,495**
Belarus	-	-	1,160	785	-
Bulgaria	-	-	1,159	1,371	-
UK	-	169	-	-	801
Germany	3	-	-	1	-
Turkey	-	1,130	4,697	14,494	30,548
Canada	-	-	111	183	-
Latvia	-	-	4,214	4,758	387
Lithuania	-	-	6,214	7,960	4,245
Poland	-	-	-	1,198	622
Russia	32	-	83	-	-
Slovakia	-	32	-	85	892
Ukraine	27,017	21,783	7,739	65	-

Source: Geostat

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3. Protected Territories

A protected territory is defined as a geographical space, which is recognized, dedicated, and managed, through legal or other effective means, to the achievement of long-term environmental conservation, with associated ecosystem services and cultural values (IUNC, 2013). The primary function of protected territories is to preserve a country's natural inheritance.

3.1 Overview of the legal and institutional arrangement

The management of protected areas in Georgia is regulated by the Ministry of Environmental Protection and Agriculture of Georgia (MEPA), the Agency of Protected Areas (APA), and 20 additional territorial administrations under the management of the Agency (APA, 2019). In 1996, Georgia developed a law regarding protected areas[46] that constitutes the legal basis for establishing protected areas, those which safeguard the country's unique environment and cultural heritage. The management of protected areas is also carried out according to a management plan, regulations, and other normative documents. There are six categories of protected area in Georgia – matching international criteria and norms, the procedures of which are based on recommendations from the World Conservation Union (IUCN) – including: strict nature reserves, national parks, managed reserves, natural monuments, protected landscapes, and multipurpose areas.

Strict nature reserves

Strict nature reserves are established to maintain a dynamic and untouched state of nature, natural processes, and genetic resources.[47] Access to these protected areas is only allowed with special permission during the conduction of non-manipulative scientific research and studies, with an insignificant impact, for environmental monitoring purposes.

National parks

A national park is generally created to protect relatively large natural ecosystems of exceptional beauty, of national and international importance, or to conserve existing biodiversity.[48] National parks cover a relatively large area; hence they are of particular importance to biodiversity. In addition, national parks play an essential role in the development of tourism, especially via the international promotion of natural and cultural heritage.

Managed reserves

A managed reserve is a protected area where human intervention is permitted to restore certain species of animals or plant.[49] Conducting particular restorative and maintenance measures within a managed nature reserve is permitted. Additionally, the consumption of certain renewable resources is permitted under strict supervision and control.

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[46] Law of Georgia on the System of Protected Areas, N136, issued by the parliament of Georgia 3 July 1996.
[47] Law of Georgia on the System of Protected Areas, N136, Article 3, issued by the parliament of Georgia 3 July 1996.
[48] Law of Georgia on the System of Protected Areas, N136, Article 5, issued by the parliament of Georgia 3 July 1996.
[49] Law of Georgia on the System of Protected Areas, N136, Article 7, issued by the parliament of Georgia 3 July 1996.

The law on animal managed nature reserves was created in 1997, prior to that stage the category did not exist in Georgia. Forest and hunting farms (established based on special licenses) existed in the place of managed nature reserves beforehand.

Natural monuments

A natural monument is a relatively small area that has a unique value or certain peculiarity.[50] They have national importance, are represented by ecosystems of rare, significant, or highly aesthetic features, with individual samples of plants or fossils, or specific geographical and hydrological formations. For instance, a natural monument could be a valley, a river delta, or a cave.

Protected landscapes

A protected landscape is a protected area where it is possible concurrently to consume natural resources sustainably, promote conservation goals, develop eco-tourism, and implement social projects for the local population.[51] The first in Georgia – the Tusheti protected landscape – was established in 2003. The Tusheti landscape is located in Kakheti, with a total area of 31,518 ha.

Multipurpose areas

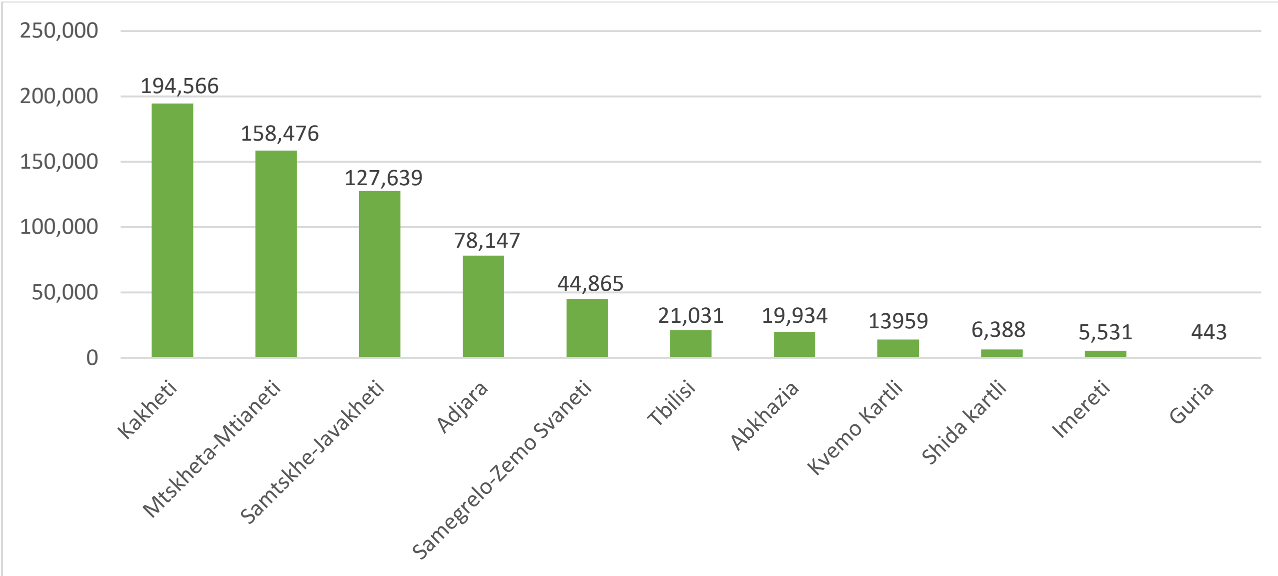
Multipurpose areas are established for economic activities organized under environmental protection requirements and for the use of renewable natural resources.[52] These areas require a relatively large area or wetlands, thus representing the biological foundation for accumulating water, the productivity of forests and pasture, hunting, fishing, the spread of flora and fauna, or for tourism. These areas may be partially modified and can include populated regions. Within the current Georgian legislation, the establishment of multipurpose areas is permitted, however, such an area does not currently exist.

3.2 The extension of protected territories

The most recent publicly available data, from 2019, on protected territories comes from the Ministry of Environmental Protection and Agriculture of Georgia and the Agency of Protected Areas. The total area of protected territories amounts to 670,978 hectares, including the regions of Abkhazia and Tskhinvali. Figure 3.1 shows the distribution of protected territories across Georgian regions. It is clear that the largest protected area (29%) is located in Kakheti. After which, Mtskheta-Mtianeti and Samtskhe-Javakheti also contain significant protected territories – 23% and 19%, respectively. While Adjara and Samegrelo-Zemo Svaneti include 12% and 7% of the total protected area. Whereas the regions of Tbilisi, Abkhazia, Kvemo Kartli, Shida Kartli, Imereti, and Guria, each hold minor shares (under 5%). On the other hand, despite the small areas in these regions, the territories within represent a significant part of protected territories for unique species.

[50] Law of Georgia on the System of Protected Areas, N136, Article 6, issued by the parliament of Georgia 3 July 1996.
[51] Law of Georgia on the System of Protected Areas, N136, Article 8, issued by the parliament of Georgia 3 July 1996.
[52] Law of Georgia on the System of Protected Areas, N136, Article 9, issued by the parliament of Georgia 3 July 1996.

Figure 3.1 Area of protected territories by region (ha), 2019

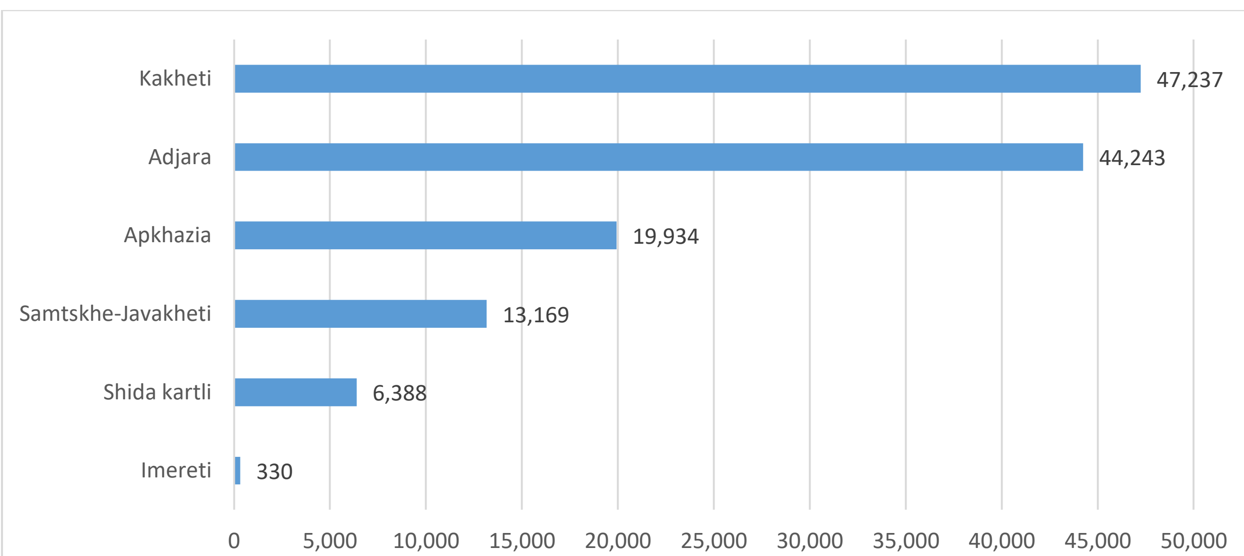


Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

Strict nature reserves

There are 14 strict nature reserves in Georgia, with a total area of 131,301 ha. The data reveals that in 2019 around 36% of strict nature reserves were located in Kakheti (Figure 3.2). After Kakheti, the regions of Adjara (33.7%) and Abkhazia (15.2%) held the greatest area of these reserves. The smallest proportions of such protected areas are found in Samtskhe-Javakheti (10%), Shida Kartli (4.9%), and Imereti (0.3%).

Figure 3.2 Distribution of strict nature reserve area by region, 2019 (ha)

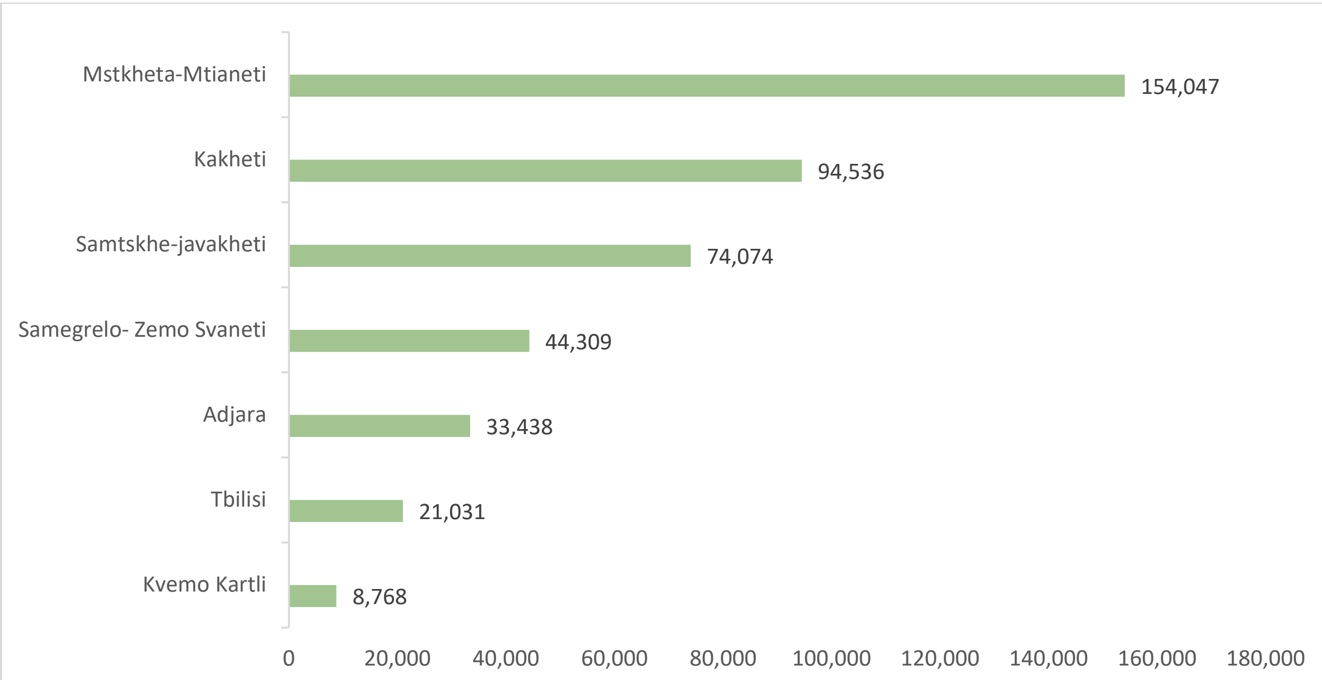


Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

National parks

Georgia at present has 12 national parks, with a total area of 430,203 ha. As can be observed in Figure 3.3, the most extensive national park area (35.8%) is located in the Mtskheta-Mtianeti region. Kakheti and Samtskhe-Javakheti also maintain significant shares (22% and 17.2%) of the total area of national parks. While Samegrelo-Zemo Svaneti and Adjara have fairly similar shares, at 10.3% and 7.8%. Tbilisi and Kvemo Kartli, with 4.9% and 2%, have the smallest national park area in Georgia.

Figure 3.3 Distribution of national park area by region (ha), 2019

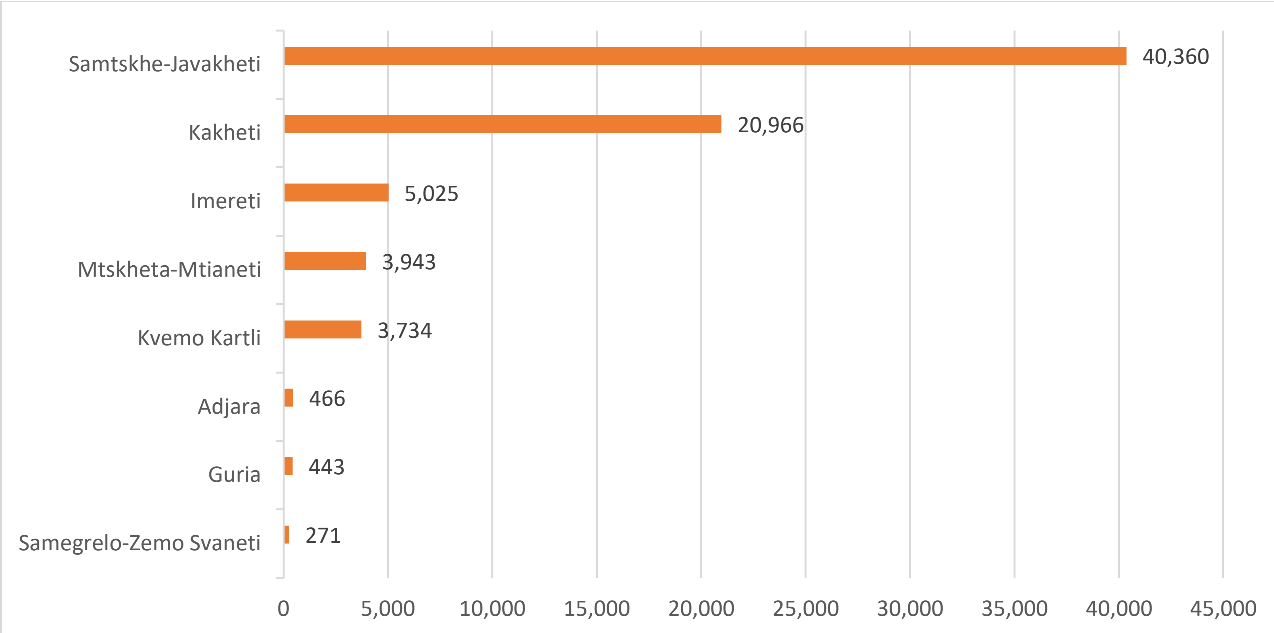


Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

Managed nature reserves

There are 23 managed nature reserves in Georgia, the total area of which is 75,208 hectares. As Figure 3.4 shows, Samtskhe-Javakheti is the region with the greatest area (53.7%) of nature reserves, followed by Kakheti (27.9%). The regions of Imereti, Mtskheta-Mtianeti, and Kvemo Kartli have similar proportions – 6.7%, 5.2%, and 5%, respectively. Although, Adjara, Guria, and Samegrelo-Zemo Svaneti hold only minor percentages (0.62%, 0.59% and 0.36%) of the total area.

Figure 3.4 Distribution of managed reserves by region, 2019 (ha)

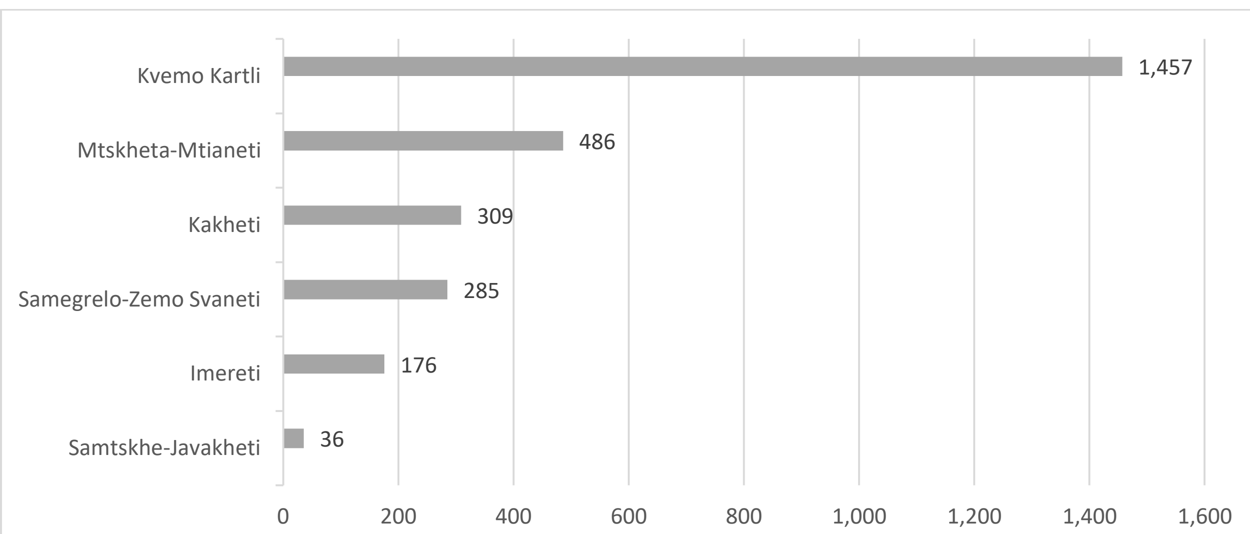


Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

Natural monuments

There are 40 natural monuments in Georgia, with a total area of 2,749 ha. As Figure 3.5 highlights, Kvemo Kartli contains the greatest proportion (53%) of natural monument area. Mtskheta-Mtianeti owns 17.7%, while 11.2% and 10.4% of total natural monument areas are located in the regions of Kakheti and Samegrelo-Zemo Svaneti. Imereti and Samtskhe-Javakheti have the smallest shares, at 6.4% and 1.3%, within this form of protected territory.

Figure 3.5 Distribution of natural monument areas by region (ha), 2019



Source: Ministry of Environmental Protection and Agriculture of Georgia, the Agency of Protected Areas

3.3 Animals in protected territories

Protected areas play an essential role in contributing to the delivery of various ecosystem services that are critical to the biological diversity of woodlands. Crucially, the World Wildlife Fund (WWF) has identified Georgia as a global eco-region of particular importance. Moreover, it is a key ornithological area and a hotspot for biodiversity. Tables 3.1 and 3.2 report the numbers of major animal and bird species within Georgian protected territories.

Table 3.1 Number of core animal species in protected territories (units)

	2000	2005	2010	2015	2016	2017	2018	2019
Chamois	807	594	552	672	617	375	670	707
Brown bear	265	325	543	863	501	344	503	505
Red deer	194	299	554	877	955	1,047	993	922
Wild cat	83	2,507	511	88	143	216	270	230
Marten	476	1,816	1,598	827	875	1,000	416	321
Hare	948	551	3,599	559	589	309	1,030	846
Badger	298	7,018	828	274	411	452	429	502
Grey wolf	310	224	626	702	559	502	1,038	495
Fox	694	275	667	513	933	1,065	1,053	560
Wild goat	150	170	150	419	418	457	563	551
Nutria	40	...	1,293	885	410	165	1,000	1,337
Jackal	187	4,173	9,151	7,309	5,745	4,870	3,524	3,579
Lynx	37	63	85	111	95	88	134	119
Wild boar	230	320	892	966	1,127	794	1,390	1,261
Roe	735	1,372	2,613	2,263	3,507	2,609	3,892	3,858
Squirrel	130	50	1,667	333	843	598	555	416
Otter	20	168	411	307	286	237	383	341
East Caucasian (Daghestan) tur	641	695	1,455	1,689	1,068	708	1650	1,384

Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

Table 3.2 Number of core bird species in protected territories (units)

	2000	2005	2010	2015	2016	2017	2018	2019
Eastern imperial eagle	2	10	46	54	51	56	56	32
Tawny eagle	10	10	...	...	158	25	25	194
Golden eagle	55	38	51	36	44	51	60	47
Owl	419	531	30	198	212	523	487	780
Nightingale	90	40	...	...	...	50	60	78
Rock partridge	365	2,120	4,670	2,235	...	3,106	2,100	1,500
Woodpecker	449	504	2,311	871	15,788	...	591	559
Sparrow-hawk	97	75	403	96	2,741	327	218	430

Gyps	28	80	116	114	167	231	...	190
Caucasian grouse	780	982	845	966	966	1,017	1,308	1,119
Cinereous vulture	12	42	184	159	116	182	228	135
Eurasian woodcock	692	528	950	3,300	7,727	307	1,175	9,000
Common wood pigeon	...	375	362	...	1,190	1,332	1,985	6,186
Goshawk	75	35	608	380	301	220	300	620
Black stork	...	10	20	1,084	215	415	30	1,093
Crow	310	150	35	2,000	2,674	1,360	1,400	2,820
Blackbird	1,930	1,842	3,652	5,000	11,151	4,033	2,666	22,426
Falcon	...	16	18	62	83	67	120	205
Caucasian snowcock	702	766	645	886	505	568	594	508
Mistle thrush	1,380	1,100	210	1,000	68	690	2,764	2,600
Eurasian jay	1,100	779	2,158	1,900	669	1,483	1,699	3,488
Black kite	...	50	17	39	33	1,577	300	146
Pheasant	45	166	647	700	...	1,725	1,800	1,125

Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

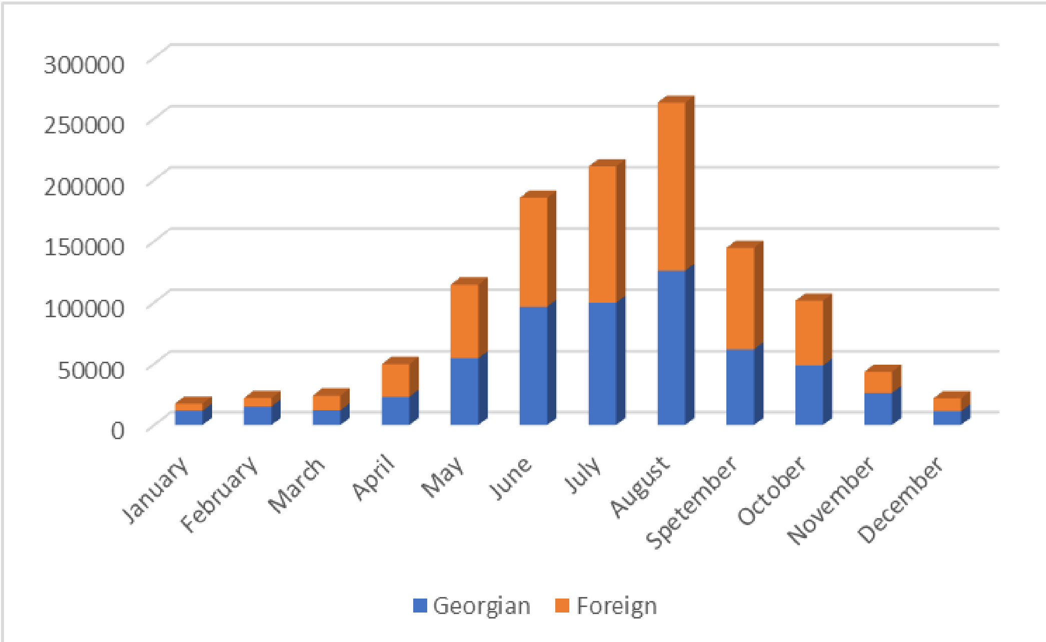
Among those listed in Tables 3.1 and 3.2, the species of animal and bird under the risk of extinction are: the chamois, brown bears, red deer, wild goats, lynxes, roe, East Caucasian (Daghestan) turs, eastern imperial eagles, golden eagles, gyps, Caucasian grouse, cinereous vultures, black storks, and Caucasian snowcocks.[53] These species are all included in the Georgian Red List. Furthermore, for biodiversity protection, the APA began intensive monitoring and research on various unique species in 2016.

3.4 Visitors

Eco-tourism is a leading form of tourism in the country, with both foreigners and Georgians attracted by the desire to visit protected territories – as of 2019, domestic and foreign visitor numbers were almost equivalent (see Figure 3.6). While the diverse flora and fauna and the abundance of historical and cultural monuments create ideal conditions for the development of eco-tourism.

[53] Decree of the Georgian president on the approval of the "Red List" of Georgia, N303, issued 2 May 2006.

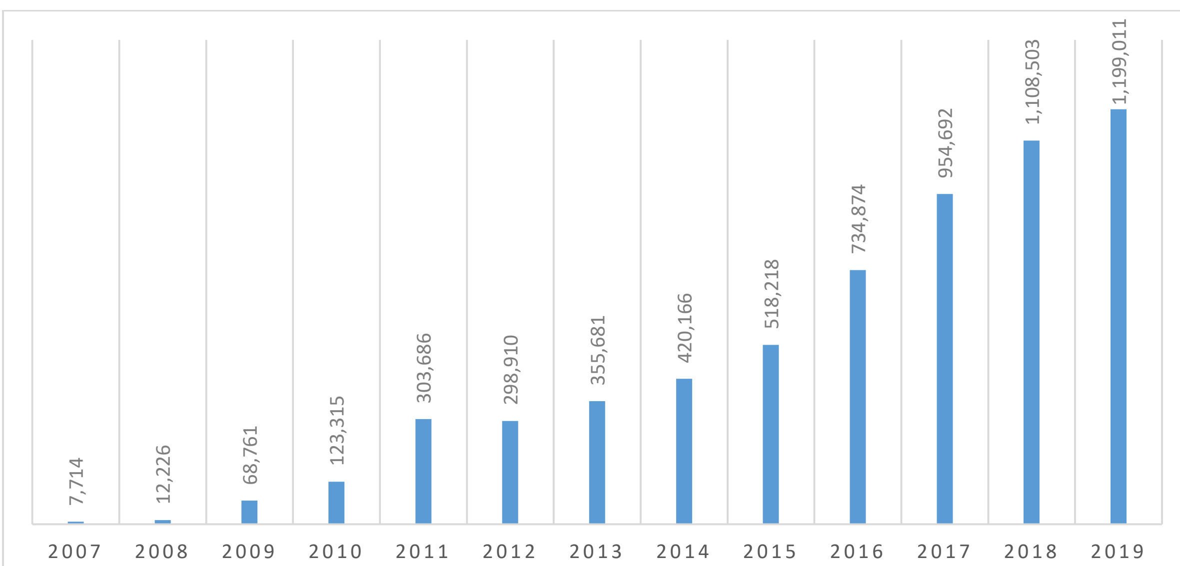
Figure 3.6 Number of visitors by month, 2019



Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

Research from MEPA reveals that eco-tourism has been expanding significantly over time. For instance, as Figure 3.7 shows, the number of visitors from 2007 to 2019 increased by over 155 times, and more than doubled from 2015 to 2019. During this period, APA, aided by MEPA, made significant infrastructural changes and created new touristic services for eco-tourism development (APA, 2019).

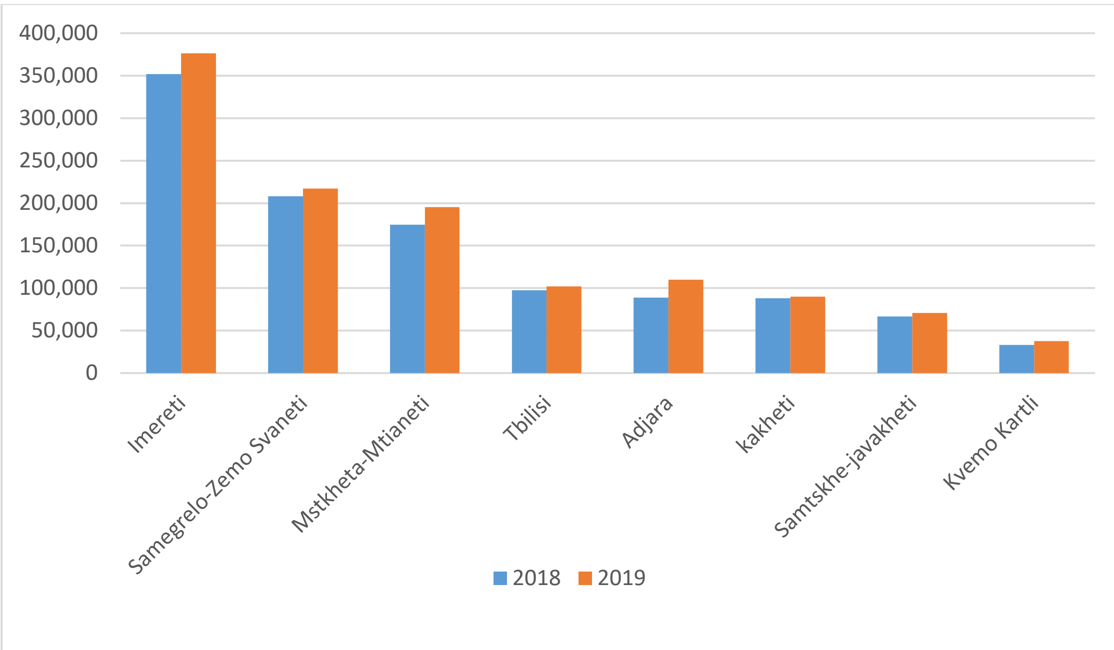
Figure 3.7 Number of visitors by year, 2019



Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

As shown in Figure 3.8, the most visited region in 2018 and 2019 was Imereti. Samegrelo-Zemo Svaneti and Mtskheta-Mtianeti were also popular destinations in terms of eco-tourism, followed by Tbilisi, Kakheti, Adjara, and Samtskhe-Javakheti. Kvemo Kartli was the region with the fewest tourist visits in 2018 and 2019, though it has only a small fraction of protected Georgian territory.

Figure 3.8 Visitor distribution in protected areas by region

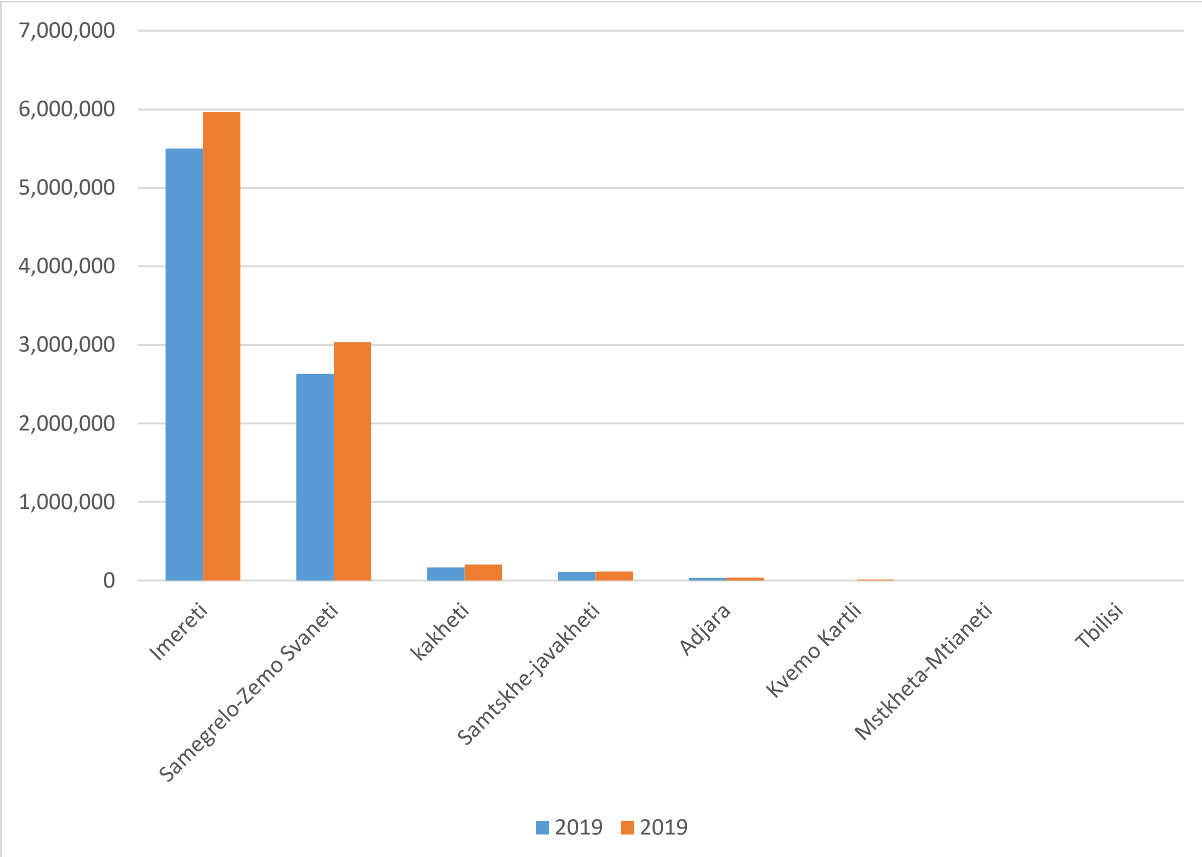


Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

Visitors and income

Alongside increasing visitor numbers, the amount of income received from tourist services in protected territories has also expanded. Based on the MEPA data, Georgia received 8,436,125 GEL from tourist services in 2018 and 9,363,447 GEL in 2019 (Figure 3.9 shows income distribution by region). As Imereti had the greatest number of visitors in these years, the region also held the largest income (63.7%), while Samegrelo-Zemo Svaneti reported the second highest at 32.4%. Surprisingly, Mtskheta-Mtianeti, despite reporting many visits, held the second smallest income from tourist services, and other regions also reported only marginal income from the provision of tourist services.

Figure 3.9 Income distribution from tourist services by region (GEL)



Source: Ministry of Environmental Protection and Agriculture of Georgia, Agency of Protected Areas

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4. Water Resources

Georgia is considered to be rich in water resources. However, these resources are not evenly distributed and are mainly accumulated in the western part of the country. At present, the issue of water resource management represents one of the most important and challenging factors for policy-makers, with water resources playing a significant role in the Georgian energy (the production of electricity from hydropower plants) and agricultural (for irrigation) sectors.

4.1 Overview of the legal and institutional arrangement

Water resource management is largely governed by the Law on Water, which was adopted in 1997. This determines the main principles and objectives of Georgia's water policy, and its main purpose is to ensure the protection and sustainable use of water resources. As defined by the law, the Ministry of Environment Protection and Agriculture is responsible for elaboration of the national policy on water conservation and use; the establishment of designated state authorities for the regulation and control of water conservation and use; the formation of protected areas on state water resource lands; coordination of activities of authorities in the field of water conservation and use; etc.

In addition to the Law on Water, there are number of legal acts governing water related issues. For example, the Law on Fees for the Use of Natural Resources determines rates for water abstraction; and the Law on Permits and Licensing determines the rules and procedures for obtaining permits for underground water abstraction.

Moreover, the Georgian government has elaborated the new draft Law on Water Management to meet obligations derived under the EU Association Agreement, signed in 2014. However, the draft law has not yet been adopted. One of the main implemented changes foreseen under the new law (in accordance with requirements of the EU Water Framework Directive) is the introduction of integrated river basin management principles, which are perceived as a viable solution to the challenges the Georgian water resource management system faces in terms of water quality and efficient use. The other significant purposes of the water framework are the following: preventing deterioration and sustaining the good status of ecosystems in different water bodies; promoting sustainability in water usage; the progressive reduction of discharges, emissions, and losses of priority substances on surface and groundwater bodies;[54] and mitigating floods and droughts, thus contributing to use of water resources in a sustainable manner.[55]

As previously mentioned, MEPA is one of the chief official bodies responsible for the management of water resources and for the development of a national strategy towards the

[54] Substances or groups of substances are on the priority list for which environmental quality standards were set in 2008, including selected existing chemicals, plant protection products, biocides, metals, and other groups like Polyaromatic Hydrocarbons (PAH) that are mainly incineration by-products, and Polybrominated Biphenyl ethers (PBDE) that are used as flame retardants.
[55] The EU Water Framework Directive.

sustainable management of water. However, there are certain responsibilities shared with other national and local authorities, for example:

- The Department of Environment Supervision is responsible for the monitoring of water pollution and checking compliance under the terms of environmental permits issued by MEPA;
- The National Environment Agency is responsible for monitoring surface and groundwater quality and quantity;
- The National Agency of mines is responsible for regulating groundwater use and issuing permits for groundwater abstraction;
- The National Food Agency controls the quality of drinking water;
- The National Energy and Water Supply Company regulates tariffs on drinking water supply, sanitation, and irrigation.

4.2 Available water resources in Georgia

Georgia can be divided into two main river basin groups – the Black Sea Basin in the west and the Caspian Sea Basin in the east:

- The internal renewable surface water resources (IRSWR) generated in the Black Sea Basin are estimated at 42.5 km^3/year. The most important rivers in terms of volume are the Enguri, the Rioni, and the Chorokhi, with an average annual discharge into the Black Sea of 5.9 km^3, 12.6 km^3, and 6.9 km^3, respectively. The Chorokhi river originates in Turkey, and its average estimated inflow from Turkey is 6.3 km^3/year (Food and Agriculture Organization of the United Nations, 2008);
- In the Caspian Sea Basin, the IRSWR generated is estimated at 14.4 km^3/year (Food and Agriculture Organization of the United Nations, 2008), implying that, compared to the west, the rivers located in eastern part of the country are less water abundant. Recent estimates of annual water discharge are not available, though according to the Georgian Soviet Encyclopedia, published in 1984, the rivers with the highest annual water discharge are: the Tergi (9.6 km^3) with headwater in Russia; the Alazani (3.5 km^3); the Khrami (1.8 km^3) with headwater in Georgia; and the Mtkvari (18.1 km^3) with headwater in Turkey (Apkhazava, Georgian Soviet Encyclopedia, 1984);
- Finally, renewable groundwater resources are estimated at 17.23 km^3/year, of which 16 km^3/year are drained by the surface water network (overlap). This gives a total 58.13 km^3/year of internal renewable water resources (IRWR) (Food and Agriculture Organization of the United Nations, 2008).

Rivers in Georgia

Georgia being rich in water resources, has more than 26,060 rivers with a total length of 59,000 km. Although the majority of rivers (99.4%) are short (less than 25 km long) (Tsiklauri, 2004). According to the Environmental Information and Education Centre of Georgia, 18,109 rivers (70% of Georgian rivers) belong to the Black Sea Basin, while the remaining 7,951 rivers stem to the Caspian Sea Basin. Table 4.1 below presents the ten longest Georgian rivers alongside their main characteristics.

Table 4.1 Rivers in Georgia and their characteristics

River	Total length, km	Length within Georgia, km	Annual average discharge, km^3	Basin size, km^2	Drainage basin
Chorokhi	438	26	6.9	22,100	Black Sea
Rioni	333	333	12.6	13,400	Black Sea
Enguri	213	213	5.9	4,060	Black Sea
Tskhenistsqali	184	184	2.8	2,120	Black Sea
Khobi	150	150	1.6	1,340	Black Sea
Mtkvari	1,515	351	18.1	188,000	Caspian Sea
Tergi	623	30	9.6	43,200	Caspian Sea
Alazani	409	391	3.5	11,800	Caspian Sea
Iori	320	183	0.5	4,650	Caspian Sea
Khrami	220	187	1.8	8,340	Caspian Sea

Sources: Ministry of Environmental Protection and Agriculture (MEPA); Apkhazava (1984)

Lakes

There are up to 860 lakes in Georgia, most of which have a small surface area; their total surface area represents 170km^2, which is 0.24% of the country's territory.[56] Paravani lake (located in the Samtskhe-Javaketi region) has the largest surface area of 37.5 km^2. The most water-abundant lake is Tabatskuri (in Samtskhe-Javakheti) with a volume of 221 km^3. While the deepest lake is Ritsa (located in Abkhazia) with a maximum depth of 101 m. Table 4.2 below shows the largest lakes (in terms of surface area) in Georgia and their characteristics.

Table 4.2 Lakes and their characteristics

Lake	Surface area, km^2	Volume, m^3	Maximum depth, m	Height above sea level, m	Region
Paravani	37.5	90,800,000	3.3	2,073	Samtskhe-Javakheti
Kartsakhi	26.3	19,300,000	1	1,799	Samtskhe-Javakheti
Paliastomi	18.2	52,000,000	3.2	-0.3	Samegrelo-Zemo Svaneti
Tabatsquri	14.2	221,000,000	40.2	1,997	Samtskhe-Javakheti
Khanchali	13.3	6,365,000	0.7	1,928	Samtskhe-Javakheti
Jandari	10.6	51,148,000	7.2	291	Kvemo Kartli
Madatapa	8.8	9,658,000	1.7	2,108	Samtskhe-Javakheti
Saghamo	4.8	7,710,000	2.3	1,996	Samtskhe-Javakheti
Ritsa	1.5	94,000,000	101	884	Abkhazia
Keli	1.3	31,653,000	63	2,914	Mtskheta-Mtianeti
Bazaleti	1.2	5,000,000	7	878	Mtskheta-Mtianeti

Sources: MEPA; Apkhazava (1984)

Water reservoirs

In total, there are 44 water reservoirs in Georgia with a total area of 163 km^2 and volume of 3.3 million m^3. The reservoirs are mostly used for hydropower plants, though also for irrigation, fishing, and recreational purposes. The largest in terms of area and volume are the Tsalka (33.7 km^2) and Jvari (1,100 mln. m^3) reservoirs, respectively. The Jvari reservoir is also the deepest, with a maximum depth of 226 m. Reservoirs are represented by either cascades (e.g., Jvari, Shaori) or pondages (e.g., Tsalka, Zhinvali) (Apkhazava, Georgian Soviet Enciclopedia, 1987).

[56] The Environmental Information and Education Centre of Georgia.

Table 4.3 The largest water reservoirs in Georgia

Reservoir	Feeding River	Area, km^2	Volume, m^3 (mln.)	Purpose of use
Tsalka	Khrami	33.7	312	Energy
Jvari	Enguri	13.5	1,100	Energy
Shaori	Shaora	13.2	71	Energy
Sioni	Iori	12.8	325.4	Energy
Tkibuli	Tkibula	12.1	84	Energy
Tbilisi	Iori	11.6	308	Complex[57]
Zhinvali	Aragvi	11.5	520	Complex[58]
Gali	Eristsqali	8.2	145	Energy
Vartsikhe	Kvirila	5.1	4.6	Energy
Gumati	Rioni	2.4	39	Energy
Algeti	Algeti	2.3	65	Irrigation
Lajanuri	Lajanura	1.6	50	Energy
Nadarbazevi	Liakhvi	1.18	8.2	Irrigation
Zonkari	Patara Liakhvi	1.4	40	Irrigation

Source: Apkhazava (1987)

Glaciers

According to the present literature, it was estimated that in 2015 there were 637 glaciers in Georgia, covering 355.8 km^2. Of these, 89.3% belong to the Enguri, Rioni, Kodori, and Tergi river basins. In western Georgia, glaciers occur above 2,800-2,900 m. In contrast, for example in Lagodekhi to the far east, the glaciation process begins above 3,600 meters. These notable differences are due to the different levels of precipitation (Tielidze, 2017). A further study by Tielidze and Wheate (2018) observes how the glacier inventory has changed over the years in the Greater Caucasus (Russia, Georgia, Azerbaijan). Between 1986 and 2014, the glacier area in the region decreased by 288.9 ± 12.8 km^2 or 19.5 ± 4.6%, and the number of glaciers from 2009 to 2020. Furthermore, the glaciers in the eastern Greater Caucasus have decreased (0.98% yr^{-1})[59] more than in the central (0.46% yr^{-1}) and western (0.52% yr^{-1}) sections, while southern glaciers reduced (0.61% yr^{-1}) more than in the north (0.50% yr^{-1}) between 1960 and 2014.

[57] Irrigation and drinkable water supply.
[58] Energy and drinkable water supply.
[59] Yr^{-1} implies annual changes.

Table 4.4 below presents a list of the longest Georgian glaciers. The extension of glaciers, as estimated in the initial observation year, is compared with estimates from satellite data collected in 2014.

Table 4.4 Glaciers and their characteristics

Glacier	River rising from the glacier	Length of glacier, km	Area, km^2		Peak height, m	Commencement of observing glaciers	Area of glacier, km^2 according to Landsat 8, 2014 data[60]
			Basin	Glacier			
Devdoraki	Devdoraki Tsqali	7.27	13.22	6.76	5,034	1960	4.4±0.12
Gergeti	Chkheri	8.53	11.28	7.32	5,034	1951	5.77±0.18
Kvishi	Kvishi	7.05	18.10	13.84	4,400	1964	N/A
Ushba	Ushba	5.95	18.80	10.30	4,540	1964	N/A
Tchalaati	Tchalaati	7.45	26.16	13.18	4,330	1960	9.24±0.28
Lekhziri	Mestitchala	11.90	61.56	41.20	4,302	1964	23.76±0.72
Koruldashi	Koruldashi	4.25	8.48	3.66	4,145	1966	N/A
Kirtisho	Tcheshura	5.00	7.10	5.63	3,840	1966	N/A
Central Suatisi	Suatisidoni	4.74	4.56	2.53	4,160	1966	2.07±0.08

Sources: MEPA; Tielidze, 2018

Geothermal water resources

According to the Geothermal Association of Georgia, the latest study to examine the resources available in the country was conducted in the 1970s. Based on this information, geothermal water reserves amounted to 250 mln. m^3 per year. These waters belong to 44 deposits, from which more than 80% are found in western Georgia. There are 50 medium depth geothermal bore-hole wells in Georgia, most of which are not functional and, interestingly, none are used for electricity generation (Geothermal Association of Georgia, 2021). There are more than 250 natural and artificial water channels connected to the deposits, with geothermal water temperatures ranging from 30 to 110 ^{0}C. Based on these studies, the expected geothermal power stemming from these deposits amounts to 420 MW/year, with a maximum elaboration of thermal energy estimated at 2.7 million megawatts/hour/year. The main areas rich in thermal resources are as follows: the

[60] https://tc.copernicus.org/articles/12/81/2018/tc-12-81-2018-supplement.pdf.

south flank of the Caucasus mountains, the plate of Georgia, the Adjara-Trialeti folded system, and the Artvini-Bolnisi platform (Melikidze, 2015).

According to the United Nations Economic Commission for Europe (2016), geothermal waters are used for a number of purposes in Georgia, such as district,[61] greenhouse and fishpond heating, agricultural drying, and industrial applications. The report highlights that Georgian geothermal waters are of supreme quality, indicating that they contain minimal amounts of dissolved salts, which, in turn, results in a reduction of scaling during utilization. Nevertheless, the available literature notes that such geothermal sources are not yet fully exploited in the country (Melikidze, 2015). However, compared to other regions, geothermal water sources in Tbilisi are utilized more often. For example, water with low mineralization tapped in the center of the city is used by the Tbilisi Balneological Health Resort and hygienic bath houses (45-500 ^{0}C). While high-temperature water (57-740 ^{0}C) tapped in the Lisi (wells no. 5-t, 7-t, 8-t) and Saburtalo (no. 1, 4-t, 6-t) areas, with a total discharge of 4,000 m^3/day, is used for the hot-water supply and heating homes and offices (Melikidze, 2015). Moreover, geothermal sources are used for heating purposes throughout the country. Table 4.5 below summarizes the utilization of geothermal sources for heat generation, as of 2014.

Table 4.5 Geothermal direct heat use, 2014

Use	Installed capacity (MW)	Annual energy use (TJ/year)
Individual space heating	13.57	130
District heating	8.74	83
Greenhouse heating	20.27	192
Bathing and swimming	30.81	290
Geothermal heat pumps	0.03	0.16
Total	73.42	695.16

Source: Melikidze, 2015

Precipitation levels

The National Environmental Agency’s (NEA) 2019 data reveals that the average precipitation level was 1,068 mm/year; reaching the maximum in Kobuleti (2,622 mm/year) in the extreme west and the minimum in Tbilisi, in the central-east (558 mm/year).

[61] A system for distributing heated water from a centralized location to residential and commercial users.

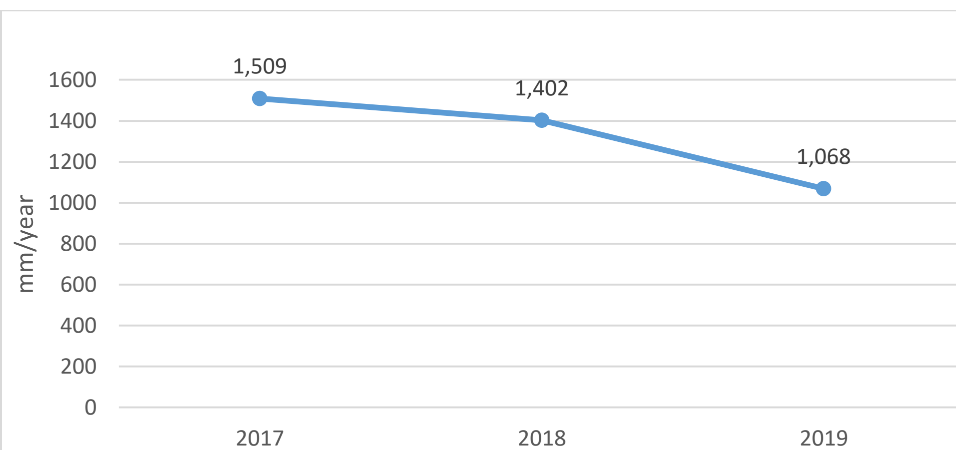
Table 4.6 Precipitation rate by location, 2019

Location	Average precipitation mm/year
Kobuleti	2,622
Zugdidi	1,848
Khulo	1,835
Kutaisi	1,576
Zestafoni	1,536
Lagodekhi	1,312
Ambrolauri	1,220
Sachkhere	1,086
Pasanauri	976
Telavi	796
Sagarejo	704
Kvareli	674
Akhalkalaki	639
Dedoplistkharo	639
Tianeti	626
Akhaltsikhe	589
Gori	587
Khashuri (Agara)	586
Bolnisi	576
Tsalka	560
Tbilisi	558

Source: Authors' calculations based on NEA data (2019)

Using NEA data, one can see that over the last three years precipitation rates have been declining (see Figure 4.1).

Figure 4.1 Average precipitation rates in Georgia (mm/year)



Source: Authors' calculations based on NEA data

Research from the UN's Food and Agriculture Organization (FAO) offers a brief description of the natural resources in Georgia. According to the FAO (2008), the long-term average precipitation level in Georgia is 1,065 mm/year, which appears to be a robust estimate as the 2019 precipitation level was found to be 1,068 mm/year.

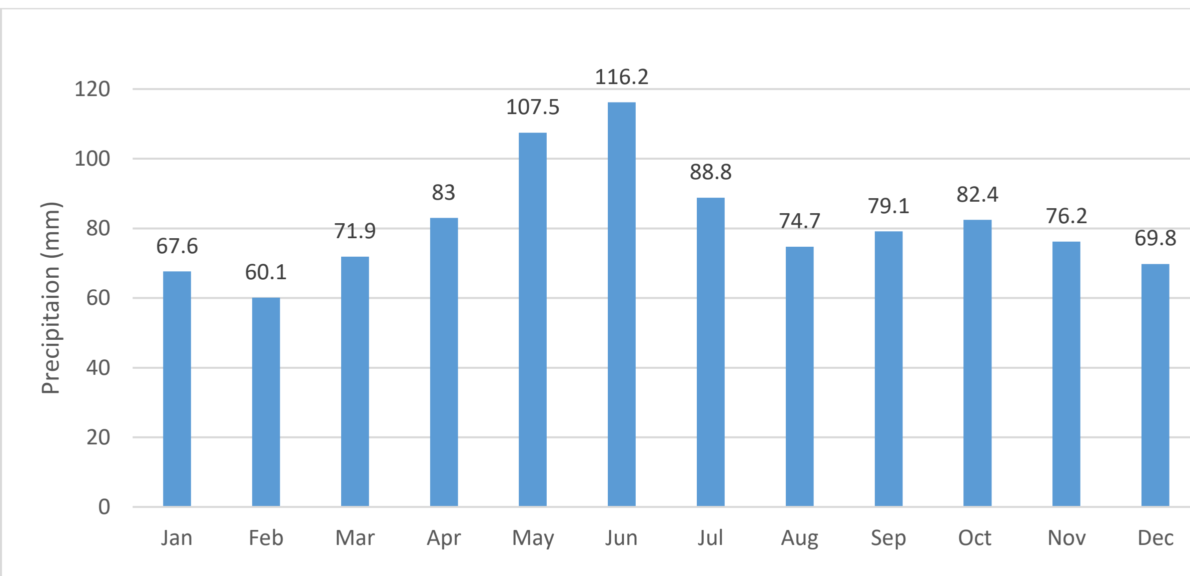
Table 4.7 Renewable water resources

Precipitation (long-term average)	1,065 mm/yr
Internal (of local sources) renewable water resources (long-term average)	58.13 10^9 m^3/yr
Total external (flowing from neighboring countries) renewable water resources	5.2 10^9 m^3/yr
Total actual renewable water resources	63.33 10^9 m^3/yr
Total actual renewable water resources per inhabitant	16,988 m^3/yr (in 2021)

Source: FAO Global Water Information System; authors' calculations

Under World Bank estimates, over the last 30 years, June and May have held the highest precipitation rates throughout the year – with average rates of 116.20 and 107.50 mm/year, respectively. Whereas February maintains the lowest precipitation rate with an average of 60 mm/year (see Figure 4.2).

Figure 4.2 Average monthly precipitation rates in Georgia, 1991-2020



Source: The World Bank Climate Change Knowledge Portal

4.3 Fresh water abstraction and water use

According to MEPA, in Collection of Key Indicators of Water Use in Georgia (2020), the total water abstraction in 2019 amounted to 30,296.69 mln. m^3, from which only 1.6% (486.02 m^3) originated from underground sources.

The total amount of end-user fresh water consumption was 29,485.21 mln. m^3, implying that 811.49 mln. m^3 (2.7% of total abstracted water) was lost during transportation; caused by a number of reasons, such as leakages, evaporation, accidents, or water-metering errors.

Abstracted fresh water is utilized for five key purposes: drinking water, irrigation, fisheries, hydropower generation, and industry. Hydropower constitutes the largest consumer, where in 2019 its intake amounted to 28,210.60 m^3 of water, which represent 95.7% of the total water usage. However, hydropower plants' water use is non-consumptive, as the water used for generating electricity is discharged back into the water body and can thereafter be used for other abstraction purposes (Mekonnen, 2011). Table 4.8 below summarizes water use from different sectors in 2019.

Table 4.8 Water use from different sectors, 2019[62]

Purpose of use	Used water (m^3)	Share in total, used water (%)	Share in total, water used excluding HPPs (%)
Hydropower	28,210.60	95.68	-
Irrigation	575.85	1.95	45.18
Drinking water	280.48	0.95	22.01
Industry	389.38	1.32	30.55
Fisheries	28.90	0.1	2.27

Source: Authors' own calculations based on MEPA data

As the water used in hydropower plants can be reprocessed, it is important to discuss water consumption excluding hydropower (as shown in the final column of Table 4.8). Thus beyond hydropower, the irrigation sector represents the largest water consumer. This is consistent with the irrigation patterns and methods utilized in the country; Georgian Amelioration suggest that the majority of irrigation systems in Georgia are the flooding methods used by farms, rather than more efficient drip and sprinkle systems. The second largest water consumer is the industrial sector, followed by households (using water for drinking purposes) and fisheries.

If we consider the levels of the two major basins – the Black Sea and Caspian Sea – 60% (17,262 mln. m^3) of total fresh water was abstracted from water bodies located within the Black Sea basin, while the remaining 40% (13,033 mln. m^3) was abstracted from bodies of water in the Caspian

[62] The table includes information regarding fresh water use, which is the total water abstraction minus water losses.

basin. Looking at fresh water use, there is unequal distribution across the basins. For example, 75% (210 mln. m^3) of drinkable water, 92% (357 mln. m^3) of the water used in the industrial sector, and 99% (573 mln. m^3) of water for irrigation was abstracted from the Caspian Sea basin. However, since the west is richer in water resources, 61% of the water used for hydropower plants was abstracted from the Black Sea Basin. Table 4.9 below summarizes the distribution of water abstraction and water consumption across the two major basins.

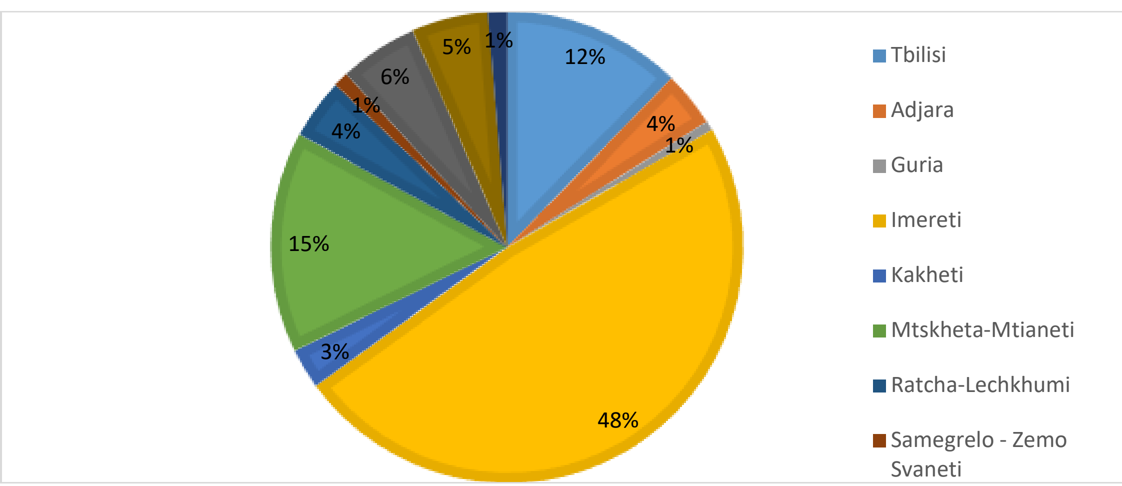
Table 4.9 Water abstraction and use in two basins

Distribution across basins	Water abstraction		Fresh water use					
				Including				
	Total	Underground	Total	Drinkable	Industrial needs	Irrigation	HPPs	Fishing reservoirs
	30,296.69	486.02	29,485.21	280.48	389.38	575.85	28,210.60	28.90
Black Sea basin	17,262.77	115.11	17,213.17	70.32	31.97	3.11	17,098.48	8.60
Caspian Sea basin	13,033.92	370.91	12,272.04	210.16	357.41	572.74	11,112.12	20.30

Source: MEPA

Total fresh water use was the highest in the region of Imereti (14,373 mln. m^3), followed by Mtskheta-Mtianeti (4,511 mln. m^3) and Tbilisi (3,658 mln. m^3), while the least water was used in Guria (191 mln. m^3). The following diagram, Figure 4.3, identifies the proportion of fresh water use across Georgia's regions. Notably, in Imereti the greatest volume of water abstraction comes primarily from hydropower abstraction (14,320 mln. m^3 of water was used in 2019 by hydropower plants, representing 99% of the total abstraction in the region), which is determined by the significant number of hydropower plants in the region.

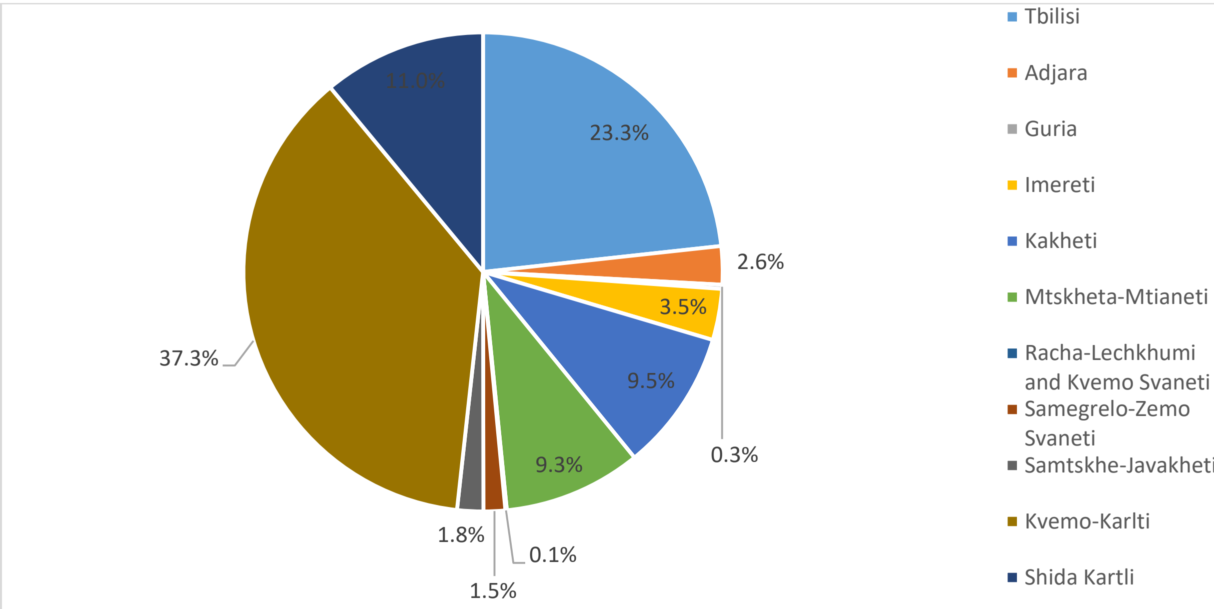
Figure 4.3 Fresh water use by region, 2019



Source: Authors' own calculations based on MEPA data

If one considers total water use excluding hydropower abstraction at the regional level, the situation changes dramatically. Omitting hydropower generation, the region of Kvemo Karli becomes the largest water consumer – with 37% of total consumption – which is chiefly determined by extensive local irrigation requirements (in Kvemo Kartli 307.54 mln. m^3 of water were used for irrigation purposes in 2019, which, excluding hydropower, represents 40% of water abstraction for the region). Kvemo Kartli is followed by the capital city with 23% of total water use. In Tbilisi, the high volume of consumption is determined by household consumption as drinking water; 31% of the country's population (1,171 thousand people) were living in the capital in 2019. Further details are presented in Figure 4.4 below.

Figure 4.4 Fresh water use by region, 2019 (excluding hydropower)



Source: Authors' own calculations based on MEPA data

MEPA estimates that the amount of wastewater discharged into bodies of surface water equaled 28,621.81 mln. m^3 in 2019. It is important to note that water consumed by hydropower plants is discharged without contamination. Therefore, 98.7% (28,239 mln. m^3) of the total discharged wastewater was normatively clean.[63] While 0.7% (187 mln. m^3) was contaminated and the remaining 0.7% (196 mln. m^3) was normatively refined.[64] According to the NEA, the main pollutants in Georgian water bodies are ammonium nitrogens, phosphates, and nitrates.

Notably, although the amount contaminated wastewater discharged is negligible compared to the total amount of discharged water, 90% of contaminated water (168. 8 mln. m^3) is discharged in the Caspian Sea, which is a closed body of water.

According to one UNECE report (2016), only 26% of wastewater in Georgia is treated. Throughout the country 41 urban centers have wastewater treatment plants (WWTPs), however

[63] Normatively clean water – that which has already been cleaned by a wastewater treatment facility when discharged into surface water bodies. It is clear of the harmful substances that can deteriorate surface water quality.
[64] Normatively refined water – that which has been purified and polluting substances removed.

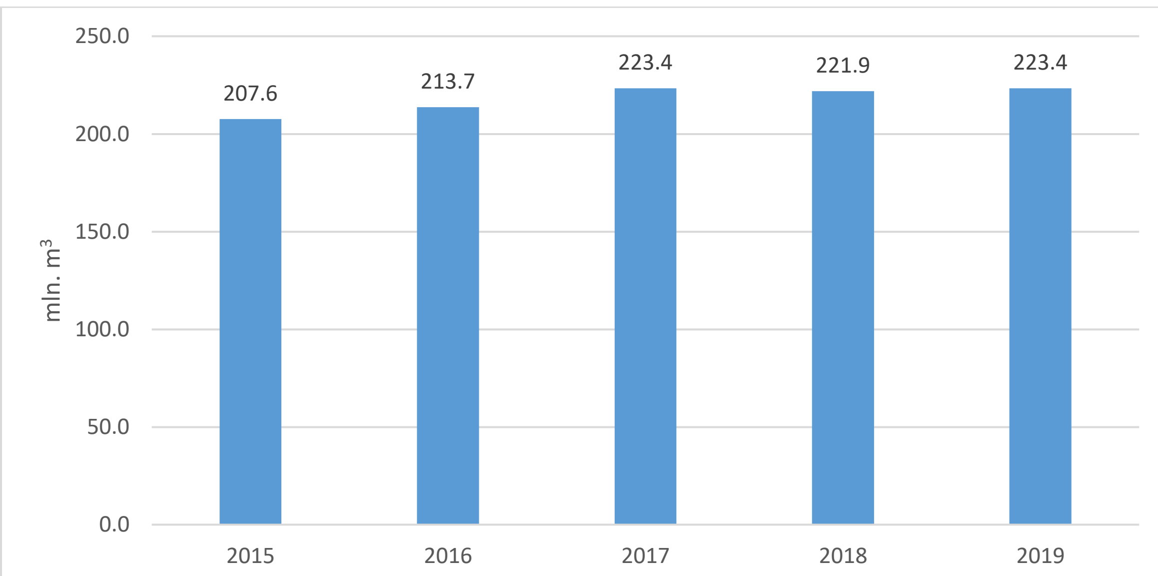
only three are operational. Moreover, the largest of the working WWTPs only has mechanical pre-treatment,[65] while the others also provide biological treatment.[66]

It is estimated that urban wastewater discharge is responsible for roughly 60% of polluting organic load in Georgian water bodies (UNECE, 2016). This report also emphasizes the fact that the concentration of nitrogen and phosphate compounds in Georgian rivers exceeds their normative values.

4.4 The water-supply and sewerage systems

According to one 2019 Geostat report,[67] there were 24 companies involved in the water-supply process. The total amount of water these companies supplied to households increased by 0.7% in 2019 and reached 223 mln. m^3 (see Figure 4.5). Compared to 2015, the total water supplied in 2019 rose by 7.61%. This increase in the household water supply is the result of additional customers connected to water supply systems. Geostat estimates that only 59.5% of the population was connected to the system in 2015, whereas by 2019 this had reached 67.7% of the total population.

Figure 4.5 Water supply to households

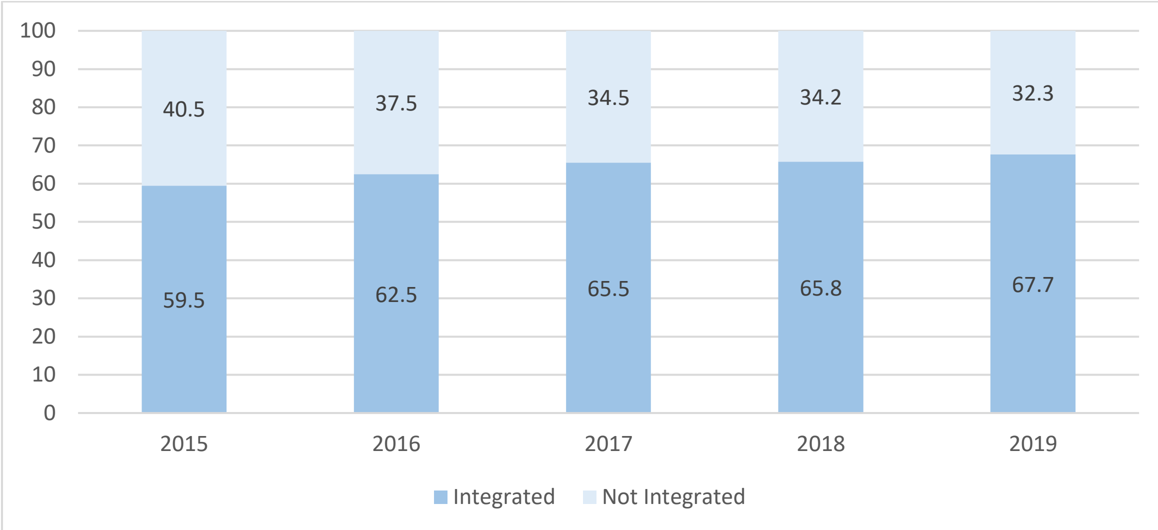


Source: Geostat

The share of households integrated in the water supply system has been growing over time (see Figure 4.6); for instance, from 2019 it increased by 1.9% (to 67.7%) in comparison to 2018.

[65] Preparing incoming water for biological treatment.
[66] Removing bacteria and other microorganisms.
[67] Geostat.

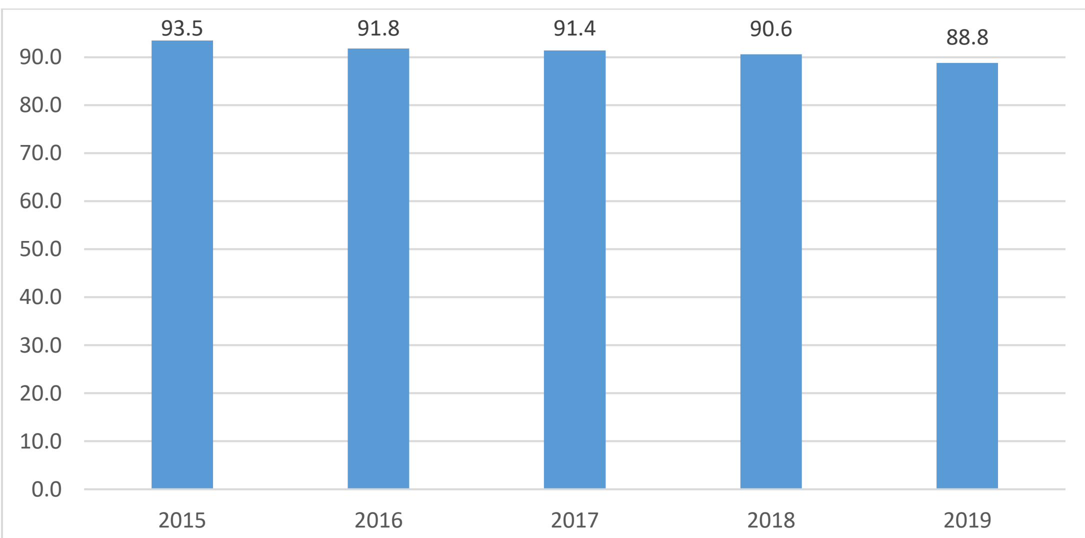
Figure 4.6 The share of households with access to a water supply system



Source: Geostat

Although there has been a continuing rise in the number of households integrated into the water supply system, despite the increased water supplied, per capita household consumption decreased continuously over the last five years (see Figure 4.7). Compared to 2015, yearly per capita household water consumption in 2019 decreased by 5.03%.

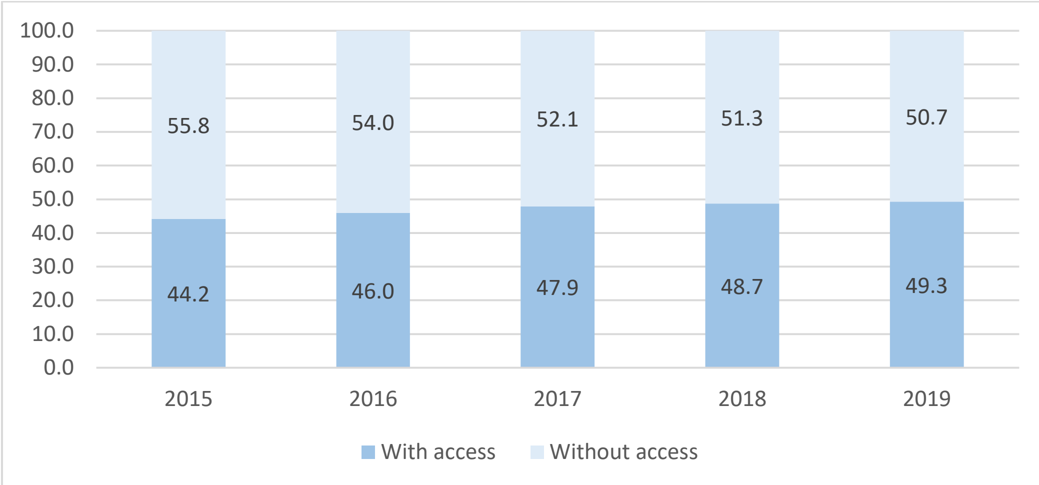
Figure 4.7 Yearly per capita household consumption (mln. m^3)



Source: Geostat

Geostat’s report also describes trends in the sewerage system. During the last five years the proportion of households connected to sewerage systems has increased. However, more than half of households (50.7%) in 2019 still had no access to a sewerage system.

Figure 4.8 Share of households with access to the sewerage system



Source: Geostat

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5. Fishery

Georgia is considered rich in hydrobiological resources, with numerous species of fish found in the Black Sea and throughout its rivers and lakes. Moreover, fish ponds are widespread across the country. Georgia is also actively involved in the international trade of fish with its trading partners, such as the USA, Canada, Russia, and Turkey.

5.1 Overview of the legal and institutional arrangement

Aquaculture in Georgia is mainly regulated by the Law on Aquaculture, which was adopted in June 2020. The law defines the principles and legal grounds for the regulation and implementation of aquacultural activities. According to the law, such activities are to be carried out on the basis of aquaculture permits. To carry out such activities, any interested individual is authorized to submit a written permit application (substantiated request) to the National Environment Agency for the use of a state or local water facility, or a land plot in its ownership or use. In accordance with Georgian legislation, aquaculture permits are issued for up to 20 years (further details regarding licenses for aquaculture and particularly the catchment of fish is provided in the subchapter on licenses below).

Moreover, the criminal code defines that fishing using electric-shock devices or other prohibited means; illegally procuring fish or other living water organisms from a craft with a total capacity of under 100 tons and exceeding 8 meters in length; or catching fish or other organisms on the Georgian Red List, after an administrative penalty for such a violation has been imposed, is punishable by either a fine, up to six months corrective labor, or imprisonment of up to one year.

Legally MEPA is responsible for the elaboration of policy on sustainable aquaculture development. While the NEA is accountable for monitoring fish catchment licenses and determining available quotas. Finally, the Georgian Food Agency is responsible for monitoring the quality of fish used in food production.

5.2 Fresh water habitats in Georgian waters

Georgia having abundant water resources, holds a suitable environment for capture fisheries and aquacultural activities. In total, there are 96 species of fish in Georgian fresh waters, 61 of which live in lentic ecosystems and the remainder in lotic ecosystems (Epitashvili et al., 2020).[68] Thirteen of these are found on the endangered-species list (Japoshvili, 2012). These include: Acipenser Sturio, Scipenser Colchicus, Acipenser Nudiventris, Acipenser Stellatus, Acipenser Gueldenstaedtii, Acipenser Persicus, Huso, Alosa Pontica, Salmo Trutta Fario, Rutilus Frisii, Capoeta Sieboldin, Sabanejewia Caucasica, and Neogobius Fluviatilis. Besides the endemic

[68] The term lentic (from the Latin lentus, meaning slow or motionless), refers to standing waters such as lakes and ponds (lacustrine), or swamps and marshes (paludal), while lotic (from the Latin lotus, meaning washing), refers to running water (fluvial or fluviatile) habitats such as rivers and streams. Marsh G.A., Fairbridge R.W. (1999) Lentic and lotic ecosystems. In: *Environmental Geology. Encyclopedia of Earth Science*. Springer, Dordrecht. https://doi.org/10.1007/1-4020-4494-1_204

species there are also nine invasive species. The Carassius is the most pervasive of these, where due to its ability to adapt to new environments, it has spread to almost every Georgian lake and river.

The most commonly caught and traded species of fish, alongside where they are largely found in Georgia, are reported in Table 5.1.

Table 5.1 Water bodies and fish species

Water body	Species
Lakes on the Javakheti Plateau	Coregonous, Cyprinus Carpio
The Mtkvari river	Capoeta, Cyprinus Carpio
The Alazani river	Silurus Glanis
Jandara and Kumisi lakes	Cyprinus Carpio, Hypophtalmichtys Molitrix
Rivers in the Black Sea Basin	Mugil, Acipenser Nudiventris, Alosa, Cyprinus Carpio, Abramis Brama

Source: Japoshvili (2012)

The Black Sea is also abundant with various species of fish. The available data shows that there were 184 species and subspecies inhabiting the Black Sea in early 1980s, 104 of which were found in the Georgian coastal zone. However, over time, both the fish stock and number of species have been declining. For instance, at the beginning of the 21st century only 69 of those species were identified in these areas (Food and Agriculture Organization, 2006). According to the same data, by 2006 the most widespread species in the Black Sea were the Black Sea anchovy, Black Sea sprat, Black Sea whiting, spiny dogfish, and the red mullet. Anchovies were considered the most profuse of these species – with an estimated total of 250,000 tons of Black Sea anchovies in 2004-2005.

The existing species of fish in Georgia (including fresh water fisheries and ponds) can be divided into two zones – mountains characterized by cold water and valley zones by warm water. The most populous fish in Georgian warm water fisheries are the carp, bighead carp, crucian carp, and amur. In cold water fish farms, the most common fish in lowland areas are the rainbow trout, and in mountainous areas the Sevan trout, rainbow trout, and the gwyniad (Georgia Agrarian Web Journal, 2021).

Georgian waters are also inhabited by several amphibians, including: the Caucasian salamander, southern crested newt, northern banded newt, smooth newt, Caucasian toad, European green toad, European tree frog, yellow tree frog, Syrian spadefoot toad, long-legged wood frog, Eurasian marsh frog, and the Caucasian parsley frog. Among these, the Syrian spadefoot toad and the Caucasian salamander are included in the Red List of threatened species.

Moreover, based on data from MEPA, there are 58 species of mollusk spread across Georgian water bodies. However, the existing data is outdated and requires further investigation for an updated understanding of the situation. The mollusks identified in Georgia include: Bittium reticulatum, Retusa robagliana, Odostomia acuta Jeffreys, Chamelea gallina, Donax semistriatus Poli, etc. There are moreover 70 species of Cladocera and 41 species of Copepoda.

The 2014-2020 National Strategy of Biodiversity and Action Plan of Georgia suggests that there have been no studies conducted since the late 1970s that explore and account for the biodiversity of existing fresh water habitats in Georgia.

5.3 Fish farms in Georgia

The development of the Georgian fishery industry commenced formally in 1930 with the establishment of the joint-stock company Saktevzi. In the early 1930s, fish processing plants were then built in Batumi, Poti, Sukhumi, and Gagra. At that time there were also around 50 aquaculture farms, with a total pond surface area of 2.5 thousand ha. According to Geostat, the area currently devoted to aquacultural activities represents 4,503 ha, 54% of which is ponds, 44% reservoirs and natural water bodies, and the remaining 4% is pools (see Table 5.2). Over the last three recorded years the area of those water bodies has been increasing; in 2018, it expanded by 2.3% compared to the previous year, and in 2019 the growth was 2.1%, largely driven by an increase in pond area.

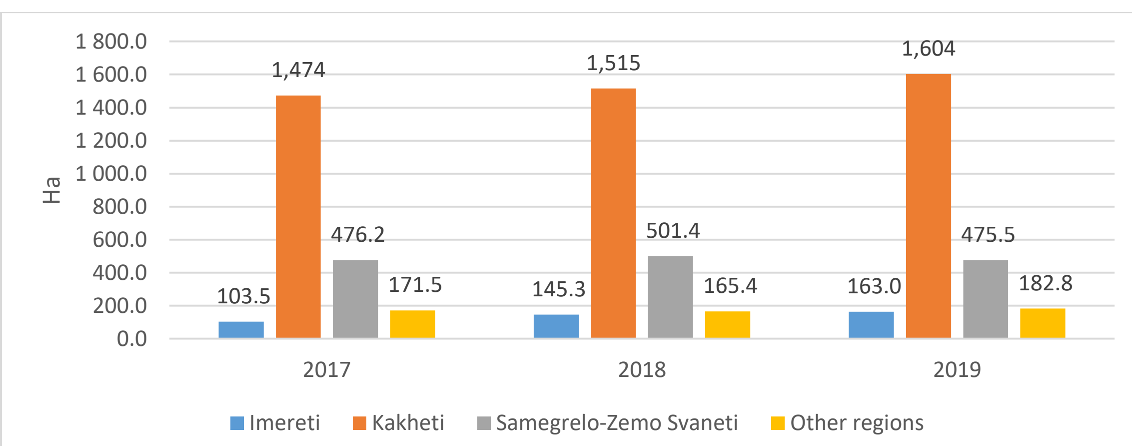
Table 5.2 Area of water bodies for aquaculture (Ha)

Water bodies	2017	2018	2019
Ponds	2,224.6	2,327.5	2,424.8
Pools	27.6	25.9	27.9
Reservoirs and natural water bodies	2,056.8	2,057.1	2,050.3
Total area	**4,309.0**	**4,410.5**	**4,503.1**

Source: Geostat

In 2019, 66% of all ponds were located in Kakheti, followed by the regions of Samegrelo-Zemo Svaneti and Imereti with 20% and 7%, respectively (see Figure 5.1).

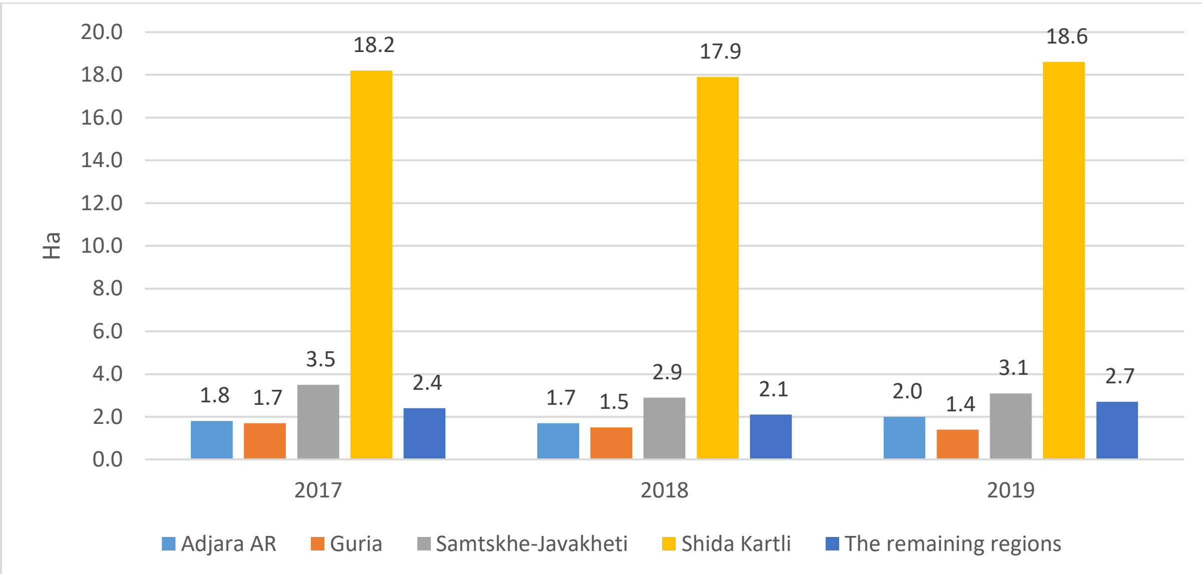
Figure 5.1 Area of aquaculture ponds by region



Source: Geostat

The largest area containing aquaculture pools is in Shida Kartli (66%), followed by Samtskhe-Javakheti (11%). Additional details are presented in Figure 5.2 below.

Figure 5.2 Area of aquaculture pools by region



Source: Geostat

Geostat provides information on the estimated number of fish in Georgian farms by taxonomic family (see Table 5.3).

Table 5.3 Fish by family at the end of the year (tons)

Fish	2017	2018	2019
Salmonidae:	**780.8**	**585.1**	**543.3**
Rainbow trout	755.7	574.7	538.0
Cyprinidae:	**1,063.9**	**1,429.2**	**1,276.5**
Common carp and mirror carp	475.9	672.2	642.3
Grass carp	170.3	223.4	179.6
Silver carp and bighead carp	405.3	501.3	431.8
Sturgeon	**199.9**	**379.8**	**370.0**
Siluridae	**22.5**	**26.6**	**39.5**
Other	**0.6**	**0.3**	**0.8**
Total	**2,067.6**	**2,421.1**	**2,230.2**

Source: Geostat

Under Geostat's estimates, the highest share of the available fish stock at the end of 2019 was accounted for in Kakheti (50%), followed by Shida Kartli (17%) and Imereti (6%) (see Table 5.4).

Table 5.4 Fish by region (tons)

Regions	2017	2018	2019
Adjara AR	121.2	88.8	86.8
Guria	106.6	144.8	100.0
Imereti	90.3	194.7	138.9
Kakheti	882.0	1,214.2	1,136.9
Samegrelo-Zemo Svaneti	184.5	108.3	81.3
Samtskhe-Javakheti	112.9	91.8	72.0
Kvemo Kartli	97.6	110.6	90.4
Shida Kartli	361.9	314.9	384.3
Other regions	110.6	153.0	139.7

Source: Geostat

5.4 Fish production

Production in fish farms

The existing literature on the topic claims that the development of the fishing industry in Georgia has been slow. High capital expenditure, slow cost recovery, and inadequate technological development (e.g., increasing the volume of production without increasing the size of pondages) are the key influences hindering growth in the industry (Association of Young Economists of Georgia, 2015). Geostat calculates that 2,464.7 tons of fish were produced across the country in 2019. In 2018, fish production rose by 17% compared to 2017. However, in 2019 the growth in production was only 4%.

Table 5.5 Fish production in ponds by fish family (tons)

Fish	2017	2018	2019
Salmonidae:	**1,164.8**	**1,475.5**	**1,339.8**
Rainbow trout	1,145.0	1,463.2	1,322.3
Cyprinidae:	**786.3**	**817.1**	**1,012.7**
Common carp and mirror carp	328.1	362.6	479.6
Grass carp	117.8	118.2	135.0
Silver carp and bighead carp	336.0	331.7	395.9
Sturgeon	**76.3**	**75.0**	**97.3**
Siluridae	**14.0**	**12.6**	**14.3**
Other	**0.4**	**0.9**	**0.6**
Total	**2,041.7**	**2,381.1**	**2,464.7**

Source: Geostat

At the regional level, Kakheti was the largest producer of fish in 2019 (35% in this region alone), followed by Shida Kartli (30%) and Imereti (10%).

Table 5.6 Fish production in ponds by region (tons)

Region	2017	2018	2019
Adjara AR	187.0	123.1	125.3
Guria	291.2	260.7	249.2
Imereti	58.8	96.8	73.3
Kakheti	717.7	661.1	865.9
Samegrelo-Zemo Svaneti	70.3	311.0	89.6
Samtskhe-Javakheti	101.6	124.4	127.8
Shida Kartli	543.5	719.7	746.9
Other regions	71.6	84.1	186.6

Source: Geostat

Moreover, according to Geostat, in 2019 Shida Kartli and Guria led the production of Salmonidae – producing 704 and 236 tons, respectively. While the regions of Kakheti and Samegrelo-Zemo Svaneti, produced the largest amount of Cyprinidae that year – 747 and 82 tons, respectively.

Fish prices, despite limited fluctuations, have been characterized by a slightly increasing trend over the last three recorded years (see Table 5.7).

Table 5.7 Fish prices in Georgia (farm gate price per kg (GEL))

Fish Species	2017	2018	2019
Rainbow trout	8.6	8.9	9.6
Carp and mirror carp	7.2	7.0	7.8
White amur	5.7	6.0	6.3
Bighead carp	3.3	3.8	4.0
Russian and Siberian sturgeon	21.3	25.3	24.9
European sheatfish	15.2	14.9	16.1

Source: Geostat

5.5 Licenses

Distinct from production in fish farms, the catchment of fish in the Black Sea and certain Georgian lakes is determined by the number of licenses issued by MEPA, based on MEPA-managed auctions. While the quotas for fish catchment are set by the NEA. Before setting an auction, NEA experts estimate the stock within lakes, and licenses are issued based around this study. Regardless, MEPA acknowledges that the current methodology is outdated and requires further improvements to provide a more realistic picture. Currently, license holders are obliged to report their monthly fish catchment to the NEA. Notably however, there are several activities which are not subject to licensing, including: coastal fish catchment in the Black Sea, catchment for the purposes of sporting activities, and for research purposes.

Table 5.8 below summarizes the lakes in Georgia subject to licensing and the quotes set in 2012 (more recent data was unavailable to the ISET Policy Institute team).

Table 5.8 List of licensed lakes and their quotas

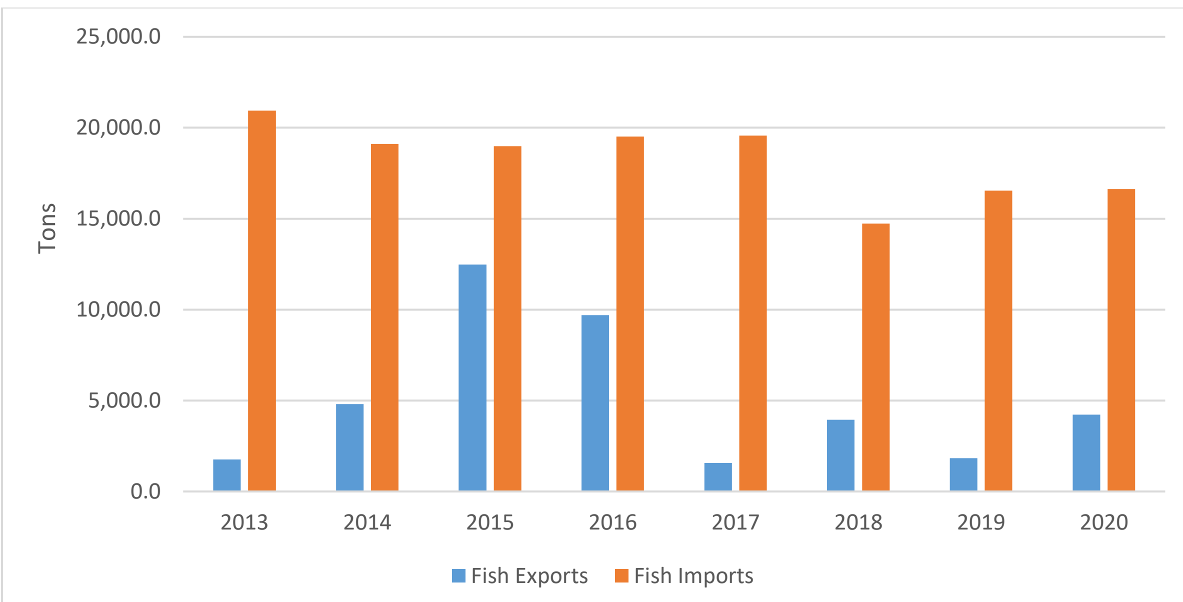
Lake	Quota (tons)	Estimated stock at the time of issuing license (tons)
Nadarbazevi lake	4.5	4.5
Jandara lake	56.1	68
Tsalka reservoir	67.05	70
Tabatskhuri lake	12.4	30
Sanata lake	2	2

Source: Japoshvili, 2012

5.6 International trade of fish

The current level of fish production cannot satisfy total domestic demand. According to Geostat, on average, 10-15% of fish demand is satisfied by domestic production, while the remainder is derived from import. In 2020, Georgia imported 16,637 tons of fish, which is four times greater than the export – 4,228 tons (see Figure 5.3). In monetary terms, Georgia spent 4.6 times more on import (31.8 mln. USD) than it earned on export (6.9 mln. USD).

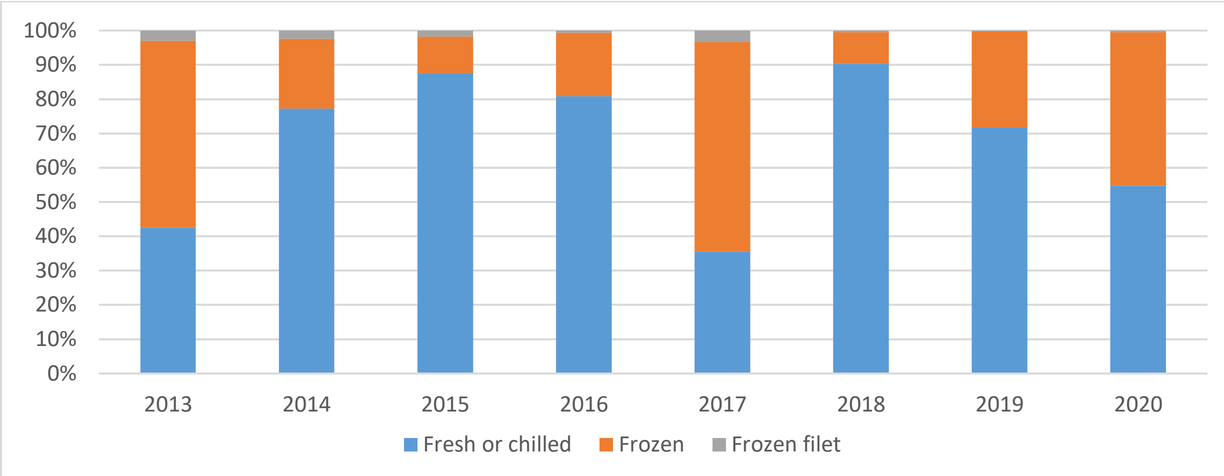
Figure 5.3 Fish export and import (tons)



Source: Geostat

Georgia exports fish in several forms, with fresh-chilled, frozen, and frozen filet constituting 99% of the total export in 2020. Figure 5.4, below, shows the distribution of fish exports in these terms.

Figure 5.4 The different forms of exported fish



Source: Geostat

The primary destination for export is Turkey, which absorbed 52% (2,190 tons) of the total fish export in 2020, followed by Azerbaijan with 31% (1,330 tons) and Russia with 8% (346 tons). The anchovy constituted 99.5% of fish exports to Turkey, exports to Azerbaijan were mainly the whiting (68%) and merluza (24%), while the trout was the only fish exported to Russia.

Historically, fish exports have largely been driven by anchovy production. In 2020, anchovy represented 52% of total fish exports. In 2018, it even constituted a record-high at 89%. The second largest contributor was whiting (from the Black Sea), which amounted to 21% (902 tons) of the total, followed by trout (produced in pondages) at 9% (363 tons), and merluza (from the Black Sea) at 8% (352 tons).

As for fish import, it reached a peak in 2013, and thereafter followed a declining pattern, with several reversions. Compared to 2013, fish imports were 21% lower in 2020.

Table 5.9 Top fish importing countries in 2020

Importing country	Imported fish (tons)
Iceland	2,796
USA	2,274
Canada	2,017
Norway	1,664
Spain	1,284
New Zealand	1,237
Turkey	809
Russia	505
Netherlands	502
Vietnam	422

Source: Geostat

It is interesting to note that Georgia also imports some of the same fish that it exports.

Table 5.10 Top ten most imported fish species in 2020

Fish species	Imported amount (tons)
Scomber	4,669
Merluza	3,449
Salmon	2,385
Whiting	904
Aleck	698
Trout	634
Catfish	304
Sardines	257
Salmonidae	176
Crucian carp	77

Source: Geostat

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6. Mining

The Mining sector has a long history in Georgia. As a part of the Soviet Union, Georgia's mineral resources were actively used in industrial activities, especially in steel production. As all Georgian regions are rich in minerals, the extraction and exploitation of mineral resources still represents a significant part of the economy (however, the exact amount of resources available remains unknown due to a lack of research and data – further details below). Moreover, the mining sector plays an important role in international trade.

6.1 Overview of the legal and institutional arrangement

The main law regulating the mining sector is the Law on Subsoil of Georgia, which was adopted in 1996. Since its development, several changes have been introduced to the law. The law affirms that subsoils located on Georgian land, territorial waters, the continental shelf, or special economic zones are a national treasure of Georgia and are protected by the state. The state is responsible for the development and implementation of a unified state policy on the management of the use of subsoil, the purpose of which is to ensure the implementation of the policy for the rational use of subsoil; to protect equal opportunities for all legal and natural persons for the use of subsoil; to develop free economic links and implement competition policy in the field of the use of subsoil; and to provide the necessary guarantees for subsoil users, including aliens, and protect their rights in the use of subsoil. The law also defines the terms and conditions for issuing mining licenses, the details of which are provided in the license's subchapter below.

There is no specific legislation regarding the usage of minerals, guiding mining technology or methodologies, or general product safety. While general environmental, labor, and investment provisions are applicable to the field.

Within the current legislation,[69] management of the mining sector is an obligation of the National Agency of Mines (NAM), which was created in 2017 and operates under the Ministry of Economy and Sustainable Development of Georgia. Within the scope of its competence, the list of its activities are as follows:

- In accordance with Georgian legislation, granting licenses defined by the Law on Licenses and Permits for the use of mineral resources (except oil and gas);
- Preparing appropriate maps of minerals (or manifestations of minerals);
- Issuing conclusions about the existence or absence of minerals in expected land areas;
- Preparing information on minerals using geological foundation materials;
- Issuing license documents, which are strict registration documents;
- Producing the License Registry(ies);
- Managing the integrated state foundation of minerals;
- Monitoring and controlling the fulfillment of licensing conditions as defined by the license;
- Developing an inventory of all conducted and ongoing industrial and scientific geological works in Georgian territory, territorial waters, the continental shelf, and special economic zones.

[69] Decree of the Georgian government N565, 27 Dec 2017.

6.2 Existing mineral resources

Georgia's mining sector is characterized by several significant deposits of manganese, copper, and gold, and in small-to-medium size quarry operations, primarily marble and construction materials (EBRD, 2018). However, the data regarding available mineral resources is limited, due to difficulties in collecting and accessing the relevant information (including geodata).

NAM reports the distribution of different mineral resources across the regions of Georgia. Although, according to the agency, no assessment of the existing stock of minerals has been conducted since the collapse of the Soviet Union. The information provided by NAM only contains data regarding the type of available resources. As such, details on the amount of resources in the country were unavailable during the creation of this report.

As presented in Table 6.1, peat, clay, and limestone represent the most widespread resources, available in almost every region of the country. Samegrelo-Zemo Svaneti and Samtskhe-Javakheti represent the regions with the most diverse mineral deposits. For the purposes of this report, the research team also requested data on gas and oil extraction from both NAM and the Georgian Oil and Gas Corporation, however this information was not provided.

Table 6.1 Availability of minerals by region

Region	Type of mineral resource
Tbilisi	Tuff
Adjara	Peat, Basalt, Diorite, Clay, Polimetals
Guria	Peat, Clay, Syenite, Tuff, Basalt, Polimetals, Gabbro
Imereti	Clay, Limestone, Sand, Tuff, Teshenite, Quartz, Diorite, Marble, Spondylitis, Basalt, Calcite, Kaolin, Manganese, Barite, Pegmatite
Kakheti	Limestone, Diabase, Clay, Sand, Marble, Gypsum, Copper, Polimetals
Mtskheta-Mtianeti	Limestone, Zeolites, Clay, Tuff, Limestone, Diabase, Basalt, Andesite
Racha-Lechkumi and Kvemo Svaneti	Diabase, Limestone, Gyps, Barite, Marble, Lead, Zink, Gold, Silver, Manganese, Arsenic
Samegrelo-Zemo Svaneti	Travertine, Peat, Limestone, Clay, Marble, Diabase, Red Antimony, Dolomite, Gypsum, Basalt, Andesite, Barite, Polimetals, Gold, Antimony, Wolfram
Samtskhe-Javakheti	Dolerite, Tuff, Andesite, Dacite, Limestone, Peat, Basalt, Diatomite, Clay, Coal, Gyps, Agate, Perlite, Slag, Gold, Copper, Polimetals
Kvemo Kartli	Peat, Basalt, Tuff, Slag, Limestone, Basalt, Granite, Dolerite, Clay, Gold, Copper, Polimetals, Silver
Shida Kartli	Zeolites, Clay, Talc, Albitophyre, Andesite, Limestone, Diabase, Gabbro, Tuff, Lead, Zink, Molybdenum

Source: NAM, 2021

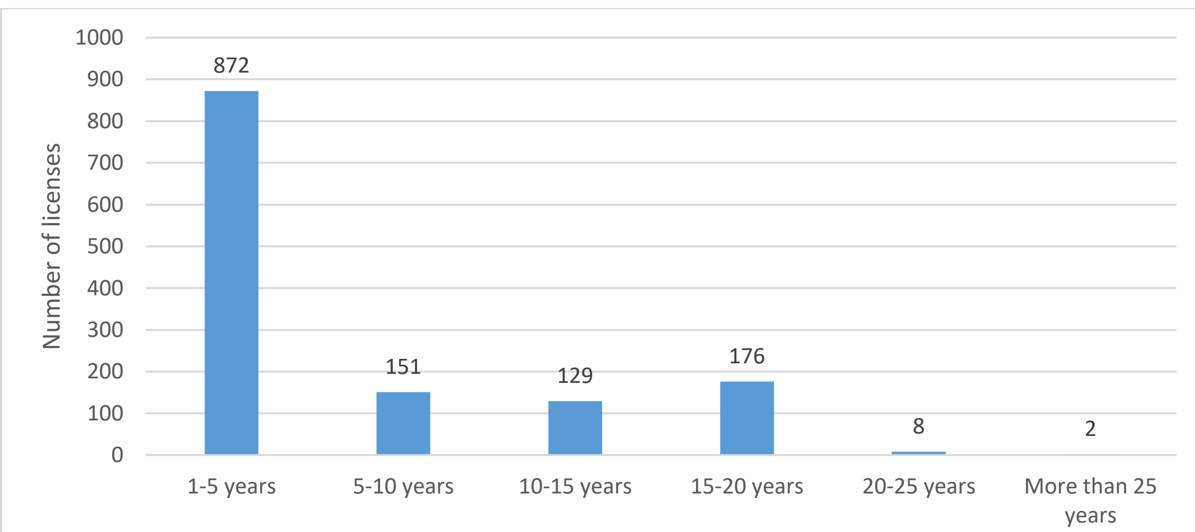
6.3 Mining licenses

Licenses for the extraction of minerals are issued by NAM via open auction procedures. In order for a legal entity or person to obtain a license, an online application should firstly be submitted to NAM. The application must include the following: data on the alleged types of resource available, the alleged location and the license timeframe, X and Y coordinates of the license objective (well or bore). If the application territory is under private ownership, the license seeker should submit a document certifying the private property, as well as the owner's consent for the license issuance. The initial auction price is 50 GEL per ha (determined by the area where the exploitation activities are supposed to take place). The highest bidder subsequently wins the auction.

Typically, licenses are issued for several years, where the maximum extraction period is dependent on the type of mineral: for ferrous and non-ferrous metals the extraction period can last up to 40 years; for construction materials up to 30 years; and for any other non-metalliferous minerals up to 30 years.[70]

Between 2010-2020 NAM issued 1,338 mining licenses in total. As mentioned, such licenses are usually valid for several years. Though NAM does not regulate the yearly extraction from a mine. Therefore, a company must determine how many resources to extract in each year of the licensing period. The majority of licenses (872 - 65% of those issued) were issued for five years or fewer, with only 81 of those 872 being issued for a single year. Only two licenses were granted for over 25 years (see Figure 6.1), at 30 and 45 years, respectively.

Figure 6.1 Distribution of licenses by years of issuance, 2010-2020

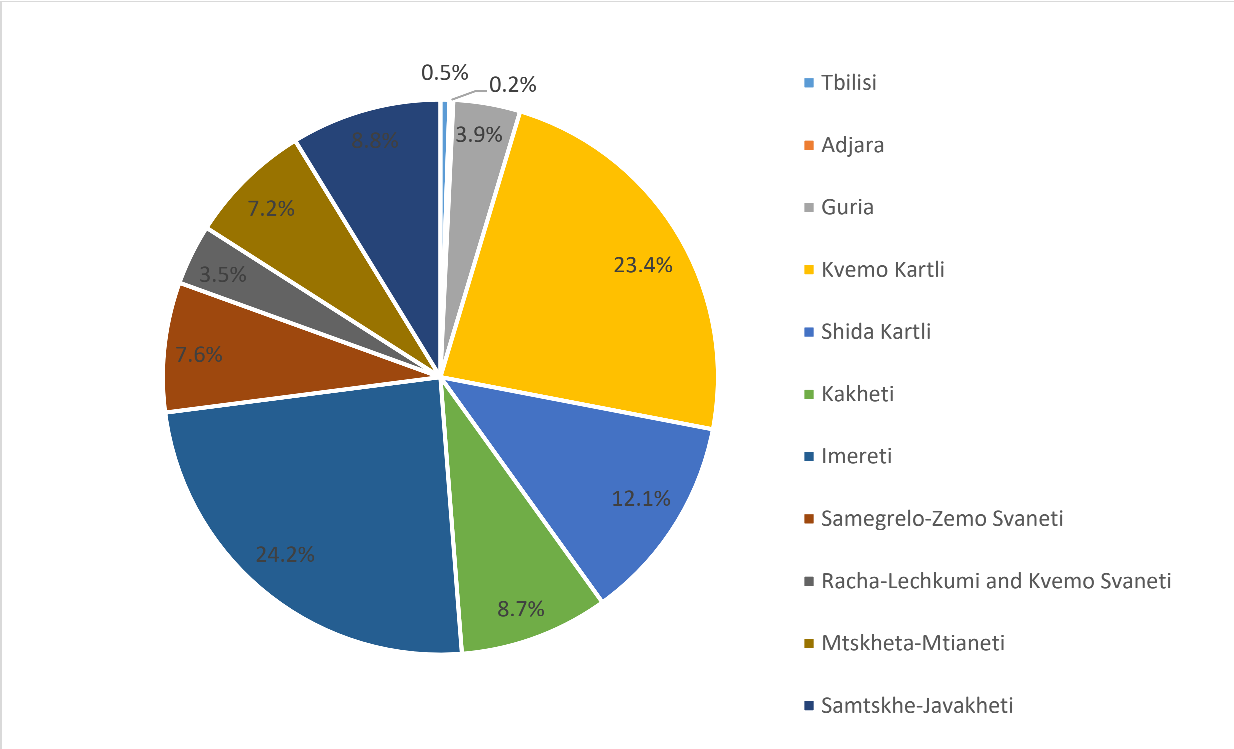


Source: Authors' calculations based on NAM data

Almost half of the licenses issued were for the regions of Imereti and Kvemo Kartli – 24% and 23%, respectively (see Figure 6.2). In Imereti licenses are mostly issued for quartz, limestone, basalt, and gravel, while in Kvemo Kartli they are generally issued for basalt, tuff, plaster, and gravel.

[70] The Law of Georgia on Subsoil.

Figure 6.2 Mining licenses issued by region, 2010-2020

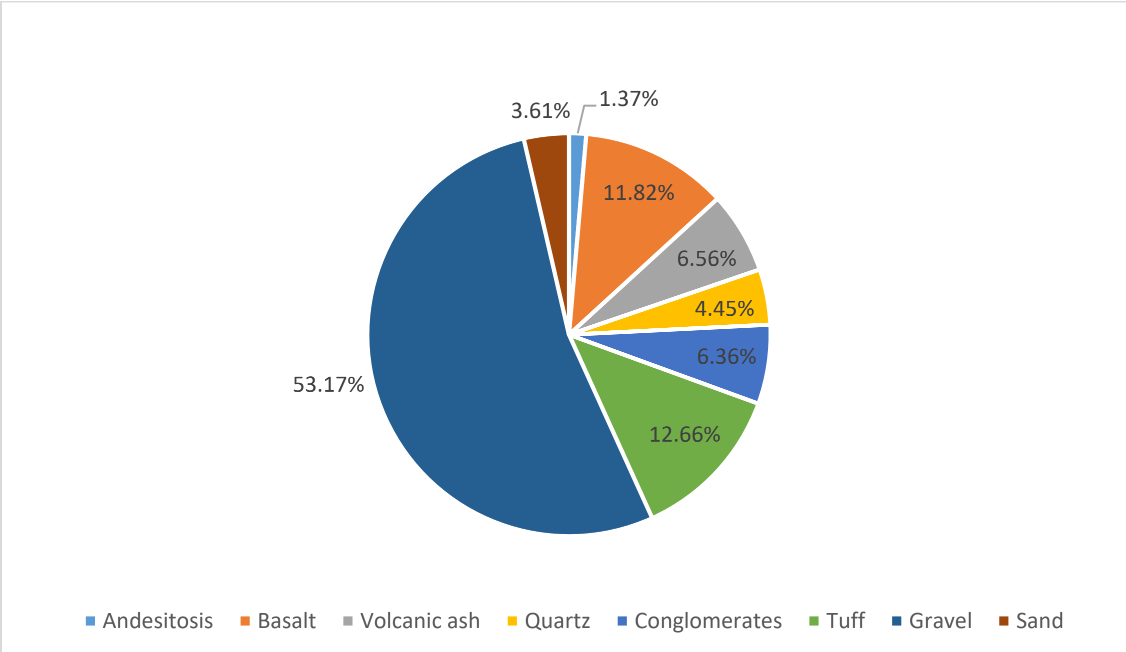


Source: Authors' calculations based on NAM data

During the period of 2010-2020, licenses were issued to extract a total area of 34,459,405 m^3 and for 17,634,016 tons of resources. These different unit measurements depend on the type of resource. For example, limestone, gold, and plaster are measured in tons, whereas tuff and gravel are in m^3.

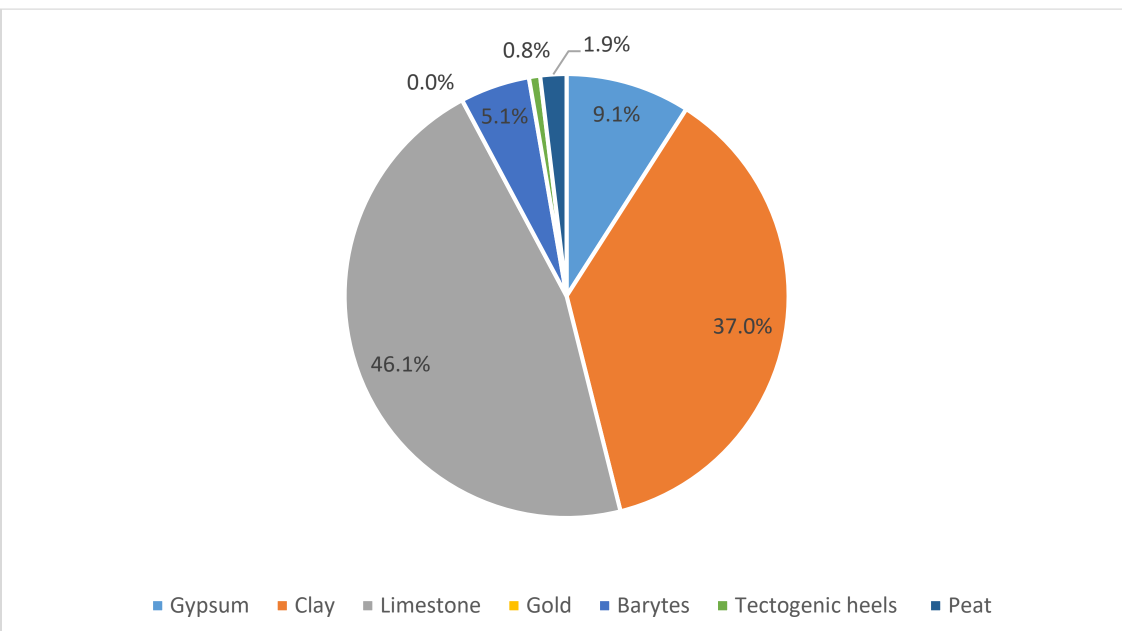
Between 2010-2020 the majority of licenses were issued for the extraction of the following resources: gravel (18,273,967 m^3), tuff (4,351,913 m^3), limestone (8,130,559 tons), and clay (6,529,067 tons). More detailed information on the type of resource for which licenses were issued is presented in Figures 6.3 and 6.4 below.

Figure 6.3 Extraction of resources (m^3)



Source: Authors' calculations based on NAM data

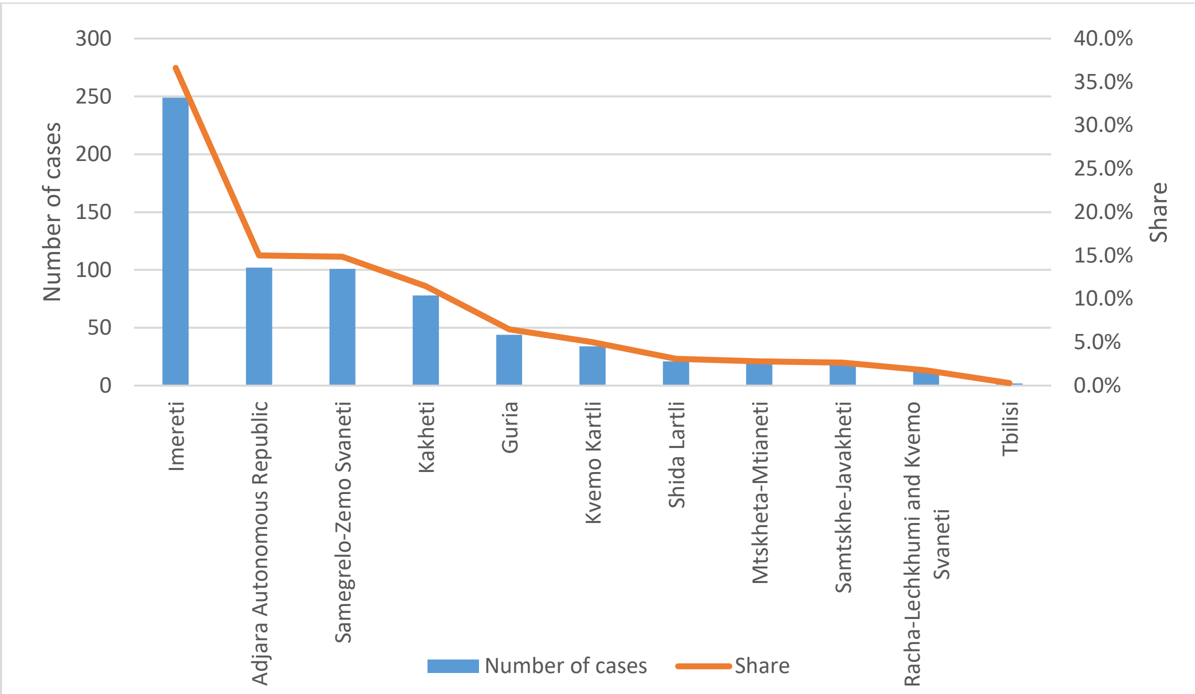
Figure 6.4 Extraction of resources (tons)



Source: Authors' calculations based on NAM data

Moreover, the Environmental Supervision Department under MEPA monitors mining activities in order to avoid the extraction of resources without a license. Throughout 2019, the department found 680 cases of illegal extraction (that without a license). The majority of these were in Imereti (249 cases), Adjara (102), and Samegrelo-Zemo Svaneti (101) (see Figure 6.5). However, MEPA did not report the minerals being illegally extracted.

Figure 6.5 Cases of illegal mining by region, 2019

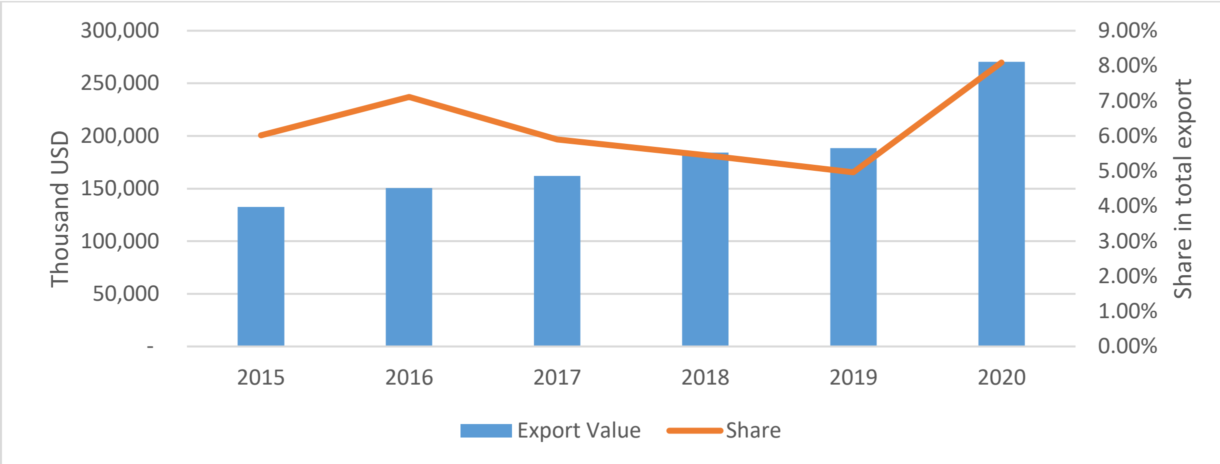


Source: Authors' calculations based on MEPA data

6.4 International trade

Georgia both exports and imports mining and quarrying goods. According to Geostat, in 2020 mining and quarrying-related export amounted to 3,343,442 thousand USD (8% of the yearly total). During the last six years, the share of total sectoral export has been gradually increasing (see Figure 6.6), with the most exported resources being cooper, manganese, slag, coal, and peat.

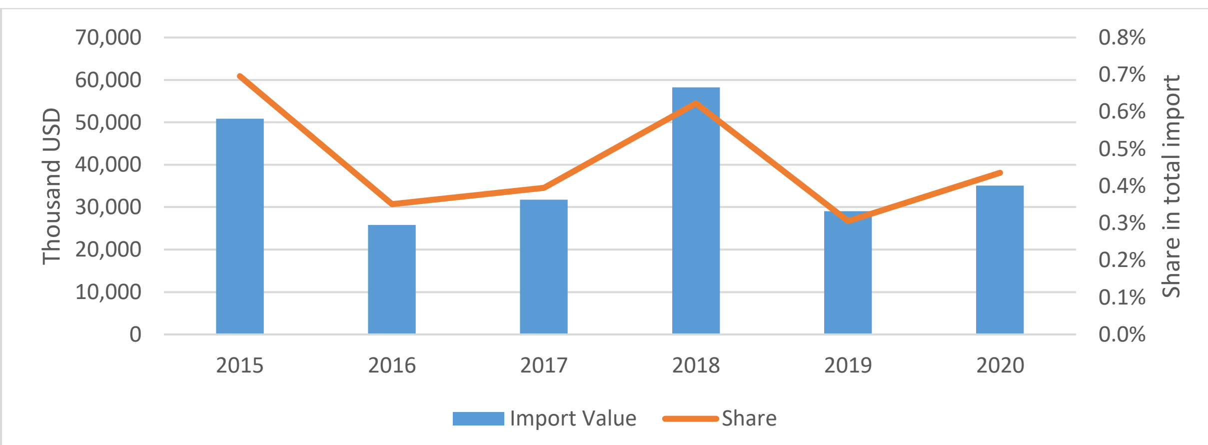
Figure 6.6 Mining and quarrying exports



Source: Authors' calculations based on Geostat data

In terms of importation, mining and quarrying imports represented 35,068 thousand USD in 2020, which accounted for only 0.4% of the total. Over the last six years, the industry share of total imports has remained relatively stable and has never exceeded 0.7% (see Figure 6.7). Notably, Georgia imports almost the equivalent products that it exports, where the main imports include manganese, copper, aluminum, and coal.

Figure 6.7 Mining and quarrying imports



Source: *Authors' calculations based on Geostat data*

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7. Ambient Air Pollution[71]

Ambient air pollution remains one of the most significant challenges around the world, particularly in big cities. According to the State Audit Office, in terms of air quality, Georgia held 111th place of 180 countries in 2016; the main source of air pollution being vehicle emissions (State Audit Office of Georgia, 2018). The other main sources of air pollution are as follows: industry, construction activities, the energy sector, and agriculture.

7.1 Overview of the legal and institutional arrangement

In Georgian legislation the rules and procedures for the improvement of ambient air quality are defined by the Law on Ambient Air Protection.[72] This law regulates harmful anthropogenic impacts on air quality within the territory of Georgia. However, the law does not regulate indoor air quality.

Under the law, MEPA is responsible for elaborating policies on the protection of ambient air quality and organizing the air quality monitoring process. Air pollution monitoring is implemented by the NEA, an agency that has been operating under MEPA since September 2008. In terms of ambient air, the NEA is responsible for creating air quality monitoring systems and ensuring their proper functioning.

The Georgian legislation also defines the maximum allowable concentration rates for various hazardous substances in the air; defined by one technical regulation issued by the Georgian government. The requirements provided for in the regulation are updated periodically (as environmental conditions and the responsibilities undertaken within international agreements evolve). The latest update of the technical regulation on ambient air quality standards took place in July 2018.[73] The standards for major pollutants are provided in Table 7.1 below. The table also compares the standards defined by the government with those of the European Commission and the World Health Organization (WHO). However, according to MEPA,[74] it is currently unrealistic for Georgia to achieve WHO standards, though reaching the EU commission maximum concentration levels represents a good target for the country. As the data reveals, the standards approved by the GoG are closer to European Union (EU) standards. It is notable that in certain instances (i.e., $PM_{2.5}$, NO_2, and O_3), there are differences in periodicity for measuring pollution levels.

[71] Ambient air is atmospheric air in its natural state, and what we breathe when the atmosphere is not contaminated by airborne pollutants. The composition of ambient air varies depending on the elevation above sea level as well as human factors such as the level of pollution (https://www.safeopedia.com/definition/2385/ambient-air).
[72] https://matsne.gov.ge/en/document/view/16210?publication=14
[73] In the table, the defined standards are only provided for those substances measured by monitoring stations; a complete list of the standards can be found in the following: https://matsne.gov.ge/ka/document/view/4277611?publication=0.
[74] Based on the stakeholder consultation held on 3 December 2020.

Table 7.1 The ambient air quality standards defined by the GoG, EU, and WHO

Substance	Periodicity	Georgian standard (µg/m³)	EU standard (µg/m³)	WHO standard (µg/m³)
Particulate matter ($PM_{2.5}$)	1 year	25	25	10
	24 hours	N/A	N/A	25
Particulate matter (PM_{10})	24 hours	50	50	50
	1 year	40	40	20
Lead (Pb)	1 year	0.5	0.5	N/A
Sulfur dioxide (SO_2)	24 hours	125	125	20
	1 hour	350	350	N/A
Nitrogen dioxide (NO_2)	1 year	40	40	40
	24 hours	N/A	50	N/A
	1 hour	200	200	200
Carbon monoxide (CO)	8 hours	10	10	N/A
Ozone (O_3)	8 hours	120	120	100
Benzene (C_6H_6)	1 year	5	5	N/A

Source: European commission air quality standards; WHO, 2006; Technical Regulation on Ambient Air Quality Standards of Georgia (accepted in July 2018)[75]

Georgia has also adopted a number of obligations under the EU Association Agreement (AA) to implement steps which improve ambient air quality in the country. These AA requirements include:

- Directive 2004/107/EC – relating to arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons in ambient air. This directive aims to establish a target value for the concentration of these substances in ambient air so as to avoid, prevent, or reduce their harmful effects – to be accomplished by 2021;
- Directive 2008/50/EC – which sets targets to achieve good quality ambient air and mitigate the impact of polluted air on human health and the environment. This directive defines the maximum allowable concentrations of several pollutants, such as sulfur, particulate matter, lead, and benzene. Before its adoption there was notably no maximum allowable threshold defined for particulate matters in Georgian legislation;
- Directive 2010/75/EU – relating to industrial emissions (integrated pollution prevention and control). This directive sets rules designed to prevent, or where impracticable to reduce, emissions into the air – to be accomplished by 2026.

[75] https://matsne.gov.ge/ka/document/view/4277611?publication=0

7.2 Air quality monitoring system in Georgia

According to the NEA, ambient air quality monitoring has been implemented since the late 1960s. However, until 2013 this process was only carried out via non-automated, stationary stations. Therefore no real-time information was available regarding air pollution, and the observation area was more restricted than at present. In 2013, the modernization process for monitoring systems commenced. There are currently 11 automatic stations operating in Georgia: Tbilisi (in five different locations), Batumi (two locations), Rustavi, Kutaisi, Zestafoni, and Chiatura. Such automatic stations offer the possibility to measure air quality over the entire 24 hours and provide real-time data. In other municipalities (Akhaltsikhe, Gori, Zugdidi, Telavi, etc.), data is taken from non-automatic stations on a monthly basis.

It is noteworthy that the monitoring in both automatic and non-automatic stations only detects selected hazardous substances: particulate matters ($PM_{2.5}$ and PM_{10}), nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), carbon monoxide (CO), lead (Pb), and benzene (C_6H_6). However, not all stations perform monitoring for each of these pollutants (further details below).

7.3 Ambient air quality and the main pollutants

Under the NEA methodology, the concentration of hazardous substances is measured by automatic and non-automatic stations, consequently the air quality is evaluated as: very good, good, moderate, bad, or very bad. The scale differs according to the pollutants, as provided in Table 7.2 below.

Table 7.2 Air quality monitoring indicators over one monitoring hour (from automatic and non-automatic stations)

Pollutant	Very good	Good	Moderate	Bad	Very bad
$PM_{2.5}$ (µg/m^3)	0-10	10-20	20-25	25-50	50-800
PM_{10} (µg/m^3)	0-20	20-35	35-50	50-100	100-120
NO_2 (µg/m^3)	0-40	40-100	100-200	200-400	400-1,000
O_3 (µg/m^3)	0-80	80-120	120-180	180-240	240-600
SO_2 (µg/m^3)	0-100	100-200	200-350	350-500	500-1,250
CO (mg/m^3)	0-5	5-7	7-10	10-15	15-50

Source: National Environment Agency

Moreover, the NEA periodically conducts indicative air quality measurements, which are less accurate than the information gained from monitoring stations. For such measurements, the NEA installs indicative tubes in a certain area and after two weeks they are taken to a laboratory for evaluation. The air quality index for indicative measurement is provided in Table 7.3 below.

Table 7.3 Air quality monitoring indicator in the given period (indicative measurements) (µg/m^3)

Pollutant	Very Good	Good	Moderate	Bad	Very Bad
NO_2	0-26	26-40	40-100	100-200	200-1,000
O_3	0-80	80-120	120-180	180-240	240-600
SO_2	0-50	50-125	125-350	350-500	500-1,250
C_6H_6	0-2	2-5	5-7	7-10	10-12
Pb	0-0.02	0.02-0.1	0.1-0.5	0.5-1	1-10

Source: National Environment Agency

The NEA identifies four major categories of air pollution in Georgia: heavy metals, particulate matters, gaseous substances, and greenhouse gases.

Before analyzing ambient air emission levels in Georgia (based on available NEA data), it is important to discuss the main sources and different types of hazardous substance.

Particulate matters (PM) – also called particle pollution, this is a general term for extremely small particles and liquid droplets in the atmosphere. They are the most notable pollutants, differing by chemical composition, size, and origin. Significantly, these particles come in various sizes and shapes and can be made up of hundreds of different chemicals. The concertation of particulate matters is measured in two size ranges – $PM_{2.5}$ and $PM_{10.}$

$PM_{2.5}$ are fine inhalable particles, generally with diameters of 2.5 micrometers or smaller, while PM_{10} are inhalable particles with diameters of 10 micrometers or less. According to the United States Environmental Protection Agency (EPA), the primary source of PM emissions are construction sites, dust, fires, and automobile emissions. From secondary sources, particles may form in the atmosphere as a result of complex chemical reactions, such as sulfur dioxide and nitrogen oxides; those pollutants emitted from power plants and industries.[76]

Sulfur dioxide (SO_2) – emissions largely occur due to metallurgical production and the consumption of fuel with higher levels of sulfur. SO_2 is also emitted from several industrial processes, such as extracting metal from ore, alongside locomotives and natural sources like volcanoes.

Nitrogen dioxide (NO_2) – originates from natural sources as well as human activities. Natural sources include the intrusion of stratospheric nitrogen oxides, bacterial and volcanic action, and lightning. The major anthropogenic sources of emissions include the combustion of fossil fuels in stationary sources (heating, power generation) and in motor vehicles (internal combustion engines) (Eskes, 2008).

Ozone (O_3) – ground level ozone is not emitted directly into the air, rather it is created by chemical reactions between nitrogen oxides (NOx) and volatile organic compounds (VOC). This happens when pollutants from cars, power plants, industrial boilers, refineries, and other sources chemically react in the presence of sunlight. Ozone is most likely to reach unhealthy levels on hot sunny days in urban environments but it can still reach high levels in colder months. Ozone can also be transported over long distances by wind, thus rural areas can also experience high ozone levels.[77]

Carbon monoxide (CO) – represents a colorless and tasteless toxic air pollutant, which is mainly emitted from the incomplete combustion of carbon-based fuels (including oil, gas, wood, and coal). Vehicles are considered the main anthropogenic source of CO emissions (United States Environmental Protection Agency, 2017).

The table below summarizes the average monthly concentration of the aforementioned pollutants across seven Georgian locations (four locations in Tbilisi, one in Kutaisi, one in Batumi, and one in Rustavi) throughout 2020. The following data, as presented in Table 7.4, is derived from automated stations, those always taking data from the same measurement position.

[76] https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

[77] https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics

Table 7.4 Average monthly concentration of air pollutants, 2020

Tbilisi (Aghmashenebeli Ave.)												
Pollutant	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
SO2	0.73	1.60	0.71	1.05	0.43	0.57	0.90	0.45	0.78	0.96	1.38	1.78
$PM_{2.5}$	30.59	24.09	25.67	10.87	9.82	12.37	12.77	11.06	18.52	25.81	29.65	48.50
PM_{10}	45.17	43.10	54.49	17.35	22.74	34.00	32.47	27.07	48.61	49.91	44.09	65.54
CO	1.37	1.21	0.97	0.60	0.57	0.50	0.47	0.68	0.90	1.38	1.40	1.47

Tbilisi (Kazbegi Ave.)												
Pollutant	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
SO2	2.32	3.43	3.33	2.05	1.98	2.10	2.32	2.18	N/A	2.68	N/A	N/A
$PM_{2.5}$	16.63	17.65	19.63	11.71	11.34	13.65	13.36	10.49	N/A	16.90	N/A	N/A
PM_{10}	27.58	36.27	39.13	28.05	31.03	33.42	32.25	26.05	N/A	36.34	N/A	N/A
O3	42.02	53.15	67.18	83.89	N/A	N/A	93.07	83.34	N/A	55.14	N/A	N/A
CO	N/A	0.40	0.32	0.21	0.27	0.25	0.27	0.22	N/A	0.37	N/A	N/A

Tbilisi (Varketili district)												
Pollutant	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
NO2	10.60	11.22	9.17	3.78	5.38	6.33	6.09	1.51	N/A	1.37	N/A	N/A
SO2	5.46	6.37	7.56	4.78	4.18	4.28	3.80	4.25	N/A	6.60	N/A	N/A
$PM_{2.5}$	23.34	20.84	24.25	10.23	10.14	13.19	11.38	10.10	N/A	20.64	N/A	N/A
PM_{10}	35.82	36.33	47.51	17.33	24.60	37.52	26.43	21.05	N/A	39.81	N/A	N/A
O3	47.22	62.15	75.69	89.72	81.97	N/A	N/A	N/A	N/A	68.43	N/A	N/A
CO	1.04	1.01	0.75	0.36	0.50	0.47	0.46	N/A	N/A	1.09	N/A	N/A

Tbilisi (Tsereteli Ave.)												
Pollutant	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
NO2	31.63	33.91	30.40	21.60	24.40	30.03	30.75	N/A	N/A	33.47	N/A	N/A
SO2	43.80	38.46	32.83	21.49	17.15	21.18	23.39	N/A	N/A	31.07	N/A	N/A
$PM_{2.5}$	20.44	22.16	24.35	10.49	12.17	15.14	15.06	N/A	N/A	21.69	N/A	N/A
PM_{10}	34.31	41.36	48.77	20.26	31.15	38.06	38.33	N/A	N/A	46.35	N/A	N/A
O3	29.72	40.62	51.75	73.37	68.79	62.91	59.37	N/A	N/A	35.39	N/A	N/A
CO	1.53	1.56	1.15	0.54	0.78	1.02	0.89	N/A	N/A	1.49	N/A	N/A

Kutaisi												
Pollutant	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
SO2	4.40	3.47	2.40	1.03	1.74	1.95	1.55	1.72	2.23	3.14	4.76	4.69
$PM_{2.5}$	19.75	18.09	14.21	11.12	10.68	12.30	11.32	9.95	14.12	16.78	16.51	16.15
PM_{10}	33.65	36.34	32.38	19.18	24.64	30.58	26.63	22.25	34.77	39.42	31.17	30.40
O3	20.50	28.19	33.84	38.13	25.65	N/A	N/A	N/A	16.21	26.06	11.73	27.12

Rustavi												
Pollutant	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
NO2	34.10	36.00	27.77	13.46	15.29	18.83	16.61	16.11	20.57	32.61	28.35	38.35

SO2	3.79	1.62	2.88	0.98	2.44	2.40	1.55	3.01	2.65	3.62	2.15	3.67
$PM_{2.5}$	43.35	32.91	37.16	15.51	12.41	N/A	18.52	20.32	36.83	42.42	35.68	56.76
PM_{10}	61.02	55.02	71.45	24.30	25.41	N/A	40.80	48.28	86.30	90.56	60.48	80.00
O3	29.24	39.13	42.22	53.72	44.66	48.93	53.05	98.88	74.22	58.68	35.91	21.06
CO	N/A	8.16	1.71	0.27	0.29	0.29	0.30	0.28	0.41	0.68	0.71	1.04
Batumi												
Pollutant	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
NO2	38.91	46.36	44.27	24.74	34.64	49.03	46.94	60.77	65.26	66.08	51.35	51.38
SO2	2.18	1.73	1.60	0.50	0.80	0.74	0.73	0.63	0.85	1.09	1.21	1.87
$PM_{2.5}$	20.54	18.13	23.91	18.79	13.18	13.12	10.66	9.60	13.57	19.12	17.49	27.25
PM_{10}	36.34	34.44	47.67	30.78	29.36	30.86	25.24	22.06	30.47	40.68	28.26	44.45
O3	40.95	47.33	37.01	54.52	39.53	20.48	11.26	15.29	11.88	16.53	14.77	21.09
CO	0.82	0.82	1.06	N/A	N/A	N/A	0.24	0.27	0.32	0.57	0.66	1.29

Source: Authors' own calculations based on NEA data

Sulfur dioxide

As one can see from the data provided above, SO_2 emissions levels have on average always remained within the very good level. Considering that fossil fuels are the main source of SO_2 emissions, maintaining good emissions levels can be seen as the result of several policies implemented in the Georgian transport sector. According to the NEA, these policies include:

- Governmental ordinance N124 on petrol quality was adopted in 2004 (with several changes introduced thereafter), and since 1 January 2017 the maximum allowed concentration of sulfur in fuel should not exceed 10 $\mu g/m^3$. Furthermore, the Environment Protection Department periodically controls the quality of fuel in Georgia;
- Several measures have been introduced to support the renovation of the country's automobiles: since 2017 excise taxes rose by 25% for every type of vehicle, while for cars older than 10 it almost doubled, and almost tripled for those more than 14 years old. On the other hand, to support the import of cleaner cars, taxes on hybrid vehicles fell by 60%, and there is zero excise tax on electric cars;[78]
- To promote the use of public transport, and thus reduce vehicle emissions, the government is in the process of improving and renovating the public transport system, especially in the capital.

Significantly, the data also reveals that concentrations of sulfur dioxide are higher in colder seasons (Oct-Mar) than during warmer periods, across all locations. This is because cold air is denser than warmer air and traps pollution for longer periods (Alejo, 2013).

Nitrogen dioxide

[78] Ministry of Internal Affairs of Georgia.

The concentration of NO_2 is only measured by four automatic stations: two in Tbilisi (the Varketili district and Tsereteli Avenue), and one in Rustavi and Batumi. In three of the four locations (except Batumi) emissions remain, on average, at the very good level throughout the year. In Batumi, during a certain period, it was at a good level on average. These results are unsurprising as Batumi is characterized by higher humidity than the other locations, and higher humidity levels tend to lead to a greater concentration of NO_2 (Cichowicz, 2017).

One potential explanations behind the satisfactory NO_2 emissions levels are the accepted standards for car emissions. According to the NEA, petrol fueled cars since 2015 have had to comply with the EURO 5 standard (which means a maximum of 0.06 g/km), while for diesel cars, the standard was EURO 4 (0.25 g/km) in 2019.

Particulate matter- $PM_{2.5}$

The concentration of $PM_{2.5}$ in 2020 fluctuated between very good and very bad levels on a monthly basis. The emissions were highest in Rustavi, as the city contains several cement and metallurgical industrial units, and these – as mentioned above – are typically a main source of $PM_{2.5}$ emissions.

Similar to SO_2, the concentration of $PM_{2.5}$ is higher in cooler periods of the year (especially Oct-Jan), because fine particles are more readily formed in cold weather (United States Environmental Protection Agency, 2017). During 2020, the lowest levels of $PM_{2.5}$ were measured in August – which is considered the hottest month of the year – in all locations.

Particulate matter- PM_{10}

The concentration of PM_{10} was moderate throughout 2020. However, it varied from very good to bad depending on the location and the season. Similar to $PM_{2.5}$, the highest emissions levels were found in Rustavi, a center for production (especially cement), which contributes to these notable emissions.

Ozone O_3

Ozone emissions remained at a very good or good level over 2020. The emission levels were typically worse during the hottest period of the year; ground-level ozone concentrations are generally highest on hot days with low humidity and when the wind is light or stagnant (United States Environmental Protection Agency, 2017). Moreover, emissions were usually higher in Rustavi (where industrial processes are actively ongoing) and in central Tbilisi (with more urban environment and traffic).

Carbon monoxide (CO)

Carbon monoxide emissions have almost always been within the very good standards range (0-5). Akin to NO_2, one of the main drivers behind low CO concentrations is the EURO 5 car emission standard that has been adopted, which sets limits for CO emissions from petrol fueled cars (under the EURO 5 standard the CO emission limit for petrol cars is 1.0 g/km). Significantly, two main locations were characterized by relatively high levels of CO concentration – Tsereteli Avenue in Tbilisi (a central road with heavy traffic) and Rustavi (with higher levels of industrial emissions compared to other locations).

The most recently updated data on the ambient air quality monitoring **results from non-automatic stations** and the indicative measurements conducted by the NEA are from 2017. These measurements, covering multiple locations, are detailed below and are based on the NEA annual report for 2017.[79]

Ambient air quality monitoring in the **Batumi** non-automatic station was performed in one location. The results show that the concentration of SO_2 has always remained at a very good or good level (from 634 individual measurements throughout the year), and never exceeded the maximum allowable concentration level. While the concentration of CO was above the maximum allowable level (at a moderate or worse quality) in only seven cases from 634 separate measurements. As for dust and NO_2, the non-automatic station measurements reveal that their concentrations surpassed the maximum allowable levels in 145 and 117 cases, respectively (from 634 separate measurements per pollutant).

There were also 44 indicative measurements performed in Batumi from 2017, over five different locations in the city. According to these results, in most instances the concentration of pollutants was either very good or good. Only in seven cases of NO_2 and one case of C_6H_6 were the concentrations moderate and bad, respectively.

In **Zestafoni** the ambient air quality monitoring results from 2017 were derived from one non-automatic station. According to the data provided by the NEA, the concentration of SO_2, NO_2, and CO never exceeded a good concentration level in 2017. The concentrations of dust and MnO_2 (Manganese dioxide) though exceeded the maximum allowable concentrations in 22 and 8 cases, respectively (from 651 measurements each).

Throughout 2017, 25 indicative measurements took place in Zestafoni, from three unique locations. The concentration levels of O_3 and SO_2 were always good or very good, while NO_2 emissions were moderate in four cases, and good or very good in six measurements.

In **Tbilisi**, a non-automatic station measured air quality in the Vashlijvari district for 10 months in 2017. According to the results, concentrations of CO, No, and NO_2 were always lower than the maximum allowable concentration levels (good or very good). However, in the case of O_3, the average actual concentration was 1.5 times higher than the maximum allowable level.

Indicative measurements (110) were also conducted over 21 Tbilisi locations in 2017. In each case, O_3 and SO_2 emissions were either good or very good; where NO_2 emissions were good or very good in 15 instances, moderate in 55 cases, and bad or very bad on 10 occasions.

[79] The NEA Annual Report for Ambient Air Quality, 2017.

Emissions of C_6H_6 were also measured in the capital and were good or very good in nine cases and moderate on three instances.

In **Rustavi**, ambient air quality monitoring was conducted in a single location, with four main pollutants measured: dust, carbon dioxide, nitrogen dioxide, and lead. The concentrations of carbon dioxide and lead were always at good or very good levels across 2017, whereas nitrogen dioxide exceeded the maximum allowable concentration in 38 cases (from 593 measurements). Critically, the concentration of dust was alarming, as in 546 cases (out of 581) the concentration was higher than the maximum allowable threshold.

Moreover, 37 indicative measurements were conducted in Rustavi, over four locations. The results of these measurements show that the concentration of carbon dioxide, ozone, and benzene were good or very good on every occasion. While nitrogen dioxide exceeded the maximum allowable level in only two cases (out of 15 indicative measurements).

In **Kutaisi**, ambient air quality was measured at one automatic station for a limited period of 2017 (January-May). During that period, the concentrations of nitrogen oxide, nitrogen dioxide, carbon dioxide and lead remained below the threshold level. Similar to Rustavi, dust also remained problematic in Kutaisi, with concentrations above the maximum allowable level in 83% of measurements.

Regarding the indicative measurements, 42 measurements were performed in five different Kutaisi locations. In every location, the concentration of sulfur dioxide, ozone, and benzene were good or very good; while for nitrogen dioxide, on nine occasions the emissions level was good, moderate in another nine, and only once (on Chavchavadze Street) was the concentration bad.

Notably, in other cities only indicative measurement methods were used. These locations include: Akhaltsikhe, Gori, Zugdidi, Telavi, Kaspi, Lanchkhuti, Mtskheta, Ozurgeti, Samtredia, Sachkhere, Senaki, Tkibuli, Poti, and Khashuri. In each location, the concentration of the following pollutants was examined: nitrogen dioxide, sulfur dioxide, and ozone. The concentration of sulfur dioxide and ozone was always below the threshold for each location; however, high levels of nitrogen dioxide were found in certain areas (in other cases the concentration level was good). A summary of the findings is provided in Table 7.5 below.

Table 7.5 Number of cases nitrogen dioxide concentration exceeded the maximum allowable level

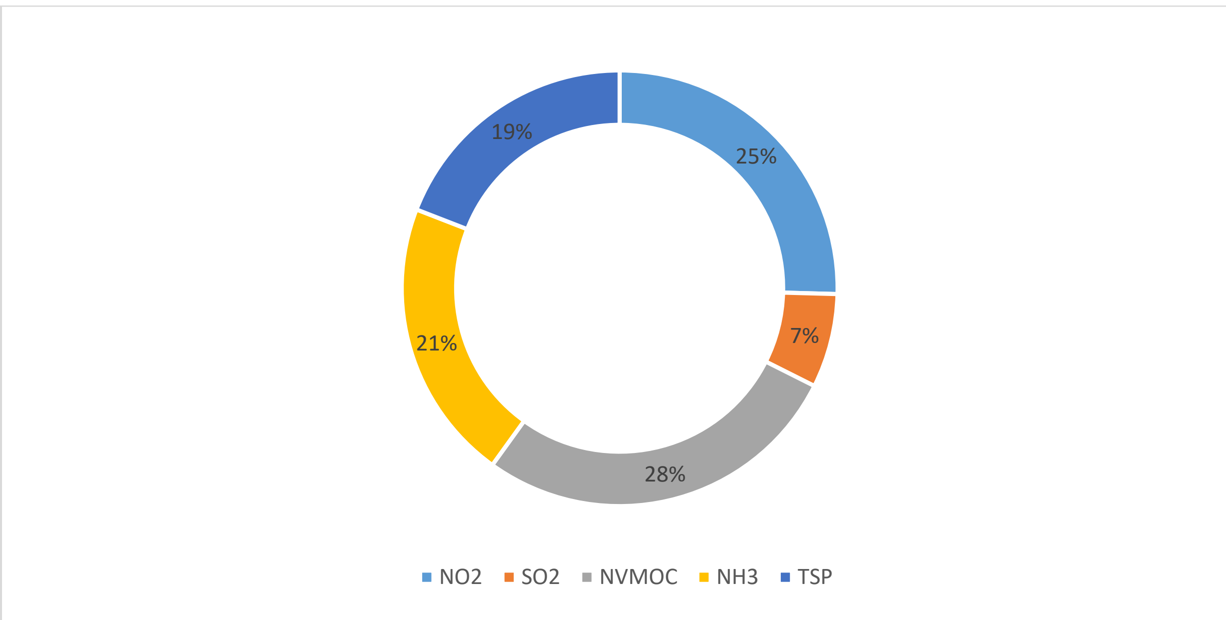
Location	Cases exceeding the maximum allowable concentration	Total number of measurements
Akhaltsikhe	2	12
Gori	4	8
Telavi	5	12
Samtredia	2	8
Khashuri	5	8

Source: NEA Annual Report for Ambient Air Quality, 2017

7.4 Emissions of hazardous substances by economic sector

MEPA provides data on the emission of various pollutants according to economic activity. There are four identifiable core categories in the emission of hazardous substances: energy, industrial processes and product use, agriculture, and waste. Such information is largely provided for five major pollutants: non-methane volatile organic compounds (NMVOC), sulfur dioxide (SO_2), ammonia (NH_3), nitrogen dioxides (NO_2), and total suspended particulates (TSP). Notably, the ministry reports that it is difficult to measure additional forms of emission, or emissions by type of economic activity, for two main reasons: there is either insufficient statistical data available (there is some but not enough) or a methodology for measurement has not yet been adopted (Ministry of Environment Protection and Agriculture, 2019).[80] As Figure 7.1 highlights, NVMOC was the largest pollutant in 2017, followed by NO_2 and NH_3.

Figure 7.1 Emissions of the five main pollutants, 2017



Source: Authors' own calculations based on MEPA data

In 2017, energy-related activities represented the main contributor of NO_2 (89%), NMVOC (60%), and SO_2 (90%) emissions. Ammonia, however, is mainly emitted within the agricultural sector. Total suspended particle emissions are split between both energy and industrial activities, with 48% and 44% of total TSP discharge, respectively (Ministry of Environment Protection and Agriculture, 2019). A detailed overview of each sector is provided below.

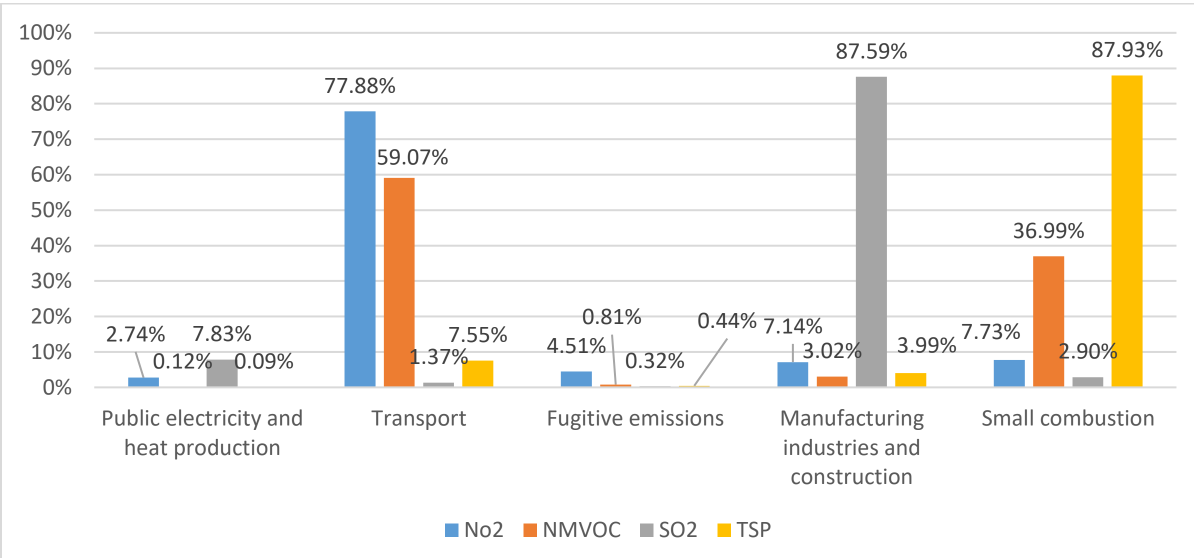
[80] The latest available data regarding emissions by sector is from 2017.

Energy

Within this category, MEPA identifies five main activities: public electricity and heat production; combustion in the manufacturing and construction industries; transport; small combustion; and fugitive emissions.

According to MEPA, transport causes the majority of NO_2 (78%) and NMVOC (59.1%) emissions, while the manufacturing and construction industries are the greatest source of SO_2 (88%). Figure 7.2 below reviews the share of sectoral activities in the emission of hazardous substances, where Table 7.6 summarizes the level of emissions for these pollutants.

Figure 7.2 Share of sectoral activities in energy sector emissions, 2017



Source: Authors' own calculations based on MEPA data

Table 7.6 Energy sector emissions (ths. tons), 2017

Sectoral activities	NO_2	NMVOC	SO_2	TSP
Public electricity and heat production	1.03	0.03	0.74	0.01
Transport	29.35	15.39	0.13	1.04
Fugitive emissions	1.70	0.21	0.03	0.06
Manufacturing industries and construction	2.69	0.79	8.23	0.55
Small combustion	2.91	9.64	0.27	12.12
Total	**37.68**	**26.06**	**9.39**	**13.78**

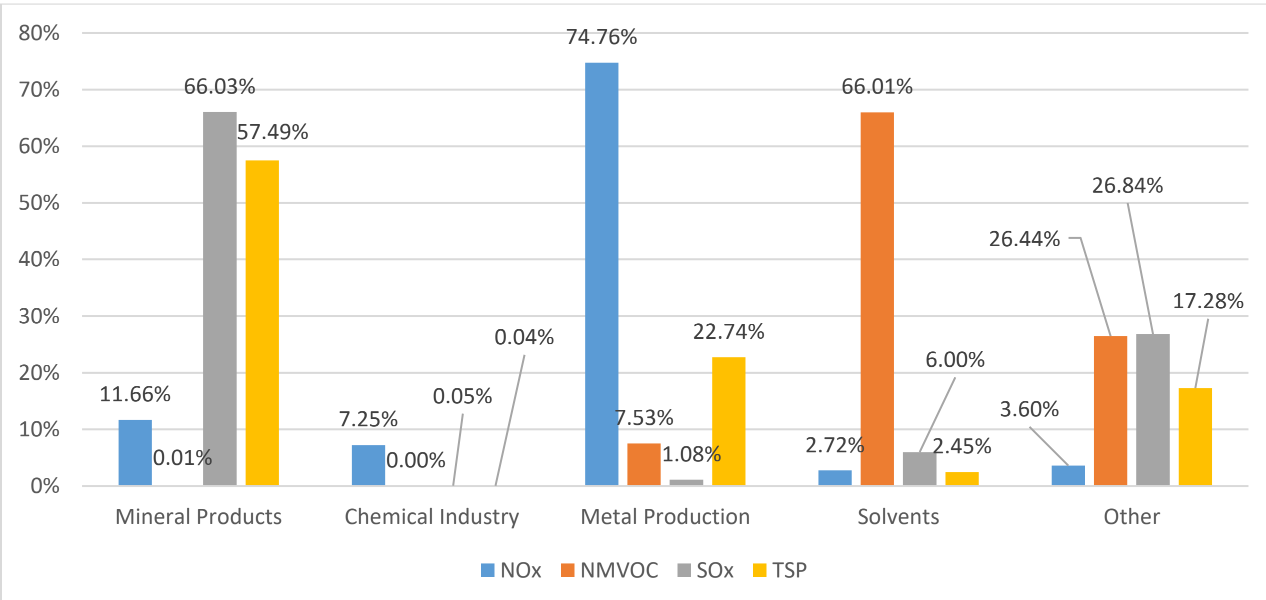
Source: Authors' own calculations based on MEPA data

Industrial processes and product use

Among industrial processes, the main contributors to emissions are mineral products, chemical industry, metal production, and solvents.

MEPA data shows that mineral products represent the largest contributor (66%) to SO_x emissions from the various industrial activities. Other industry, including food and drink production, paper manufacturing, and wood production also plays a significant role in SO_x emissions (27%). The production of minerals represents the largest source of TSP (58%), followed by metal production (23%) and other activities (18%). Metal production maintains the highest share in NO_x emissions (75%), while solvents significantly contribute to NMVOC emissions (66%). Figure 7.3 below identifies the contribution of various industrial activities towards hazardous substance emissions. Table 7.7 thereafter summarizes the absolute level of emissions from the sector.

Figure 7.3 Share of sectoral activities in industrial sector emissions, 2017



Source: Authors' own calculations based on MEPA data

Table 7.7 Industrial sector emissions (ths. tons), 2017

	NOx	NMVOC	SOx	TSP
Mineral products	0.27	0.00	0.62	7.16
Chemical industry	0.17	N/A	0.00	0.00
Metal production	1.70	0.52	0.01	2.83
Solvents	0.06	4.55	0.06	0.31
Other (food and drink production, paper manufacturing, wood production)	0.08	1.82	0.25	2.15
Total	**2.28**	**6.89**	**0.94**	**12.46**

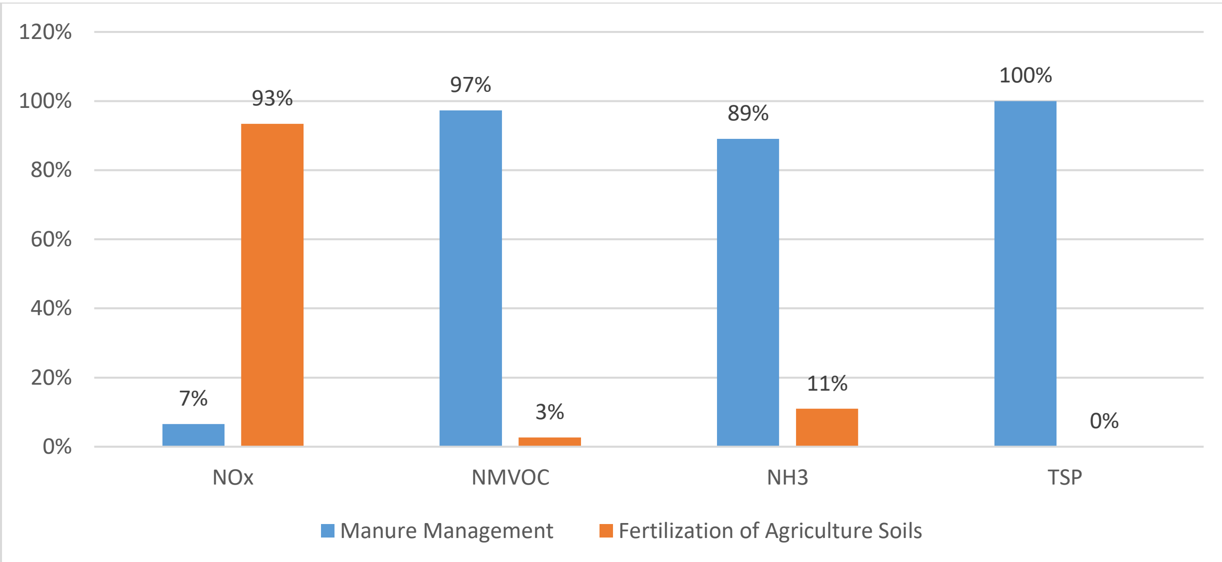
Source: Authors' own calculations based on MEPA data

Agriculture

Within the agricultural category, there are two main activities – manure management and fertilization of agricultural soils – acting as the main emissions source for four hazardous substances: NO_x, NMVOC, NH_3, and TSP.

As evident from Figure 7.4, manure management represents the main source of NMVOC, NH_3, and TSP emissions, holding 97%, 89%, and 100% respective shares in emissions. In contrast, NO_x emissions are mainly derived from fertilizing agricultural soils (93% of NO_x emissions are from the agricultural sector).

Figure 7.4 Share of sectoral activities in agricultural sector emissions, 2017



Source: Authors' own calculations based on MEPA data

The following, Table 7.8, summarizes the absolute value of emissions from the agricultural sector.

Table 7.8 Agricultural sector emissions (ths. tons), 2017

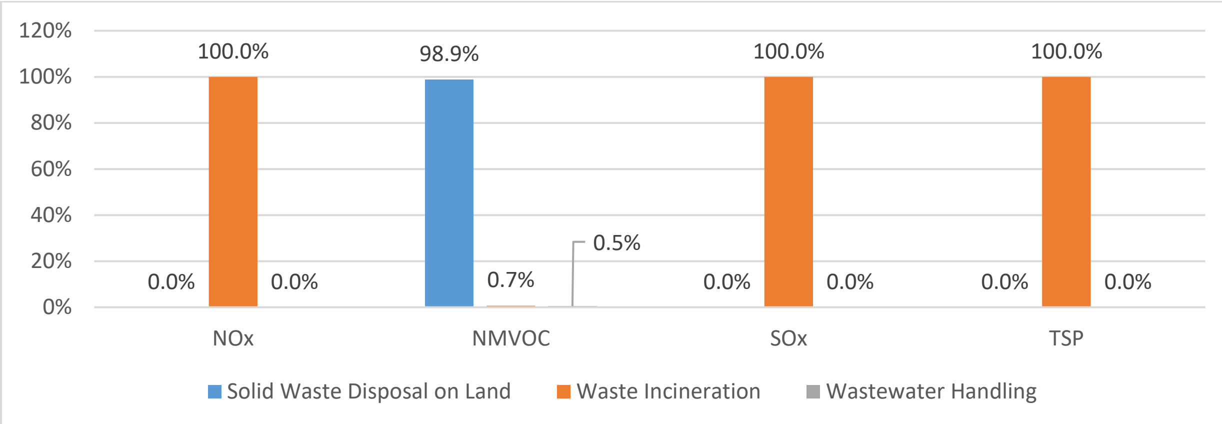
	NOx	NMVOC	NH_3	TSP
Manure management	0.11	6.90	26.13	2.01
Agricultural soils	1.58	0.19	3.22	N/A
Total	**1.69**	**7.09**	**29.34**	**2.01**

Source: Authors' own calculations based on MEPA data

Waste

Waste disposal itself, including solid waste disposal on landfills, waste incineration, and wastewater handling, can become a source of hazardous substances. As represented in Figure 7.5 below, waste incineration is the only activity to contribute to NO_x, SO_x, and TSP emissions from the waste management sector. NMVOC emissions primarily come from solid waste disposal on land (98.9%), waste incineration (0.7%), and wastewater handling (0.5%).

Figure 7.5 Share of sectoral activities in waste management sector emissions, 2017



Source: Authors' own calculations based on MEPA data

Table 7.9 summarizes the emissions from waste management activities in absolute terms.

Table 7.9 Waste management sector emissions (ths. tons), 2017

	NOx	NMVOC	SOx	TSP
Solid waste disposal on land	N/A	0.672	N/A	N/A
Waste incineration	0.018	0.005	0.001	0.022
Wastewater handling	N/A	0.003	N/A	N/A
Total	**0.018**	**0.679**	**0.001**	**0.022**

Source: Authors' own calculations based on MEPA data

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8. Waste Management

Waste management represents a critical environmental, social, and economic issue all around the world, and Georgia is no exception. From the emission of hazardous substances into the air, soil, and in underground and surface waters, waste can have a substantial negative impact on the environment and on human health. Furthermore, the land resources occupied by landfills represent an additional issue for smaller countries. Alongside economic growth, accumulated waste also expands (additional details below), therefore finding optimal waste collection and management is another vital issue for policy-makers in the country.

8.1 Overview of the legal and institutional arrangement

The waste management sector in Georgia is chiefly regulated by the Waste Management Code, adopted in 2014. Under the code, MEPA is responsible for defining and implementing a unified state policy on waste management, as well as registering waste and creating a waste database. On the other hand, the Ministry of Regional Development and Infrastructure (MRDI) has to ensure the arrangement, management, and closure of non-hazardous waste landfills, alongside the organization of waste transfer stations. Within the Georgian Local Self-Government Code, local municipalities are responsible for municipal waste management, including the development of municipal waste management plans. Since 2012, local municipal management includes the following responsibilities: collecting and transporting household waste; ensuring the orderly provision of bins; and discharging bins on a daily basis, according to a predefined schedule. While landfill management is the responsibility of the Solid Waste Management Company (see additional details below).

In the Autonomous Republic of Adjara and within Tbilisi, the management of nonhazardous waste and the construction, operation, and closure of landfills is the responsibility of the relevant local authorities.

Moreover, the Waste Management Code defines the main principles of waste management that should be carried out without endangering the environment or human health. During the waste management process, the following principles ought to be taken into consideration:

- Precautionary principle – requires action to prevent serious and irreversible damage, even before harm can be scientifically demonstrated or economically assessed;
- Polluter pays principle – the waste generator or waste owner bears costs related to waste management;
- Proximity principle – waste should be treated at the nearest waste treatment facility, taking into account both environmental and economic efficiency;
- Self-sufficiency principle – an integrated and adequate network of municipal waste disposal and recovery facilities should be established and operational.

The new Waste Management Code also considers the principle of Extended Producer Responsibility (EPR). The OECD indicates that EPR is a concept where “manufacturers and importers of products should bear a significant degree of responsibility for the environmental impacts of their products throughout the product life-cycle, including upstream impacts inherent in the selection of materials for the products, impacts from manufacturers' production process itself, and downstream impacts from the use and disposal of the products. Producers accept their responsibility when designing their products to minimize life-cycle environmental impacts, and when accepting legal, physical or socio-economic responsibility for environmental impacts that cannot be eliminated by design" (OECD, 2006).[81]

This therefore implies that the producer is responsible, among others, for the following actions: the separate collection of different types of waste, waste preparation for re-use, transportation, recycling (including restoration), and, at the final stage, waste disposal on landfills in accordance with the environmental standards. This responsibility can be fulfilled by individual companies or collective unions of several producers.

8.2 Landfills in Georgia

Within the existing legislation, the protection and development of landfills is regulated by the Law of Georgia on Environmental Impact Permits. According to the law, landfills have to obtain an environmental impact permit before operating. These permits, issued by MEPA, can be acquired after an environmental impact assessment into the development of landfills within a certain territory. In order for a landfill to obtain a permit to operate it should satisfy the following standards:

- It should maintain a day-to-day waste management system;
- It should satisfy health and environmental standards;
- There should be qualified staff with relevant technical knowledge.

According to the Waste Management Code, only waste which cannot be reduced, reused, or recycled with more environmentally friendly technologies can be disposed of or buried in landfills. Based on the law, there are theoretically three different types of landfills:

- For hazardous waste – waste is considered hazardous if it has one or more of the following characteristics: explosive (substances and preparations which may explode under the effect of flame, or which are more sensitive to friction than dinitrobenzene); oxidizing (substances and preparations which show highly exothermic reactions when in contact with other substances, particularly flammable substances); flammable (liquid substances and preparations with a flash point equal to or greater than 21°C and less than or equal to 55°C); corrosive (substances and preparations that may destroy living tissue on contact); etc. Significantly, it is currently not possible to dispose of hazardous substances, such as chemical or medical waste, because no such relevant landfills exist within the country;
- For non-hazardous waste – for disposal that does not fall under the definition of hazardous waste (including municipal and household waste);

[81] https://www.oecd.org/env/waste/factsheetextendedproducerresponsibility.htm

- For inert waste – waste that does not undergo any significant physical, chemical, or biological changes: does not dissolve, burn, or come in any other chemical or physical reaction, biodegrade, or affect other materials in a manner that could cause environmental pollution or damage to human health.

Moreover, according to the EU waste management framework[82] landfills should satisfy the following requirements:

- Location – landfills should be located far from urban and rural habitation, as well as from recreational zones, rivers, protected territories, and from areas with underground water resources. The risks of flooding and landslides should also be taken into consideration;
- Managing water flows – any water flows on landfill territory must be avoided to ensure that water that passes the territory and becomes polluted is not then discharged into other water bodies;
- Protect soil and water – landfills should be arranged in a way that protects soil and water from pollution;
- Mitigate threats and inconveniences associated with landfills, such as: smell, the emission of pollutants, noise, abundance of insects and rodents, etc. Landfills should be bordered in a manner that avoid the spread of waste to nearby territories.

Almost every landfill in Georgia was built during the Soviet era and most do not satisfy these environmental standards (including proper bordering, having barriers to protect underground waters, collecting and treating wastewater, etc.). As previously mentioned, prior to 2012 the management of landfills was the responsibility of local municipalities. Thereafter, the Solid Waste Management Company was established, which aimed to manage all existing municipal landfills throughout the country. The Waste Management Strategy (2014-2024) also introduced a plan to close small municipal landfills and, in their place, to arrange larger regional landfills.

The Solid Waste Management Company identifies 56 landfills in Georgia, 54 of which are owned and managed by the company (two landfills in Tbilisi and the Adjara AR are managed by local authorities).[83] From those 54 sites, the company has rehabilitated 31 since 2013, which now function for several municipalities, and the remaining 21 landfills were closed.[84] After the closure of certain municipal landfills, the company transformed them into transfer stations to make waste disposal processes more efficient. Such transfer stations operate by collecting household waste from rural areas and compressing it into containers, which are then sent to existing landfills for disposal at a later date. Thus far, five company transfer stations have been created: in the Ureki, Kvareli, Manglisi-Tsalka, Borjomi-Bakuriani, and the Mestia municipalities. The company states that it plans to expand the chain of transfer stations – by converting old municipal landfills – alongside the development of regional landfills, located in more remote areas away from

[82] Directive 2008/98/EC of the European Parliament and Council on Waste, 19 November 2009.

[83] In the capital waste management is carried out by Tbilservice Group LTD (since 2007), while in Adjara it is performed by Sandasuptaveba LTD (Since 2006).

[84] According to the 2008/98/EC of the European Parliament and Council on Waste of, 19 November 2009, a landfill is considered closed after the competent authority has carried out a final on-site inspection, has assessed all the reports submitted by the operator and has communicated to the operator its approval for the closure. After a landfill has been closed, the operator shall be responsible for its maintenance, monitoring, and control.

municipal living environments. At present, preparatory works, technical-economic research, and project implementation planning are underway in four regional landfills. The regions currently considering the development of regional landfills are: Imereti, Racha-Lechkhumi and Kvemo Svaneti, Kvemo Kartli, Kakheti, and Samegrelo-Zemo Svaneti. While the planned placement of regional landfills in Shida Kartli and Mtskheta-Mtianeti is still to be decided.

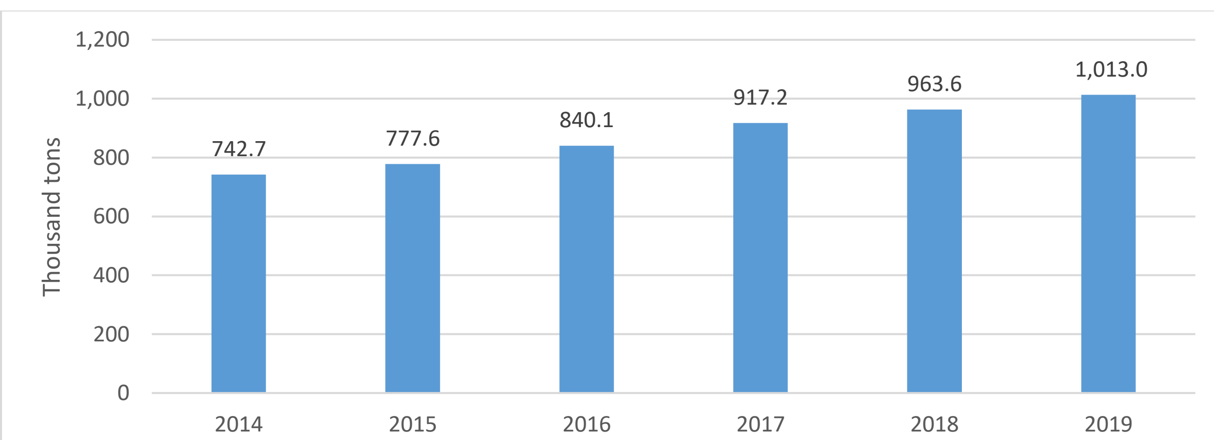
Currently, there are two high-standard landfills located in Tbilisi (83 ha) and Rustavi (7 ha). The Rustavi landfill also allows for the separate disposal of different types of waste. It is moreover equipped with the technology to produce biogas from waste. These relatively newly constructed landfills operate under European standards.

In addition to the (official) landfills described, in rural areas there are various ‘chaotic’ landfills close to rivers and in remote territories; even though the Waste Management Code prohibits the dumping or disposal of waste in environments outside waste collection containers and facilities. There is presently no statistical information regarding either the number of such landfills in the country or on the composition and amount of waste disposed in such areas (Policy and Management Consulting Group, 2015).

8.3 Waste accumulation

MEPA is responsible for the calculating the total amount of waste disposed of yearly in official landfills. According to their records, approximately 1,000,000 tons of municipal waste was deposited in Georgian landfills in 2020. Over the years, parallel to economic development, the amount of waste discarded into landfills has been increasing (see Figure 8.1). However, the picture does not fully reflect the present situation, as a substantial part of household and non-household waste is disposed of outside official landfills and, consequently, such details are not recorded.

Figure 8.1 Amount of waste disposed of in landfills

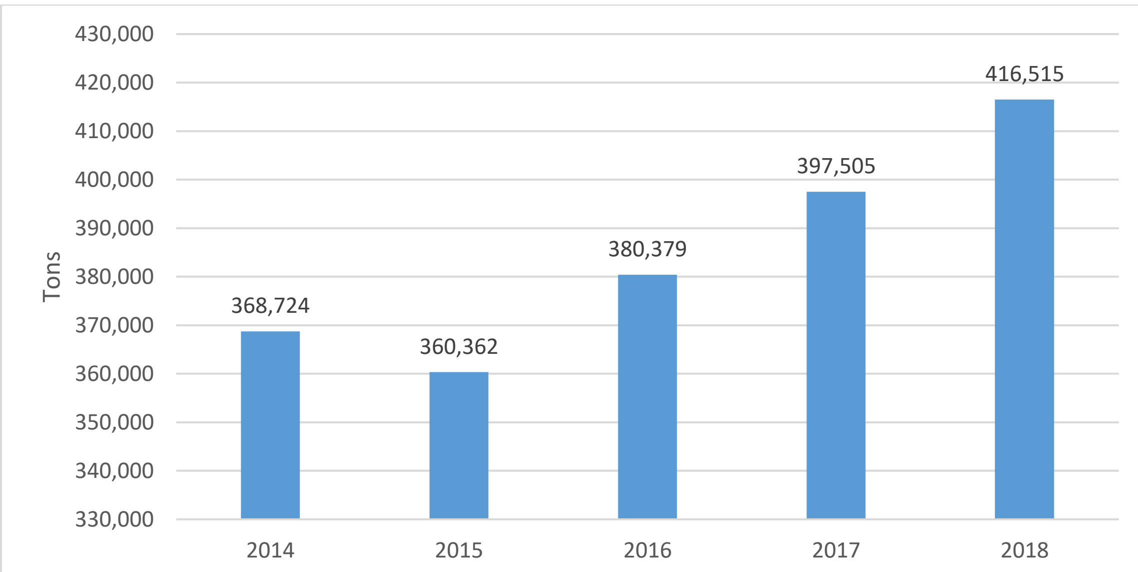


Source: MEPA

There is no systemic approach in Georgia towards the collection of disaggregated data by the type of waste generated and collected. However, periodically, different institutions attempt to estimate the composition of waste in the country.

In 2014, Tbilisi City Hall investigated the composition of waste generated in the capital. According to the study, 70% of waste generated in Tbilisi was organic, followed by 13% plastic waste, 10% paper waste, 2.4% glass, and 1.1% metal; the remainder consisted of textiles, wood, hygienic and other type of waste. The Tbilisi City Hall research shows that between 2014-2018 the amount of collected city waste rose, matching economic growth and an increased population (see Figure 8.2).

Figure 8.2 Amount of waste gathered in Tbilisi, 2014-2018

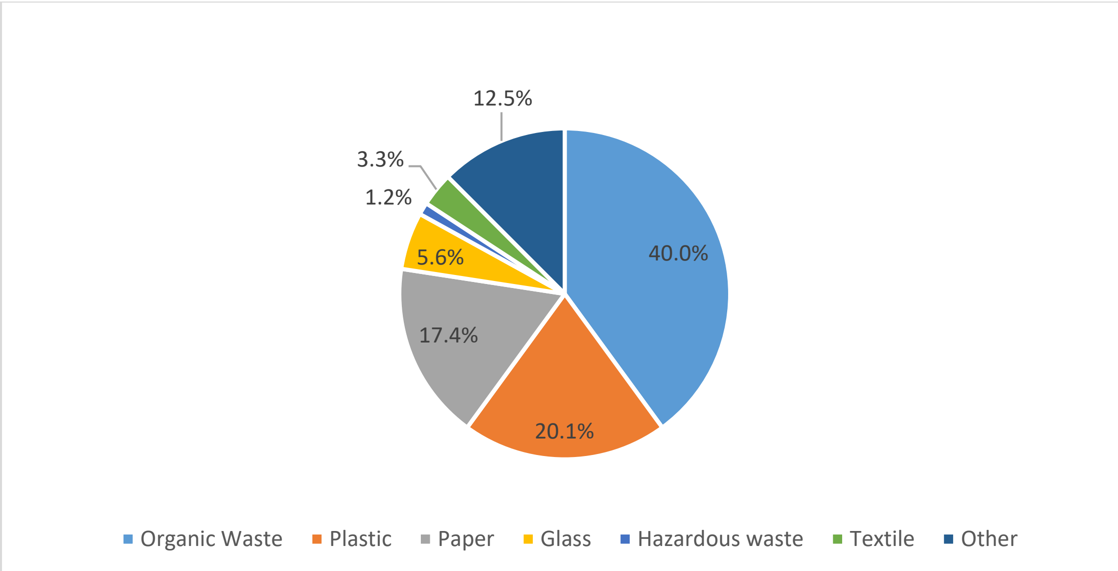


Source: Tbilisi City Hall, 2019

The Waste Management Technologies in Regions (WMTR) program also provides certain estimations regarding waste composition in Georgia. By their estimates, in Georgia there were 26-33 thousand tons of plastic, 45-50 thousand tons of paper, and 90-100 thousand tons of glass waste in 2016. Due to the data limitations, it was not possible to estimate the country's aluminum waste.

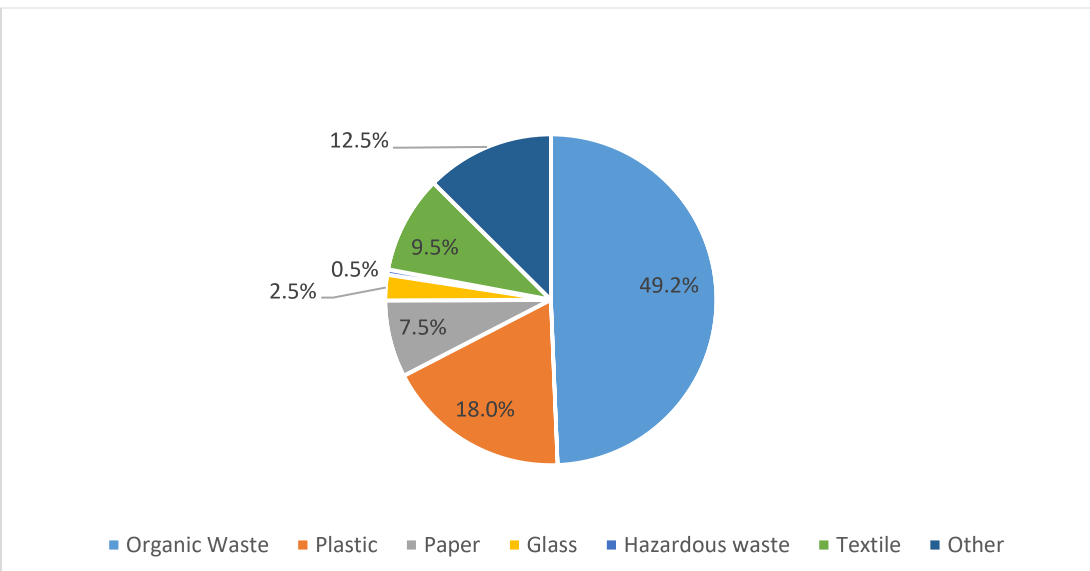
One of the most recent studies on waste was conducted by the Heinrich Böll Stiftung in 2020. Their research helped estimate the composition of waste generated in two cities – Rustavi and Batumi (the results are presented in Figures 8.3 and 8.4 below). Organic waste was estimated to constitute 40% of the total waste in Batumi and 49.2% of waste in Rustavi. In both cities, plastic held the second largest share in total waste (20.1% in Batumi and 18% in Rustavi), followed by paper in Batumi (17.4%) and textiles in Rustavi (9.5%).

Figure 8.3 Composition of waste in Batumi, 2020



Source: Heinrich Böll Stiftung, 2020

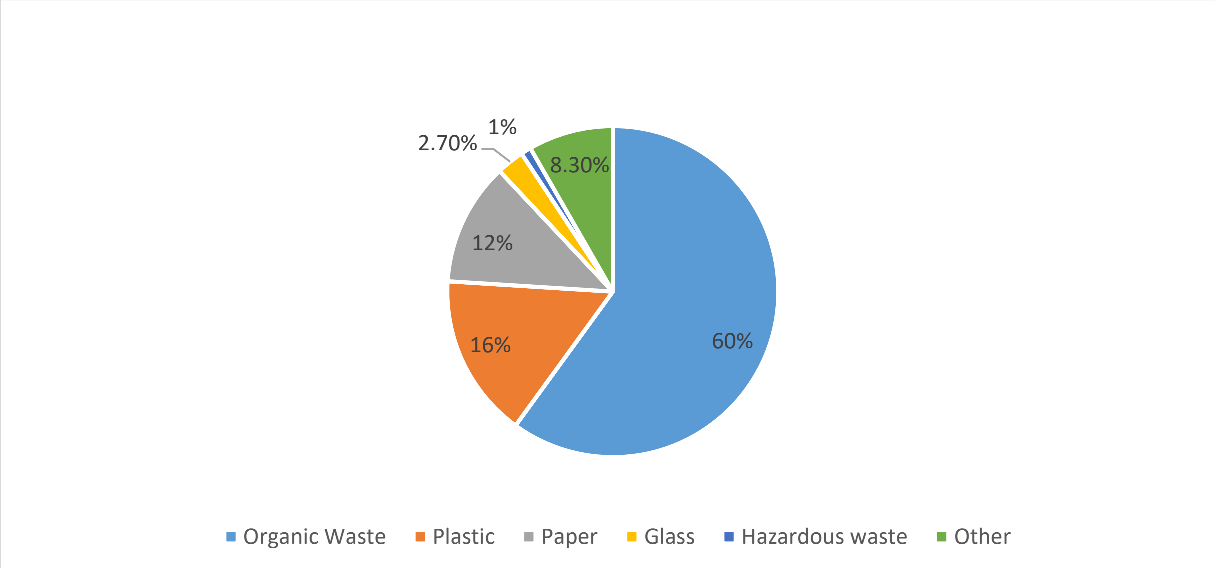
Figure 8.4 Composition of waste in Rustavi, 2020



Source: Heinrich Böll Stiftung, 2020

Based on the available information, the average composition of waste at the country level has also been projected (see Figure 8.5). The methodology used for this estimation is not publicly available. Significantly, it was impossible to estimate the percentage of textile waste at the country level (included in the Other category).

Figure 8.5 Composition of waste in Georgia, 2020



Source: Heinrich Böll Stiftung, 2020

Heinrich Böll Stiftung estimates that organic waste (which is a natural biodegradable refuse derived from either plants or animals) has the highest proportion of total waste generated (60%), followed, distantly, by plastic at 16%, and paper at 12%. These results are unsurprising as, according to the World Bank, developing countries (like Georgia) are the largest contributors to organic waste production. For instance, in 2016, 57% of all organic waste was generated by low-income countries (World Bank, 2018).

There have moreover been several separate studies that discuss the specific categories of waste over different years. However, these studies were not systematic, therefore the available information is fragmented.

Plastic waste

As described above, under Heinrich Böll Stiftung estimates, the share of plastic waste in 2020 was 16% of total Georgian waste; whereas, based on information provided by MEPA, using different morphological studies of waste composition, plastic represents an average 13% of annual generated waste. An additional source – the Caucasus Environmental Knowledge Portal – suggests that an annual average of 14.9% is plastic waste. Crucially, each of these results are estimations based on unique methodological approaches (information regarding the format of these approaches is not available).

In plastic waste, polyethylene bags have always accounted for a significant portion of the total. Heinrich Böll Stiftung suggests that before 2019 the Georgian populace used over 3,000,000 units of polyethylene bags (different sizes and colors) annually. As bags are extremely cheap (free prior to 2019 in grocery stores and other shops) the population had little incentive to reduce the usage of, or reuse, polyethylene bags. Thus, the vast majority of bags were disposed of in landfills. However, based on governmental ordinance N472,[85] the use of polyethylene bags with a density lower than 15 microns has been banned since 2019. Only biodegradable plastic bags are currently allowed in Georgia, while other plastic bags are no longer provided to final shoppers for free, which increases demand for reusable bags.

Waste by sector: residential, industrial, and medical

Beside the above-mentioned studies, MEPA carried out an accounting of residential, industrial, and medical waste in 2007. Although the study is already outdated and the situation has likely changed since, there are no more recent studies available. The results of the waste inventory from 2007 are detailed below.

Residential waste

Residential waste is defined as the disposed materials that households generate and can comprise either hazardous or non-hazardous waste.

As there is no official accounting system for residential waste, the estimation criteria during the accounting process were the number of citizens in the regions and the volume of garbage transportation vehicles. By MEPA estimates, 2,371,900 m^3/per year of residential waste was accumulated in Georgia in 2007. Unsurprisingly, the highest volume (45%) of residential waste – 1,095,000 m^3/per year – was generated in Tbilisi (the largest population, 1,103,200 residents at the time), followed by the regions of Adjara (327,700 m^3/per year) and Samegrelo-Zemo Svaneti (203,300 m^3/per year). A summary of MEPA's assessment for 2007 residential waste is presented in Table 8.1 below.

Table 8.1 Estimated residential waste in Georgia, 2007

Region	Accounted residential waste m^3/per year	Share in total residential waste generation
Tbilisi	1,095,000	45%
Adjara AR	327,700	13%
Samegrelo-Zemo Svaneti	203,300	9%
Imereti	191,700	8%
Kvemo Kartli	179,200	8%
Shida Kartli	161,100	7%
Samtskhe-Javakheti	122,500	5%
Kakheti	60,500	3%
Guria	14,900	1%
Mtskheta-Mtianeti	14,100	1%
Racha-Lechkhumi	9,500	0.4%
Total	**2,371,900**	**100%**

Source: MEPA, 2007

[85] https://matsne.gov.ge/ka/document/view/4325640?publication=0

Industrial waste

Industrial waste is defined as that produced by industrial activities, which includes any material that is rendered useless during a manufacturing process, such as within factories, mills, and mining operations.

To estimate the industrial waste across the country, MEPA developed a questionnaire for different industrial entities. At the time of the analysis, most industrial waste was disposed of within territories near the industrial entities (rather than landfills), without satisfying any environmental standards. The estimates for industrial waste from selected companies (based on information reported in questionnaires) is summarized in Table 8.2 below.

Table 8.2 Estimated industrial waste, 2007

Region	# of surveyed companies	Waste from fuel production and consumption (tons)	Scrap-iron (tons)	Waste from chemical production (tons)	Plastic (tons)	Glass (tons)	Construction waste (tons)	Wood waste (tons)	Other Waste (tons)	Total Industrial waste (tons)
Adjara	52	22,354	119	62	N/A	N/A	5,000	4,200	60	31,795
Guria	10	N/A	N/A	N/A	N/A	10	400	130	81	621
Samegrelo-Zemo Svaneti	30	4,514	10	N/A	N/A	15	20	210	1,340	6,109
Imereti	30	3	3	768,008	N/A	110	20	950	531	769,625
Shida Kartli	16	N/A	60	N/A	N/A	N/A	2,460	250	100	2,870
Mtskheta-Mtianeti	16	N/A	N/A	N/A	N/A	N/A	55	370	N/A	425
Kvemo Kartli	53	5	52	13,034	N/A	N/A	19,710	410	140	33,351
Kakheti	74	N/A	N/A	N/A	N/A	14	7,500	2,910	314	10,738
Tbilisi	132	641	1,474	15	12	55	510	40	1,493	4,240
Total	**413**	**27,517**	**1,718**	**781,119**	**12**	**204**	**35,675**	**9,470**	**4,059**	**859,774**

Source: MEPA, 2007

Over 850,000 tons of waste, as described in Table 8.2 above (more than 98.9% of accumulated industrial waste in 2007), was categorized as hazardous. Moreover, according to the same study, in 2006, 13,174 tons of technical oil, 11,921 tons of wheels, and 3,282 tons of accumulators were generated in countrywide waste.

Medical waste

Medical waste is considered to be a subset of waste generated in healthcare facilities, such as hospitals, physicians' offices, dental practices, blood banks, and veterinary clinics, as well as medical research facilities and laboratories.[86] The inventory of medical waste was compiled using a methodology similar to that used for industrial waste – sending specific questionnaires to selected medical institutions. A total of 268 medical institutes (75 of which were located in Tbilisi with the remainder across other regions) were examined under the study. However, 10 medical institutions in Tbilisi and 53 in other regions could not report the requested information at a disaggregated level. While, from these 268 institutions, 45 medical entities reported that they did not account for their medical waste at all. Based on the information provided, the research team

[86] Defined by the United States Environmental Protection Agency: https://www.epa.gov/rcra/medical-waste.

estimated that in 2007 a total of 8,196.403 tons of medical waste were accumulated in Georgia. This estimation was further based on the number of beds available to patients in each institution. A summary of the research on medical waste is provided below in Table 8.3.

Table 8.3 Estimated medical waste, 2007

Region	Number of beds	Estimated medical waste (tons)
Tbilisi	7,122	3,379.869
Adjara	1,642	873.650
Guria	345	183.467
Racha-Lehkhumi and Kvemo Svaneti	255	135.587
Samegrelo-Zemo Svaneti (excluding Poti city)	1,230	654.322
Imereti	775	412.472
Mtskheta-Mtianeti	183	101.796
Samtskhe-Javakheti	686	602.951
Kvemo Kartli	1,094	581.618
Shida Kartli	909	483.079
Poti	266	694.592
Total	**14,507**	**8,196.403**

Source: MEPA, 2007

Over half the medical waste generated in 2007 is estimated to have derived from two regions – Tbilisi and Adjara, which have more than half the available beds in the country.

8.4 Recycling

The traditional approach to waste management – disposal in landfills – can no longer answer the modern environmental challenges. It has therefore become far more relevant to introduce waste recycling technologies. Recycling[87] also helps to recover some of the valuable resources embedded in waste, thus, in addition to reducing the use of virgin natural resources, less waste is disposed of in landfills and the risk of pollution also declines.

In Georgia there is no large scale, country level approach to recycling. However, in certain regions (Tbilisi, Adjara, Kakheti, Kvemo Kartli, Shida Kartli, and Imereti) the recycling of paper, plastic, glass, and wheels is ongoing. According to the Caucasus Environmental Non-Governmental Organization Network (CENN), there currently are 35 companies that recycle or collect different types of waste around the country (see Table 8.4). In some cases, recycling companies manage the collection, transportation, recycling, and production of the final product.

[87] The types of waste that can be classified as recyclable are: plastic, glass, paper, bio waste, metal, construction waste, electric devices, cars, wheels, batteries, etc.

Table 8.4 Recycling companies by type of activity, 2020

N	Company name	Type of activities performed	Region
1	LLC ‘LMY’	Recycling plastic	Tbilisi
2	LLC ‘Ecosphero’	Recycling plastic and wheels	Tbilisi
3	LLC ‘Bokva’	Recycling plastic	Tbilisi
4	LLC ‘Repeti’	Recycling plastic	Tbilisi
5	LLC ‘A Plasti’	Recycling plastic	Tbilisi
6	LLC ‘Lordi’	Recycling plastic	Tbilisi
7	LLC ‘Euro Plast’	Recycling plastic	Tbilisi
8	LLC “Kavkaspack’	Recycling plastic	Kvemo Kartli
9	LLC ‘Eco Geopet’	Recycling plastic	Kvemo Kartli
10	LLC ‘Iga Georgia’	Recycling plastic	Imereti
11	LLC ‘Sever’	Recycling plastic	Adjara
12	LLC ‘Zugo’	Recycling plastic	Adjara
13	LLC ‘Achiko 2001’	Recycling plastic	Adjara
14	LLC ‘Clean World’	Collection and recycling plastic, paper and glass	Tbilisi
15	LLC ‘Georgian Paper Production’	Paper recycling	Tbilisi
16	LLC ‘Paper +’	Paper recycling	Tbilisi
17	LLC ‘Kriala’	Paper recycling	Tbilisi
18	LLC ‘Neo Print’	Paper recycling	Shida Kartli
19	LLC ‘Rony’	Paper recycling	Adjara
20	LLC ‘To-pa’	Paper recycling	Kakheti
21	LLC ‘Fabrica 1900’	Paper collection	Tbilisi
22	Social enterprise entity ‘Green Gift’	Paper collection	Tbilisi
23	LLC ‘Georgian paper production’	Production of cartons	Tbilisi
24	LLC ‘Gegmeti’	Recycling of aluminum	Tbilisi
25	LLC ‘GTA group’	Recycling of aluminum	Tbilisi
26	LLC ‘TRC’	Recycling of wheels	Tbilisi
27	LLC ‘Raber tech’	Recycling of wheels	Tbilisi
28	LLC ‘Ecoorganical corp’	Recycling of wheels	Tbilisi
29	LLC ‘Eco energy’	Recycling of wheels	Shida Kartli
30	LLC ‘Glass’	Recycling of glass	Shida Kartli
31	LLC ‘Kere’	Recycling of glass	Shida Kartli
32	LLC ‘Oilio’	Collection of food oil	Tbilisi
33	LLC ‘Biodiesel Georgia’	Collection and recycling of food oil	Tbilisi
34	LLC ‘Sanitari’	Collection of hazardous and non-hazardous waste and further management	Kvemo Kartli
35	LLC ‘Geo Mulch’	Collection of wood waste and organic mulch	Kvemo Kartli

Source: CENN

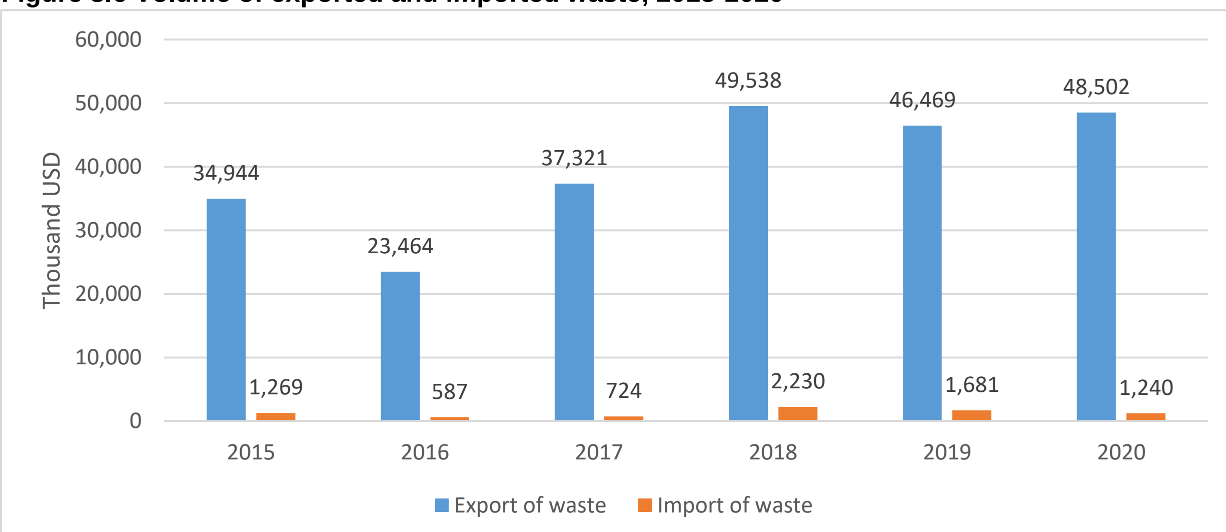
Moreover, since 2012, a non-commercial organization – Coop Georgia – has been operating in Tbilisi and provides the following services: the customer choses a preferable waste bin (glass, paper, and/or plastic) and pays a fee for that bin. While the rest of the service is free. The company regularly discharges bins and ensures the transportation of separated waste to relevant recycling companies.

8.5 International trade of waste

Georgia is involved in the trade of several types of waste with its trading partners. Geostat reports annual data on the value of exported and imported waste, although information regarding the amount of internationally traded waste is not available.

Geostat reveals that the value of exported waste has been significantly exceeding the value of imports. That is hardly surprising as there are a very limited number of recycling companies operating in Georgia. However, as there is no waste separation system in the country, it becomes difficult and expensive for exporters to segregate different types of waste or to clean leftovers (i.e., if plastic waste is disposed of alongside bio waste, it becomes too costly to remove the leftovers from the plastic). It should be noted that the value of imported waste represented only 0.015% of total imports in 2020, while waste exports accounted for 1.45% of total exports during the year. The trends characterizing the international trade of waste in Georgia is presented in Figure 8.6 below.

Figure 8.6 Volume of exported and imported waste, 2015-2020



Source: Geostat

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ISET Policy Institute www.iset-pi.ge iset-pi@iset.ge 995 322 507 177