In order to effectively visualize the reported natural disasters and to efficiently assess the hazards, vulnerabilities and risks applicable to this Atlas, various spatial and non-spatial data (instrumental, historical, reported natural disaster data, statistical data and other geo-data) have been applied.

For the hazard assessment, specific hydro-meteorological data was used. Within the territory of Georgia, a system of regular meteorological observation stations has been active since 1844. Up until 1990, the number of meteorological stations and posts equated to 100 stations and 60 posts. Since 2008, the number of meteorological stations has been reduced to 14 and the number of posts has also been reduced to a total of 14.

Information pertaining to natural disasters with specific locations (i.e. mudflow, landslide, rock-fall and snow avalanche) was provided by the NEA, the historic (as well as instrumental) data on earthquakes was provided by Ilia State University, Institute for Earth Science Studies. Due to the unavailability of specific, detailed data on the geographic locations of wildfires, it was decided that the MODIS burnt areas (2000-2017) data source would be applied. Some data was also collected on previously reported natural hazards from various sources are described in more details in Chapter 3.2.

In order to effectively assess the risks, both the CENN geo-database and other statistical and spatial data sources provided by various institutions were used. This data was processed in the framework of the project. The list and sources of all of the complete data are provided in greater detail in Annex 2.

Obtaining and subsequent processing of data has been associated with a number of difficulties, these include: the majority of data not existing in a digital format, problems related to data sharing and communication, and the dispersed locations of related datasets. In addition to this, much of the data that was applied was outdated and inaccurate. These inaccuracies will certainly have an impact on the results of the analyses, and should be substituted by updated and more detailed information in the future, to improve the results.
### Natural Conditions

#### Hypsometry

Georgia’s territory extends to an altitude of around 5,201 m above sea level. Geographic coordinates are: in the North – latitude 43° 35' 25" N and longitude: 40°23' 31" E. In the South – latitude 41° 02' 58" N and longitude: 46° 30'E. In the West – latitude 43° 23' 31" N and longitude: 40° 00 30" E. In the East – latitude: 41° 17' N and longitude 46° 44' 31" E.

The surface of Georgia’s territory characterized by complex hypsometry and is subdivided into several major altitudinal zones. At the highest part of Georgia (Svaneti part of the Caucasus Range), the change in elevation within 4-20 km, ranges between 2,700-3,550 m.

Dividing Georgia’s territory by elevation (altitude) ranges provides quite a detailed picture of its hypsometric development (see Table 2.1).

#### Digital Elevation Model

The DEM used in the Atlas for hazard assessment is the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM) that was developed jointly by the U.S. National Aeronautics and Space Administration (NASA) and Japan’s Ministry of Economy, Trade, and Industry (METI). The ASTER GDEM resolution (pixel size) is about 30 m, this was further resampled into a 100 m pixel (1 ha), the unit of hazard analysis used in the Atlas.

<table>
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<th>Altitude</th>
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<th>Eastern Georgia</th>
<th>Entire Georgia</th>
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ჰიფსომეტრია

ზედაპირის სიმაღლითი განალება, დახრილობისა და დანერგვის ხარისხი. ფუნქციები შექმნილია ASTER-ის საელოულო მონაცემის სიმაღლის შემოფილი მოდელის გამოყენებით.

წყლის ხერხები იქნებოდა საზოგადო განმართვა, ფოთხერქებთაობა და დახრილობის კარგი. ჩვენმა გრაფიკთან ASTER-ის საელოულო მონაცემების საშინაოდ შეიცავს ზოგადი მონაცემთა თანამედროვე შეჯსრი. კონცენტრაციის ან ადგილობრივი ჰაერთა ამოღები.

Source: ASTER GDEM is a product of METI and NASA, CENN/ITC
Quaternary subaerial andesites, dacites, andesite-dacites
Upper Pliocene. Subareal andesite-basalts, andesites
Sedimentary, Volcanogenic-sedimentary and Volcanic Rocks

Geology

Quaternary system (undismembered)

Neogene system (undismembered) sandstone, clays, conglomerates (marine and continental molasse)

Upper Miocene and Lower Pliocene andesites, basalts, dacites and rhyolites (Goderdzi Suite)

Upper Eocene and Oligocene conglomerates, sandstones, sillstones, clays, olistostromes (Kinta suite),

Upper Eocene olistostromes, gritstones, sandstones, foraminiferal marls, lavas and volcanic tuffs of basalts and trachytes

Middle Eocene sandstones, limestones, tuffs, olistostromes, basalts, andesites, dacites and rhyolites, volcanic breccias

Lower and Middle Eocene marls, argillites, sandstones, limestones, conglomerates

Lower and Middle Eocene conglomerates, gritstones, sandstones, foraminiferal marls, lavas and volcanic tuffs of basalts and trachytes

Upper Jurassic and Aalenian sandstones, sandstone and siltstone turbidites, conglomerates, marls, limestones,

Carboniferous conglomerates, gritstones, sandstones, argilites, lenses of limestones (Kvishi suite),

Triassic sediments – daciti-rhyolitic volcanites, quartz sandstones and siltstones are observed on

Quaternary deposits – fluvial proluvial, diluvial, old glacial, colluvial and other formations are

The territory of Georgia, as a part of the Caucasus, is located within the collision zone of the

Jurassic sediments overlaying the older formations are found in all tectonic units of Georgia.

Mesozoic and Cenozoic rocks, sandstones, tuffs, and volcanic tuffs of andesite and basaltic compositions,

Neogene rocks are found mainly in molasses depressions. They are represented by marine (clays,

Quaternary deposits – fluvial proluvial, diluvial, old glacial, colluvial and other formations are found almost throughout the territory of Georgia. These include river terrace formations, three moraines of glacial period and volcanic formations in the form of volcanic cones and lava streams (on the Greater Caucasus Range, south to Kazbegi and on the Trialeti Range, near Borjomi).

Cretaceous sediments are found within the folded system of the Greater Caucasus Range. Creta-

Jurassic rocks – clay-shales, sandstones, limestones, and black clay shales, silicites, sandstones and gritstones, lenses of limestones (Dizi series)

Permian and Triassic rocks on the southern slope of the central part of the Great Caucasus.

Mesozoic rocks – Triassic rhyolitic volcanites, quartz sandstones and siltstones are observed on the

Upper Paleozoic rocks – clay-shales, sandstones, turbidites, silicites, lenses of marbles and lime-alkaline andesite-dacite volcanics are exposed on the southern slope in the central part of the Great Caucasus.

Ultrasonic sediments overlying the older formations are found in all tectonic units of Georgia. These sediments are comprised of clayshales, sandstones, turbidites, rhyolites, and basaltic lavas and their pyroclastic deposits, clays, conglomerates, and red zoonic sediments.

The folded system of the Greater Caucasus; 2) The Transcaucasian intermountain zone; and 3) The folded system of the Lesser Caucasus. Each tectonic unit is subdivided into secondary and tertiary tectonic units.

The oldest Precambrian rocks – Lower and Middle Paleozoic rocks are found in all tectonic units. The rocks of this period – gneisses, crystalline schists, amphibolites, etc. are exposed within the zone of the Greater Caucasus Range and Lesser Caucasus.

The tectonic units can be distinguished on the territory of Georgia by the Earth crust disposition, geological characteristics and evolution:

1) The folded system of the Greater Caucasus; 2) The Transcaucasian intermountain zone; and 3) The folded system of the Lesser Caucasus. Each tectonic unit is subdivided into secondary and tertiary tectonic units.

Stratigraphy

The theory of the Greater Caucasus, as a part of the Caucasus Range, is located within the collision zone of the European and Asian segments. It is built mainly of Mesozoic (540-60 Million years) and Cenozoic sediments (60 Million years-present). Early (Precambrian and Paleozoic) formations occupy smaller area.

The theory of the Greater Caucasus Range and Lesser Caucasus.

The theory of the Greater Caucasus Range, as a part of the Caucasian and Afro-Arabian plates, in the Mediterranean (Alpine-Himalayan) belt, at the interface of European and Asian segments. It is built mainly of Mesozoic (540-60 Million years) and Cenozoic sediments (60 Million years-present). Early (Precambrian and Paleozoic) formations occupy smaller area.
Paleocene-Eocene plagiogranit-porphyries granodiorite-porphyries
Upper Cretaceous rhyolites
Upper Cretaceous teschenites, camptonites and monchiquites
Protrusions of mantle serpentinous ultrabasites
Upper Paleozoic quartz-diorites, diorites, gabbro-diorites
Middle Jurassic pyroxenites, gabbros, diorites
Upper Paleozoic microcline granites, granodiorites

Geology

Faults

Subalkalic

Alcalic

Tholeitic

Other Symbols

Volcanic Rocks

Plutons and Subvolcanic Bodies
2.2.3 Geomorphology

The modern relief of Georgia is comprised of forms with different hypsometric and morphographic features heavily dissected mountain slopes, deep erosive gorges, intermountain depressions, flat lowlands, plains, plateaus and uplands. A height of 2,400–3,000 m above the sea level and above of the central section of the Greater Caucasus range within the boundaries of Georgia is characterized by canyon and kar-canyon type glaciers (the total area of glaciers exceeds 550 km²).

The geomorphologic unit of the Lesser Caucasus covers the Adjara-Trialeti, Shavsheti, Arsiani and Loki (Somkhiti) Ranges, the Akhaltsikhe depression and the Shua Khrami mountains (the highest peak is the Kanli Mountain, 2,987 m). The section of the Lesser Caucasus located in the northern part of the territory of Georgia is characterized by hilly and gorgy terrain. In some areas the tower-shaped mountains, plains, plateaus and uplands. Different relief types are found in the territory of Georgia due to the geological structure of its specific parts, petrography of rocks and exposure to hydro-climatic effects. Erosive, volcanic, karstic, gravitational, and old glacial landforms should be noted as the most important landforms.

The section of the Greater Caucasus Range located in the northern part of the territory of Georgia stretches for 690 km from northwest to southeast. Its average height is 3,520 m, the maximum height is 5,201 m (Shkhara Peak). The main dividing ridge and associated branches (including Gagra, Bziju, Kodori, Svaneti, Shatileri, Zeskho, Racha, Gremtli, Kartli, Kakheti, etc.) are characterized by erosive dissection and steep slopes, as well as older glacial landforms (braughs, cirques, moraines, etc.) and karst formations (caves, dolines, shafts, etc.). The upper part at a height of 2,400–3,000 m above the sea level and above of the central section of the Greater Caucasus range within the boundaries of Georgia is characterized by canyon and kar-canyon type glaciers (the total area of glaciers exceeds 550 km²).

The geomorphologic unit of the Lesser Caucasus covers the Adjaras-Trialeti, Shavsheti, Arsiani and Loki (Somkhiti) Ranges, the Akhalskhe and the Shua Khrami mountains (the highest peak is the Kanli Mountain, 2,987 m). The section of the Lesser Caucasus located in the territory of Georgia is characterized by hilly and gorgy terrain. In some areas the tower-shaped mountains, plains, plateaus and uplands. Different relief types are found in the territory of Georgia due to the geological structure of its specific parts, petrography of rocks and exposure to hydro-climatic effects. Erosive, volcanic, karstic, gravitational, and old glacial landforms should be noted as the most important landforms.

The geomorphologic unit of the volcanic mountainous zone of southern Georgia is comprised of: the Erusheti Upland, Javakheti Plateau, Samsari Range, Tushla Depression and Zemo Khrami Lava Plateaus. The above geomorphologic units are almost entirely built of Neogenic and Quaternary basalt and andesite-basalt lavas the surfaces of which are heavily dissected by canyon-type ravines of rivers, old and modern lacustrine depressions, boulder trains formed as a result of frost weathering, etc.
გეომოფოლოგია

High-mountain landscape of the central and western Caucasus axial line developed on Paleozoic crystal rocks

Wrinkle ridges and massifs formed of Mezo-Cainozoic and sedimentary rocks with deeply disintegrated denudation relief

Wrinkle-boulder ridges and massifs formed of Mesozoic and Paleogene volcanogenic and sedimentary rocks with deeply disintegrated denudation relief

Medium-denuded wrinkle ridges and massifs formed of Mezo-Cainozoic limestone with karst relief

Structural-denuded plateau with bare crystal basis in some areas

Source: Atlas of Georgia, 1964; Geography of Georgia, part I, 2000
2.2.4 კლიმატი Climate

საზღვარში ზოლში 1,480-2,530 მმ-ის საზღვარში ვალებადობს. უფრო მაღალ, ზღ. დონი-ნალექების ჯამი 380-900 მმ-ის საზღარში ვალებადობს. ზღ. დონიდან 1,000-1,200 მ-ზე მაღალი ჭითხაბის ზღვის ნოვიო ნოსტატული კლიმათია, რომელიც თანდათან კლებულობს: ხუმი ღამე ზღ. დონიდან 920 მ - 10.40C, მეშინა ზღ. დონიდან 1,421 მ - 5.70C, ბახმარო ზღ. დონიდან 1,926 მ - 40C. თანდღამე მოშდება 5-8 სმ-დან 1.5-2.5 მ-მდე აღსანიშნავი განონობის ხელშემოწმება.

Western Georgia is characterized by a highly diverse climate, which is further conditioned by the complexity of its landscape (topography), i.e. the spread of its territory at a high elevation (5,000 m above the sea level) and periodic penetration of air masses (characterized for tropical and polar zones) that are frequently noted in its regions. Georgia's territory can be divided according to the following climatic conditions:

- Marine subtropical humid climate region, which comprises the entirety of western Georgia.
- The transitional region from the subtropical continental climate to the marine humid climate, which covers the territory of Eastern Georgia with its temperate, humid, subtropical climate. The Javakheti volcanic plateau and sub-portion of adjacent slopes shall be deemed as part of the second climatic portion, which is located at an elevation of 1,500-2,000 m above the sea level and is characterized by its dry subtropical climate and high plateaus.

Within the marine subtropical humid climate portion, at an elevation of 700-800 m above the sea level, the climate is very humid and moderately humid. The total annual precipitation within the coastal zone fluctuates between 1,480-2,530 mm. At a higher elevation, of around 1,800-2,000 m above sea level, the total annual precipitation equals between 1,200-2,500 mm. The annual average temperature within the coastal zone is 14.1 – 14.70C, where 410C is the absolute maximum and -8 -140C is the absolute minimum. The transitional region from the subtropical continental climate to the marine humid climate, which covers the territory of Eastern Georgia with its temperate, humid, subtropical climate. The Javakheti volcanic plateau and sub-portion of adjacent slopes shall be deemed as part of the second climatic portion, which is located at an elevation of 1,500-2,000 m above the sea level and is characterized by its dry subtropical climate and high plateaus.

In the above stated territories, the annual average temperature is between 10 and 12.90C, where the absolute maximum reaches between 40 and 410C, the absolute minimum decreases to between -23 and -280C and the total annual precipitation fluctuates between 380 and 900 mm. In Eastern Georgia, at an elevation of between 1,000-1,200 m above sea level, the average annual temperature falls to between 4-60C, the absolute maximum fluctuates between 16 and 340C and the absolute minimum decreases to between -34 and -420C. The total annual precipitation rises between 530 and 1,400 mm in this region. Daily rainfall exceeding 20-50 mm often occurs, facilitating the development of mudflow, landslide and flood processes.

In both of the above noted climatic zones there is no hard snow cover created at an elevation of around 400-500 m above sea level on annual basis. At an elevation of between 800-1,500 m above sea level the duration of snow cover may last between 60 and 130 days, while at a higher elevation it can last between 150 and 190 days. The height of snow cover at an elevation of 800-1,500 m above sea in separate circles (sections) may reach between 50 cm and 1.5m; it may even exceed 2-3 m at elevations above 1,000-1,200 m.
ნალექები

Precipitation

აგურიანი, რომ წვიმის ჰიდროგეოლოგიური და ბოტანიკური ფაქტორები იზოლირება მთების რუკაზე, გრაფიკული და გარდანგრძელი გეოქსისტური მოძრაობა მასში, თუმცა მთებში წვიმის თხინი ფაქტორები შეიძლება გამოიწვიოთ პოლიტიკურ და რეზიდენციურ რელიეფ ტექნიკურად ან გეოლოგიურად მჟავირალთა ტექნიკურად.

ნალექების ფაქტორებზე მძღოლი მასშტაბით ისწავლის, ხოლო ბოტანიკური ფაქტორები და ეკოლოგიური პარამეტრები უნდა ითვლიდა შორის ნერგები და იტერაცია მათთან.

2.2.5 ნალექები

2.2.5 Precipitation

The atmospheric precipitation (that along with geological-geomorphologic and botanical factors plays an important role in the development of some of the major natural processes) is often characterized by a compound regime of distributional difference in the territory of Georgia. This is further conditioned by a complex orography, a large difference in relative heights between areas, as well as various conditions of spreading humid air masses that penetrate from the Black Sea, etc. Due to its proximity to the Black Sea, the annual total of precipitation in western Georgia is higher (594-4,000 mm) than Eastern Georgia (400-1,800 mm). The Black Sea Zone (Batumi – 2,318 mm, Poti – 1,639 mm; Sokhumi – 1,460 mm; the Caucasus and the Adjara-Trialeti Ranges (Gagra ridge 1,644 m above the sea level – 1,737 mm; Gudauri – 1,926 m above the sea level – 1,406 mm; Bakhmaro – 1,926 m asl – 1,406 mm) are distinguishable by their abundance of precipitation. In general, the annual total precipitation increases with elevation. However, this trend has been interrupted in some locations (upper Svaneti caves, Javakheti Plateau, Tori and Ahalsitskhe caves) due to the influence of certain orographic conditions. Within the territory of Georgia, 55-75% of all precipitation occurs in the warm season (April to October). From the viewpoint of major natural hydro-meteorological hazards (landslide, snow avalanche, strong flash flood), particular attention should be paid to the quantity of precipitation per day. Specifically, where a daily total of rainfall exceeds 20-30 mm and when the quantity of days can be from 1 to 28 days, dependant on the individual municipalities of western Georgia. In eastern Georgia, it fluctuates between 0.4-11 days on an annual basis. The maximum level of precipitation per day, 350 mm, was recorded in western Georgia, specifically in the town of Lanchkhuti.

The height of snow cover and its duration increases along with a growth in the elevation of the area. In western Georgia, the height of snow cover at an elevation between 600 and 800 m above sea level equals between 6 and 10 cm respectively, and its duration is 57 days. At an elevation of between 1,500 and 2,200 m, it is between 20 and 40 cm respectively and its duration is between 120 and 140 days. The height of snow cover at an elevation above 2,000 m exceeds 5 m in all places, while its duration equals roughly 195 days. In western Georgia, the height of snow at an elevation of between 600 and 800 m above sea level, and at a higher elevation, frequency equals between 150 and 200 cm or more of snow, and its duration lasts between 70 to 220 days.

Visualization and Primary Analysis of Meteorological Data

It is vitally important to have knowledge of the distribution of precipitation and spatial trends (and/or absence of precipitation that, together with high temperature, can cause droughts) in the territory of Georgia. In order to visualize and analyze these factors and these data, the everyday measurement data of precipitation, obtained from the 83 meteorological stations, has been used (however, gaps in records and missing data have impacted the saturation of this data). Based on this information, using statistical software 'R', different thematic climate index maps have been produced. These are:

Map 1: Rx5 – Average multi-year distribution of the maximum 5-day precipitation; Map 2: CDD – Distribution of maximum length of dry spell (RR<1mm) (multi-year data); Map 3: CWD – Distribution of maximum length of wet spell (RR>1mm) (multi-year data); Map 4: Rx1 – the daily distribution of the maximum 1-day precipitation; Map 5: CWD – Distribution of maximum length of wet spell (RR>1mm) (multi-year data); Map 6: CDD – Distribution of maximum length of dry spell (RR<1mm) (multi-year data).
Average Multi-year Distribution of the Maximum 5-day Precipitation

Possible Maximum 1-day Precipitation for 5-year Return Period

Possible Maximum 1-day Precipitation for 10-year Return Period

Possible Maximum 1-day Precipitation for 25-year Return Period

Possible Maximum 1-day Precipitation for 50-year Return Period

Possible Maximum 1-day Precipitation for 100-year Return Period

Source: NEA & CENN/ITC

Scale: 1:5,000,000

Meteorological station
ب. 3.1 Cultural Heritage

From the second half of the second millennium AD, a process of gradual establishment of the very first consolidation of Georgian nations (tribes), the Colchis and Iberian kingdoms, started in the southwestern and southwestern territories of Georgia (see Figure 2.1).

In the 1st century AD, after a process of consolidation, the term “Sakartvelo” (Georgia) was introduced to indicate the unified state territories.

At the end of the 2nd century, the territory of Georgia comprised the part of the land that included the modern day territories of Azerbaijan, Armenia and Turkey and covered an area of 150,000 km² (see Figure 2.2).

From the 3rd century, the country’s territory significantly changed through various conflicts, expansions and defeats. Furthermore, Georgia’s territory and its borders continued to significantly change within the 6th and 7th centuries when the Ottomans conquered the Samtskhe-Saatabago Region. In the second half of the 17th century, the country’s territory had reduced to 102,000 km².

The country’s boundaries were again changed during the 19th and 20th centuries, when the south and eastern boundaries were significantly altered due to the consequences of the Russia-Turkey wars and various subsequent treaties that were agreed.

In 1921, Georgia was occupied by Russia and, in 1922, became a part of the Soviet Union. In 1991, Georgia regained its independence and the vast majority of the country’s borders have not been altered, delimited or demarcated since that time. The only exception to this is the 241 km section of the current border between Georgia and Turkey.

Georgia is a country with a large cultural heritage. It is important to note that its archaeological history, its architectural history, as well as its general history has been preserved in various monuments, churches, monasteries, castles, fortresses, old bridges, museums, theatres, etc.
Land Cover

Land cover is defined as the observed physical cover on the earth’s surface. When considering land cover in its pure and strict sense it should be confined to only describe the vegetation and man-made features covering the land mass. Consequently, areas where the surface consists of bare rock or bare soil are describing land itself rather than land cover. Also, it is disputable whether water surfaces constitute land. However, in practice, the scientific community usually describes those aspects under the term land cover. Land use is characterized by the rearrangements, activities and inputs that people undertake in a certain land cover type in order to produce, change or maintain it. This definition of land use establishes a direct link between both land cover (natural systems) and the actions of people in their environment (man-made systems).

The vast diversity of the geological structures, landscapes and hydro-climatic conditions of Georgia’s territory, as well as its rich plant cover, stimulated the development of a variety of different types of soils. Georgia’s soil cover, in general, represents a reflection of the features of the physical and geographical conditions under influence, of which some have been created and some have been developed. Consequently, a rich spectrum of soils can be found in the territory of Georgia.

One of the main features of Georgia’s land cover is forest, which covers almost 40% of its territory. Forest vegetation (coniferous forest - 16.4%; deciduous forest – 83.6%) cover the slopes of the Caucasus Mountains, Adjara-Trialeti, Shavsheti, Aragvi, Liakh, Zhaghati and the Liki ridges and at an average elevation of between 400 and 2,000 m above the sea level. The total area of coverage of the forests of Georgia is more than 29,000 km².

There are more than 850 lakes in Georgia covering a total area of 770 km². The total area of wetlands is 2,250 km² and the total area covered by glaciers in Georgia is 506 km².

Land Cover Data Processing

A basic land cover database was provided by Geoland, it was reclassified to simplify the data (see table 2.2). The land cover layer was then updated by CENN based on cadastral data and satellite imagery. Due to missing data, the study was derived from the satellite imagery alone. In the course of updating the old data, the following order of importance was considered (listed in order, from high to low): populated areas, forests, agricultural lands, shrubs and grass cover/meadows, etc.

After this process, the new land cover was again reclassified, for example: arable land and pasture were redefined as cropland; meadows and haylands were redefined as grasslands; etc. Table 2.3 shows the land cover types and the areas (in km²) that they cover.
### Table 2.3.3

<table>
<thead>
<tr>
<th>Region</th>
<th>Municipality</th>
<th>Gain (ha)</th>
<th>Loss (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kakheti</td>
<td>Gurjaani</td>
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<tr>
<td>Zemo Svaneti</td>
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<td>58.881</td>
</tr>
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<td>23.911</td>
<td>58.881</td>
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<tr>
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<td>Shuakhevi</td>
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</tbody>
</table>

**Source:** Global Forest Watch
2.3.4 Administrative-territorial Division

Georgia is divided into the following territorial and local self-governing units:

1. Autonomous republics (A/R);
2. Regions;
3. Municipalities (districts): the settlements which are self-governing units, and which have a level of regional representation and executive self-managing bodies. Municipalities also have their own property, income, budget and administrative centre, and a municipality is an independent juridical entity;
4. Self-governing cities: a town-category settlement, which has a self-managing unit status;
5. Sakrebulos (communities): local representation self-governing entities;

Processing of Borders of the Administrative Units

No up to date digital maps were available for all of the communities of Georgia. Therefore, the borders of the administrative units applied, for the assessment of the exposure, vulnerability and risk in this Atlas (as well as in the web-atlas), were made by integrating two sources of information: the borders of communities that were provided by Geoland, and the borders of the communities obtained from the cadastral database. The attributed data was linked either to the level of regions, level of districts or the level of the communities (e.g. the recorded natural disasters, population, number of school children, hospitals, doctors, etc.).
There are a variety of buildings in Georgia, covering residential, nonresidential, office and administrative buildings, which are located in areas with relatively favorable physical-geographic and economic-geographic conditions. Settlements that are located near motorways, recreation zones, the coast, etc. generally have a higher density of buildings than more rural settlements (that was afterwards used to assign vulnerability types to the buildings). Instead of the building footprint polygons, buildings were converted to points coinciding with the center of the polygon, and Tkibuli, etc) (see Figure 2.4).

Due to the favorable geographic living conditions, the intermountain plain of Georgia has the most common building types mainly on piles, which remains frequent even now (see Figure 2.6), while in Eastern Georgia, the building types consist of mainly stone and/or brick houses.

After the building density map was generated for the whole country, it was then combined with the data layer of the communities to effectively calculate the number of buildings for each community.

The total number of buildings estimated for Georgia using this procedure was 1,178,000. The number of residential buildings was estimated to be 730,000, the nonresidential buildings were 93,000, and the agricultural buildings were 156,000.
Generating Population Density Maps

The information regarding the number of people living within Georgia and their locations was provided by Geoland and is based on statistical information from 2002, this information was later calculated per ha and was sourced from the various Sakrebulo communities. The population data from 1989 was used for the occupied territories, as no up to date information was available. In order to distribute the population of the occupied territories over the built-up areas (from a ratio scale of 1:5,000 on the topographic map) a dasymetric mapping approach was utilized. The population density that was calculated based on the available data contains uncertainties due to its out-dated nature. It has not been possible to get any additional updated information regarding the population densities for the smaller administrative units.
Transportation networks are a significant element at risk as are all other social-economic elements at risk that need to be considered during the vulnerability and risk assessment.

Various types of transport networks are present in Georgia, specifically: railroads, roads, harbors, airports, etc.

The first railway between Zestaphoni-Poti and Tbilisi-Poti became operational in 1871-72. Later, in 1902, the town of Borjomi was connected to the community of Bakuriani with a narrow-gauge railway line. The total length of Georgia’s railway network is 2,344.2 km. Railway transport in Georgia is used for commuting and carriage of various resources, materials and goods intended for export, import and transit. The construction of highways in Georgia was started at the beginning of the 20th century. However, railroads remain highly important for the transportation of population, import, export and (raw) materials from the ports to the main cities and vice versa. The total length of Georgia’s motorway roads equals more than 40,000 km, of which 10,121 km are roads considered to be of both international and state importance. Furthermore, 15,921 km are streets in different types of settlements, 22,503 km are unpaved roads and all other roads cover 47,521 km.

During various analyses presented in this Atlas, the road types were grouped in 4 main categories: highways, streets, unpaved roads and pathways.

The total length of Georgia’s coastline is 309 km. The most important ports for the country are: Batumi, Poti, Sokhumi and Kulevi. Georgian ports are located within the Europe-Caucasus-Asia Transport Corridor and fulfill the shipment of dry cargo, fuel and oil products.

There are currently both 300 and 500 kW power-transmission lines in Georgia’s territory, that connect the country to the Azerbaijan, Armenian and Russian electricity systems. Construction of a 500 kW transmission line, that will connect Georgia with Turkey will be completed in 2012.

As water supply, electricity supply, gas supply, mobile telephone networks and sewage systems.
The total area of Georgia’s protected territories is equal to 595,743 ha, of which, 580,000 ha is composed of land territory and 15,743 ha by the sea.

Strict Nature Reserve/Wildness Area is the main category of the protected areas, where economic activities are prohibited is to protect the natural ecosystems and allow for scientific access in these areas. Within the territory of Georgia, the areas that have been declared as state reserves are: Batsara, Babaneuri, Lagodekhi, Vashlovani, Mariamjvari, Liakhvi, Borjomi, Kobuleti, Kintshire, Richtia-Musara, Pshika-Gumista and Ritsa; they have a combined total area of 138,248 ha.

National Park was created to maintain unique natural areas, as well as for scientific and educational purposes. The total area of Georgia’s national parks is 348,790 ha. The following national parks have been created in Georgia:

- mountainous high-humidity ecosystems – Kolkheti National Park;
- arid and semiarid ecosystems – Vashlovani National Park;
- extreme southern area of distribution of the Eastern Spruce – Algeti National Park;
- mountain and highland ecosystems and biodiversity – Tusheti National Park;
- biodiversity of highland ecosystems – Kasbegi National Park;
- mountainous high-humidity ecosystems – Javakheti National Park.

Natural Monument – declared as such to protect and maintain specific natural features of national importance. Currently, the following natural monuments can be found in Georgia: the Alazani Grove, the Artsivi Gorge, and the Takhti-Tepa and Imereti Caves.

Habitat/Species Management Area – created to protect unique animal species and plants; it is permitted to use the natural resources within its boundaries for limited economic purposes only. The total area of the preserves/reservations in Georgia equals 71,785 ha. The following preserves/reservations function in Georgia: Ajamaeti, Lagodekhi, Ilto, Khoruli, Gardabani, Iori, Chachuna, Katsoburi, Kobuleti, Tetrobi, Kartsakhi, Suldi, Khanchali, Bughdasheni, Madataphi and Sataplia.

Protected Landscape – created for the harmonious coexistence of nature and human beings, for the development and support of recreation and tourism, and for the protection of regional economic potential and traditional rules of the community. In Georgia, there exist the Kintrishi and Tusheti Protected Landscapes, with a total area of 34,163 ha.
2.3.9 ეკონომიკა

The main sectors of Georgia’s economy consist of: agriculture (crop growing, livestock breeding), industry (metal manufacture, machine engineering, chemical and petrochemical, construction materials, timber and paper, light and food industries), energy, transport (motor, railway, marine, air, and oil and gas pipelines), and trade. Recently, tourism has also become one of the main priority sectors of the country’s developing economy.

According to data from 2010, Georgia’s Gross Domestic Product (GDP) equaled 20,743.4 mln GEL ($11,636.5 mln), while the per capita Gross Domestic Product was 4,675.7 GEL ($ 2,623), the growth of the country’s GDP was 6.3%.

The total, combined value of Tbilisi, the capital of the country, equates to 43% of the country’s total GDP. The second and third places in terms of contributing GDP are divided between the Imereti-Racha-Lechkhumi-Kvemo Svaneti and Kvemo Kartli (see Figure 2.8).

GDP of Georgia by types of economic activities in current prices are represented in Table 2.4.

Spatial Distribution of GDP

In order to develop a map of the economic indices (e.g. GDP), which is necessary for an assessment of the exposure, vulnerability and risks, the above data, which was only available as total values for the regions and economic sectors (excluding the data for the occupied territories), had to be spatially distributed on the basis of the land cover classes. This was done by dividing the GDP of a specific sector (e.g. agriculture) by the number of pixels (ha as 1 pixel on the maps covers 100 by 100 meters) for the specific ground covers (e.g. crops). As a result of this calculation, a numerical value has been attributed to each pixel. This procedure is extremely generalized, but given the fact that no spatially distributed economic data was available it was considered as the best proxy in terms of measurement.