National Report on the State of the Environment of Georgia

2007 - 2009

FOREWORD

This National Report on the State of Environment 2007-2009 has been developed in accordance with the Article 14 of the Law of Georgia on Environmental Protection and the Presidential Decree N 389 of 25 June 1999 on the Rules of Development of National Report on the State of Environment.

According to the Georgian legislation, for the purpose of public information the National Report on the State of Environment shall be developed once every three years. 2007-2009 National Report was approved on 9 December 2011.

National Report is a summarizing document of all existing information on the state of the environment of Georgia complexly analyzing the state of the environment of Georgia for 2007-2009. The document describes the main directions of environmental policy of the country, presents information on the qualitative state of the environment, also presents information on the outcomes of the environmental activities carried out within the frames of international relations, and gives the analysis of environmental impact of different economic sectors.

National Report is comprised of 8 Parts and 21 chapters:

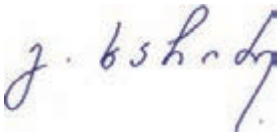
- Qualitative state of environment (atmospheric air, water resources, land resources, natural disasters, biodiversity, wastes and chemicals, ionizing radiation),
- Environmental impact of different economic sectors (agriculture, forestry, transport, industry and energy sector),
- Environmental protection management (environmental policy and planning, environmental regulation and monitoring, environmental education and awareness raising).

In the development of the present State of Environment (SOE) the Ministry of Environment Protection was assisted by the EU funded Project Support to the Improvement of the Environmental Governance in Georgia.

In the search of necessary information for the purpose of the SOE development assistance has been provided by almost all organizations and bodies of the country as a result of which by the staff of the Ministry of Environment Protection a draft Report of the State of Environment of Georgia for 2007-2009 was developed.

National Report was prepared and published in the Georgian and English languages.

The Ministry is ready to express its deep appreciation for all remarks and suggestions that would facilitate to the improvement of the publication in future.



George Khachidze

Minister of Environment Protection

INTRODUCTION

According to the Georgian legislation, for the purpose of public information the National Report on the State of Environment is developed once every three years. After the agreement with the interested ministries and other organizations the draft Report is approved by the Minister of Environment Protection of Georgia.

In the development of present SOE the Ministry of Environment Protection was assisted by the EU funded Project Support to the Improvement of the Environmental Governance in Georgia. The Project was implemented by IBF International Consulting.

During the document development the EU invited 1 international and 1 national consultant. Tom Stafford (the Project International Expert, Ireland, Office of Environmental Assessment Environmental Protection Agency) and Ms. Lia Todua (the Project National Expert, Georgian Center for Strategic Research and Development), who assisted the Ministry of Environment Protection to prepare the National Report on the State of Environment of Georgia for 2007-2009 and to improve the existing Rule of the Report Development.

For the transparency of the National Report preparation process in January 2010 an Experts Working Group/ Public Council was established. The Council was comprised of the representatives of NGOs, social and scientific organizations. During 2010 several public hearings of the draft Report were arranged, comments and remarks concerning the project were expressed.

Draft National Report on the State of Environment was sent to the relevant ministries and Tbilisi Mayor's Office for consideration. The present document was prepared on the basis of received comments and recommendations.

Report preparation process was fully highlighted on the web-page specifically created for this purpose: http://www.soegeorgia.blogspot.co

All release versions, received comments and remarks were regularly put on the Ministry's and the above-given web-pages.

The Report was approved by the Order of the Minister of Environment Protection of Georgia of 9 December 2011 # 54 on the Approval of the National Report on the State of Environment of Georgia for 2007-2009.

Ministry of Environment Protection of Georgia expresses deep appreciation and gratitude to the representatives of the European Union in Georgia for ensuring the preparation of this National Report. In particular, personal acknowledgement is expressed to Mr. Per Eklund, Mr. Philip Dimitrov and Mr. Michal Nekvasil. The Ministry also acknowledges the contribution of all people who participated in the development of the document.

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CONTENT








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SUMMARY OF THE REPORT

This report describes the state of the environment of Georgia. In particular the parameters of different environmental factors are assessed, the type of activities affecting them are described and the actions undertaken to mitigate those impacts. The measures which the Government of Georgia is undertaking to improve the state of the environment are also presented.

Unfortunately this report can not describe the state of the environment in Georgia's occupied territories where no control is possible. Chaotic cutting of rare forest species is taking place in those territories in addition to the exploitation of inert construction materials from Abkhazia's coastal rivers which are being used for infrastructural works in preparation for the Sochi 2014 winter Olympic games. The mines and ores left uncontrolled in these territories are also considered to pose a significant risk to the environment.

AIR QUALITY

During 2005-2009, air quality monitoring in Georgia was conducted on quite a limited scale. In 2009, the air quality was measured in only four cities (Tbilisi, Kutaisi, Batumi, Zestaphoni) and only at one station in each city.

The extension and modernisation of the Georgian air monitoring network started in 2009. Tbilisi now has three operational monitoring stations, one of which has commenced ground-level ozone concentration measurements. An air quality monitoring station has been installed in Rustavi. Nevertheless further extension and modernisation of the monitoring network is necessary as well as installation of automatic monitoring units. The parameters for air monitoring are also to be updated – for example, instead of measurements of dust content in air only its finest particles referred to as PM_{10} and $PM_{2.5}$, should be measured.

Motor transport is the main source of air pollution in Georgia. The high volume of emissions from the motor transport sector is a result of many factors. In order to decrease emission levels various measures should be implemented such as: the gradual phasing in of stricter motor fuel quality and vehicle emission standards in combination with enforcement of those requirements; establishment and gradual decrease of an age limit for cars; traffic optimisation; development of electric transport, etc.

CLIMATE CHANGE

Global climate change is one of the most acute problems in the world today. Its impact can already be observed in Georgia: extreme natural occurrences have become more frequent and climatic parameters have changed. The following regions of Georgia are the most sensitive to climate change: high mountains, sea coast and the semi-deserts of East Georgia. It is necessary that climate change adaptation measures are planned and implemented in those regions to minimize physical threats and possible economic loses.

At the same time, like many countries, Georgia is going to take measures to reduce as much as possible the main cause of climate change – greenhouse gases. A priority area is the more intensive use of the Clean Development Mechanism for the introduction of environmental friendly technologies and know-how in the country.

WATER RESOURCES

Georgia has an abundance of fresh water resources. At present the water quality monitoring network covers only a small part of Georgian fresh water bodies. Out of 26 thousand rivers with a combined channel length in excess of 60 thousand kilometres, regular measurements of water quality are undertaken at 39 points on 22 rivers.

Groundwater quality monitoring is not currently being carried out. More than half of the country's population abstracts drinking water from individual groundwater sources (from springs and wells) and uses it without any prior treatment. The gradual re-establishment of groundwater quality monitoring is necessary, in particular in the regions within the boundaries of Samegrelo, Tskaltubo, Alazani, Kartli and Marneuli-Gardabani artesian basins.

The network of surface water monitoring should also be extended, in particular in recreational waters as regular water monitoring takes place at only one point on one recreational lake – Paliastomi. A system of regular water quality monitoring in recreational lakes together with a warning system for the public should be introduced. The reasons for contamination of recreational waters should also be identified and eliminated.

Regular monitoring of drinking water quality commenced in Georgia in 2008-2009. Programmes aimed at the improvement of drinking water supply systems are underway in many regions in Georgia and will lead to significant improvements in the quality of drinking water supplies.

The biological monitoring data of the Black Sea coastal waters of Georgia show an improvement of the ecosystem (as in the whole Black Sea). The quality of recreational sea waters is generally satisfactory although a number of cases of high levels of pollution was observed close to the river estuaries (Tchorokhi, Supsa, Bartskhana). Municipal wastewaters represent the main cause of pollution of these waters as well.

Renovation of the sewage network, including the construction of new wastewater treatment plants, and the construction of modern landfills are underway throughout the whole country (including the Black Sea Coastal Zone). These works will significantly reduce pollution loads entering Georgia's waters and improve the water quality in surface water bodies.

LAND AND SOIL

Georgian land resources are limited and protection of land and soil is essential. The total area of terrestrial territory is 69.7 thousand square kilometres, of which only 15% can be cultivated and 70% has a natural-economic use (forests, bushes, meadows and pastures). One form of land degradation of concern is land desertification which results in the progressive loss of plant cover in dry steppes and semi-deserts. Around 4% of the country (3,000 km^2) is vulnerable to the desertification process. This is mainly in the Shiraqi, Eldari, Iori, Taribani, Naomari, Ole and Jeiran-Choli valleys.

A National Program to Combat Desertification was approved in 2003 which due to insufficient financing was not fully implemented. A National Program on Protecting and Enhancing Productivity of the Soils of Georgia for 2003-2010 was also prepared in 2003. This programme has also not been implemented in full. Preparation of a comprehensive policy on management of land resources and soil protection is very important together with provision of necessary funding for its implementation.

NATURAL DISASTERS

Natural disasters take place on quite a large scale in Georgia and with a high frequency of recurrence due to the complex geological and geographical conditions in Georgia. The frequency of natural disasters has increased in the recent past and this increase is considered to be a consequence of the effects of global climate change as well as human activities, such as deforestation, overgrazing of pastures, etc.

To avoid the loss of human life and in order to decrease the economic damage caused, an Early Warning System is under development, which will be based on appropriate monitoring, analysis and forecasting of these phenomena.

MINERAL RESOURCES

Georgia is quite rich in mineral resources, the extraction and processing of which is essential for economic development of the country. However, these processes can have a significant impact on the environment. This is particularly the case for the metal mining industry. Decades of extraction was carried out without due regard to environmental requirements. Nowadays planning of costly environmental remediation measures is on the agenda together with identification of financing and capacities for their implementation.

BIODIVERSITY

Georgia is extremely rich in biodiversity. Unfortunately the status of many species and ecosystems are in decline. Of particular concern are the big mammals (deer, wild goat, bear, striped hyena), populations of which can no longer be restored/maintained without special conservation measures. At present several such measures are being undertaken such as reintroduction of the wild goat and Persian gazelle into the Vashlovani and Borjomi National Parks.

The main reasons for biodiversity degradation and which still exist, are poachers and illegal forest loggers as well as unsustainable agricultural practices. Measures are underway to suppress poaching and introduce sustainable forestry practices.

The protected areas system is the principal mean for protection and preservation of biodiversity in Georgia. Currently 7.1% of the territory of Georgia is covered by protected areas of different categories. It is planned to further extend the system of protected areas.

Absence of biodiversity monitoring influences to some extent the effectiveness of planning and implementation of protective measures. A National Monitoring System is currently being developed. National indicators for this system have already been developed and methods of data collection are currently being selected.

A Resource-centre accessible via internet has already been created , where biodiversity monitoring data will be available.

Biological resources use is strictly regulated in Georgia through defined rules for fishing and hunting. Violation of these rules can incur administrative, civil and criminal charges. There are also defined areas, species and terms for hunting.

WASTE

The annual volume of domestic waste produced per capita in Georgia at a National level is approximately half that of the European average. However, waste volumes are rapidly increasing in line with improvements in the economy. Over a hundred landfills are used in Georgia for waste disposal, of which only five (2 municipal and 3 private) meet the required environmental standards. The remainder represent a considerable source of environmental pollution and as such, their replacement with modern landfills is urgently required. At the same time a strategy should be developed to reduce the amount of waste going to landfill, in particular the removal of recyclable and biodegradable waste streams should be targeted. This will require significant investment in infrastructure within the country for the segregation, separation, reuse and treatment of such wastes. Municipal waste collection systems are also to be improved as they do not currently cover all built up areas of the country.

Disposal of hazardous wastes, including medical wastes, at the municipal landfills is of particular attention. The exact amount of such wastes is not known. The neutralization, collection, and transportation of medical waste is only properly organized in Batumi and Kobuleti. It is necessary to establish a system for treatment and destruction of all medical waste in the country.

Large quantities of industrial wastes remaining at the sites of former Soviet industries require attention. That of concern is up to 100 thousand tonnes of arsenic-containing wastes in Racha-Svaneti which require remediation.

CHEMICALS

Two major groups of chemicals especially hazardous to the environment and human health, persistent organic pollutants and ozone depleting substances are subject to special regulation in Georgia. These substances are not produced in Georgia and their import and export is controlled. In the latter half of the twentieth century these chemicals were commonly used in agriculture (pesticides) as well as in industrial and consumer electronic equipment. These chemicals are still to be found in the country. For instance there is a large stock of obsolete pesticides stored in temporary burial. To avoid pollution of the environment by these substances, they should be collected and treated.

IONIZING RADIATION

Both natural and man-made sources of ionizing radiation can be found in Georgia. Background levels of radiation in the environment do not exceed acceptable limits. The Chernobyl accident resulted in contamination of some areas of the country with radioactive substances, however at present there is no threat to human health and the environment.

No radiation sources are currently produced in Georgia. The sources in use today are imported from abroad, with a small share of the sources remaining since the Soviet period.

Georgia has developed the appropriate infrastructure for the control of nuclear and radioactive materials and has enhanced its institutional and technical capacity to combat illicit trafficking. The detection and neutralization of radioactive sources, control of which was lost during disintegration of the Soviet Union, is now conducted together with strict control of import-export of nuclear and radioactive materials.

ENVIRONMENTAL IMPACT OF ECONOMIC SECTORS

Agriculture and Forestry

Two thirds of Georgia's land area is used for either forestry or agriculture. In 2009, 47.3 percent of the Georgian population lived in the countryside.

Agriculture was traditionally the main stay of the Georgian economy, and from an employment perspective it still remains as such, although its contribution to GDP has substantially decreased from 50% in 1990 to only 10% in 2009. In line with this, the environmental impact of agriculture decreased substantially. For example, the use of high volumes of pesticides and fertilizers in the second half of the twentieth century resulted in pollution of both the surface and groundwater with nitrates and pesticides. In the last 20 years use of agrochemicals has fallen substantially resulting in reduced levels of pollution of natural waters from the agricultural sector.

It should be noted that despite the decrease in the national herd, the condition of the pastures has not improved. The main reason for the degradation of pastures is the unavailability of additional pastures to Georgian farmers (for example the winter pastures of North Caucasus were closed). Substantial degradation of pastures has been observed particularly in alpine meadows.

One of Georgia's most valuable natural resources is its forests. Apart from their economic value, forests provide soil and water protection functions. Forests also play a major role in the provision of resources for the population, in particular firewood used for heating homes and meeting timber needs. Forests are also of immense importance as sources of secondary wood materials and non-timber resources for local residents.

The economic crisis of the 1990's resulted in intensive (often illegal) exploitation of Georgian forests and thus degradation of a substantial part of the Georgian Forest Fund. The balance between the rate of deforestation and the forests natural growth/replacement capacity was broken. However, no proper inventory of forests has been undertaken in the last 20 years, so no exact information on their condition exists.

TRANSPORT

The Georgian transport sector represents a significant pressure on the environment. The number of transport vehicles has doubled since 2001, while the number of buses and minibuses tripled. It is expected that vehicle numbers will increase over the next decade. The majority of private car owners are concentrated in urban centres, mainly Tbilisi, and this trend is set to continue.

The vast majority (90%) of pollutants emitted into the air in Georgia's urban environment arise from motor transport. The high average age of the national fleet and the low quality of automotive fuel (as compared to European standards) contribute to the high levels of vehicle emissions.

The rapid growth in vehicle numbers on Georgian roads seems set to continue, as are overall air emissions from this sector, which will place increased pressure on the environment. In order to address the situation, a range of projects are being implemented, including the rehabilitation and improvement of local and national roads, improved traffic management in urban centres, improving public transport, changing the parking scheme etc. In the future, more attention must be given to integrated transport planning including the management of mobility demand. The use of electrically powered transport, low-carbon fuels and the introduction of new technologies such as hybrid and fuel cell vehicles in the country should also be explored.

INDUSTRY AND ENERGY

The collapse of the economy in the 1990s resulted in a significant decrease of the impact of the industry and energy sectors on the environment. There has been some growth in these sectors in more recent times, particularly in the energy sector. However, growth within the sector has been based on improved and more environmentally sound technologies, and as such has less impact on the environment. There are still obsolete technologies that remain from the Soviet era within the industry and energy sector. Significant rehabilitation works undertaken in the Energy sector in 2007-2009, resulted in the reduction of systemic loses and increases in generation thus contributing to the sector 's overall efficiency.

Targeting the security of energy supply, the country naturally aims to make maximum use of internal energy resources, which are primarily sourced from renewable resources. At the moment approximately 40% of Georgia's energy needs are met by domestic renewable energy sources, namely hydro resources and firewood.

In general, Georgia's GDP (nominal) energy intensity is 2.5 times higher than that of EU27 which indicates big

potential for energy savings.

With these regards, important steps were taken by the Ministry of Energy: significant rehabilitation works were carried out in the sector and introduction of energy meters are successfully being implemented. Introduction of graded tariffs for energy carriers should be mentioned specifically as a significant energy saving measure, which creates additional incentive for consumers to use less energy.

A number of pilot projects in the named direction as well as public awareness raising projects carried out by the Ministry of Energy are to be mentioned also. In this direction, the Ministry also participates in projects designed in the framework of EU's energy program INOGATE as well as the projects under the Clean Development Mechanism. The Ministry cooperates with international organisations such as European Energy Charter, European Energy Union, and other governmental and non-governmental organizations. All the listed activities are to facilitate successful implementation of the joint goals of the energy efficiency and environmental protection.

STATE ENVIRONMENTAL MANAGEMENT

Policy and planning

In order to ensure the constitutional right of citizens to live in a healthy environment, the State provides for the protection of the environment and the rational use of natural resources. While doing this, the economic and environmental interests of society must be balanced. One of the roles of a Sustainable Development Strategy is to provide a framework to achieve this balance. Georgia has not yet developed such a strategy.

National Environmental Action Plans are used as a tool for medium-term environmental planning, in addition to sectorial environmental plans and environmental plans of administrative units. The priority issues highlighted in these plans are reflected in the medium-term action plan of the Government which is the basis for annual budgetary expenditure planning. In addition, Georgia receives substantial funding from international donors to support projects in the environment sector.

A comprehensive assessment of the state of the environment and the effectiveness of current environmental activities is the basis for good environmental planning. This report is the first attempt to make the state of the environment easily accessible for both decision makers and the broader public.

ENVIRONMENTAL REGULATION AND CONTROL

As of 2009, environmental regulation within Georgia was undertaken through licensing and permitting, as well as through the establishment of norms, rules and technical regulations. The Environmental Inspectorate ensured compliance with all of these requirements.

Many initiatives have been undertaken to improve the environmental regulation system. Firstly, the development of a system of inventory and monitoring of biological resources, which allows scientifically based quotas to be established, in order allow for the sustainable use of these resources and prevent their degradation.

Some legal amendments are required to improve the efficiency of the environmental impact assessment and permitting system. It is also necessary to improve the overall quality of the environmental impact assessment document. Information campaigns are desirable in order to improve public involvement and participation in environmental impact assessment process.

ENVIRONMENTAL RESEARCH, EDUCATION, AND AWARENESS RAISING

The Ministry of Environment Protection of Georgia focuses significant efforts on improving the environmental awareness of the population. The Ministry regularly organises meetings, conferences, briefings, greening and cleaning actions, ecotours for students and school pupils and media-tours. In addition, information and educational brochures are published and documentary films focussing on specific environmental issues are made. The web-pages of the Ministry and the Georgian Aarhus Centre's also serve to inform the public on environmental issues.

The Protected Area's Agency of the Ministry of Environment Protection is undertaking training of Geography and Biology school teachers. Training for primary school teachers is also planned. Scientific-popular lectures for school children are regularly conducted.

Planning and implementation of joint initiatives by the Ministry of Environmental Protection and the Ministry of Education and Sciences for improvement of environmental education are of high importance.

IN CONCLUSION

Each citizen of Georgia has to take care of its rich natural environment. As the economy grows and modern life progresses, adverse effects on the environment increase and as a result the environment needs continuous protection. It is essential that environmental protection receives due attention.

SOCIOECONOMIC FACTORS AFFECTING THE ENVIRONMENT

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SOCIOECONOMIC FACTORS AFFECTING THE ENVIRONMENT

I/1. 1. POPULATION

In 1992 the overall population of Georgia was about 5.5 million people. During the 1990's the population decreased rapidly. Since 2000 the population has been more or less stable. The current population (2009) is 4.4 million, however the figures for Abkhazia AR and Tskhinvali are not considered reliable.

Approximately 53 per-cent of the Georgian population lives in urban areas. The average population density is 66 people per square kilometre, although the distribution is uneven. The population density is higher along the Black Sea coast and in river gorges. In highland regions population density is lower.

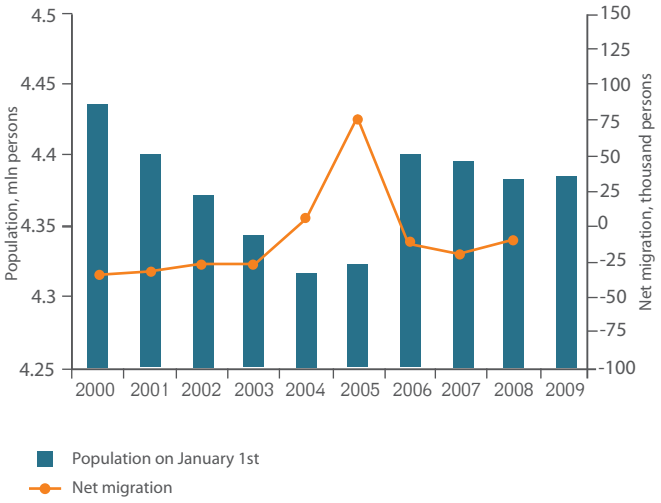

Figure 1.1. Population number (without Abkhazia AR and Tskhinvali region) and migration between 2000 and 2009. Source: Statistical Yearbook of Georgia, GEOSTAT, 2009

I/1. 2. HOUSEHOLDS

The main environmental areas households impact on a national scale are, energy consumption, water consumption, generation of waste and its disposal.

The average occupancy in Georgia is 3.6 persons per household. This figure has reduced by 0.17 since 2000, while at the same time there has been an increase in the average household income. Increased household incomes are reflected in consumer trends with households purchasing a larger number of domestic appliances and an increase in the average level of car ownership, more use of energy and resources, and more generation of waste. As a result the impact of households on environment grows. This trend is likely to remain at least in the medium term.

Despite income levels, practically all households rank health-care, social security, education, municipal and infrastructure issues above the environment.

I/1. 3. ECONOMY

Fundamental economic reforms carried out in Georgia had immediate effect on country's development. As a result, in 2007, the country demonstrated 12.3% GDP growth rate.

In 2008, the Russian military aggresion together with the global financial crisis posed Georgia with serious challenges. Nevertheless, the country withstood those challenges, showing 2.3% GDP growth in 2008, while recession level in other countries` economies was quite high and 6.4% growth in 2010 (after 3.8% decrease in 2009).

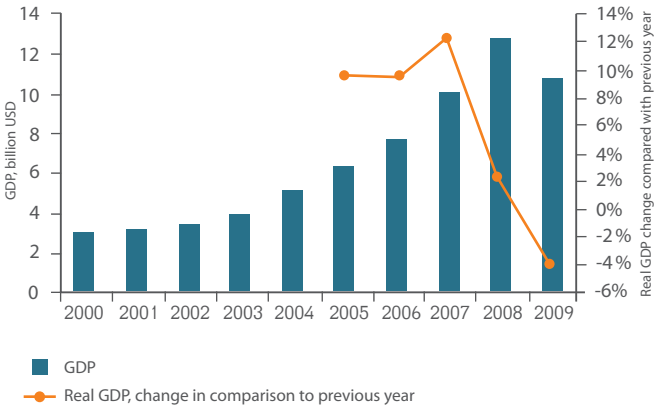

Figure 1.2 Nominal gross domestic product (US dollars) and its real dynamics

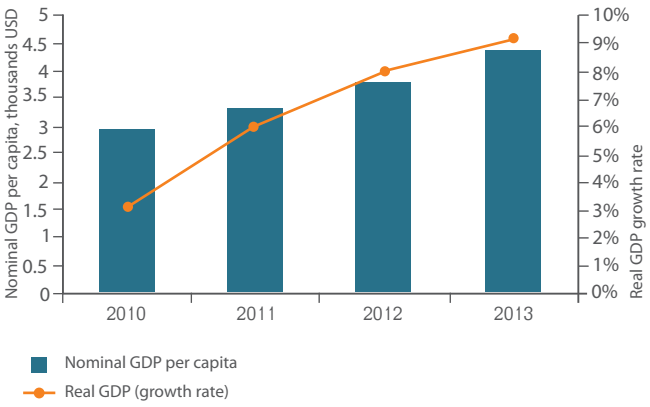

Figure 1.3 Government of Georgia microeconomical prognosis over the period 2010-2013. Source: Government of Georgia, Basic Data and Directions (BDD) 2010-2013. Tbilisi, 2009

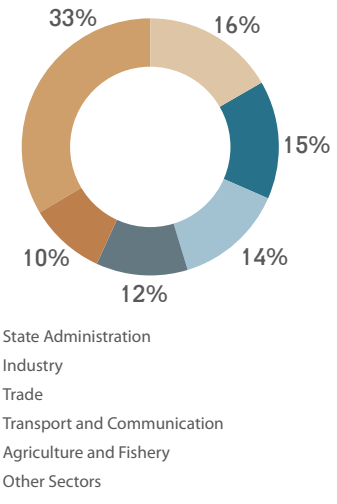

Figure 1.4 Georgian GDP structure according to sector 2009.

The quick recovery of Georgian economy was a result of the governmental policy aimed at minimization of crisis effects based on following principles: investment in local infrastructure, strengthening of social protection and adding to investment attractiveness of the country, as well as effective use of the 4.5 billion assistance devoted by the Brussels Donors Conference to overcoming the results of the Russian-Georgian war of 2008.

The structure of Georgian GDP has changed significantly in the last 20 years. The share of GDP derived from industrial and agriculture has decreased considerably while the share derived from services and trade grew.

I/1. 4. INFRASTRUCTURE

From 1990 until recently, investments in internal infrastructure were minimal, although some large transnational projects have been implemented (for example the East-West pipe lines).

The current program of the Georgian government (adopted by the Parliament in February 2009) underscores protection from the world economic crisis and determines three areas of spending for the 2.2 billion GEL economic stimulus package; 1.45 billion GEL (Internal state resources and donor aid) for infrastructure projects; 0.5 billion GEL for direct donor projects and 0.25 billion GEL, that remains with the consumer as a result of the reduction of the tax burden.

Recent capital investments have been focused on infrastructural development in the rapidly growing areas of transport and communications. These two areas have received almost half of the total investment in capital stock.

The Government plans to finance infrastructure projects during 2010-2013 which will attract foreign investments. This will promote business development and create new jobs. Transport, energy, water supply and sewage systems are set as priority areas for infrastructure projects.

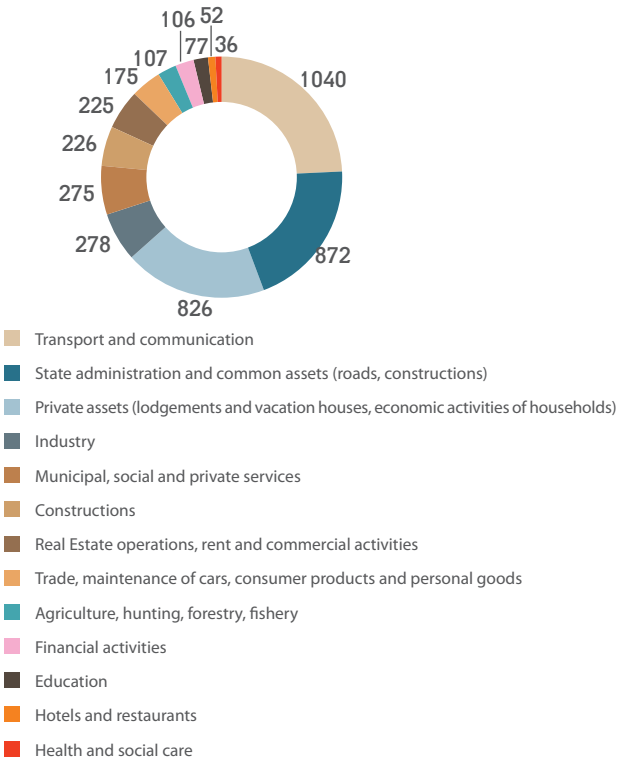

Figure 1.5 Structure of capital stock development in 2008. million GEL.

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I/1. 5. MAIN CHALLENGES

Current economic trends suggest that pressures on the environment will generally increase in Georgia within the medium term. In certain sectors such as transport, the pressures may become acute in a shorter time-frame.

During the last seven years, the government actively encouraged private investment in business activities through a policy of reducing financial and bureaucratic barriers. As a result, Georgia's investment climate rating has improved considerably. This Policy will continue in the medium term. Significant state and foreign investment in big infrastructural projects are set to continue.

Changes are also expected at a household's level. The growth of real GDP per capita will drive consumption growth; this in turn will result in increased loads and pressures on the environment.

The key challenge for environmental policy makers is the identification and timely forecasting of environmental impacts, and to develop appropriate responses, including preventive measures, to mitigate their impacts.

II

AIR PROTECTION

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AMBIENT AIR QUALITY

Ambient air quality monitoring is conducted at seven stations located in five cities: Tbilisi, Kutaisi, Batumi, Zestaphoni and Rustavi. Three of these stations were installed in late 2009, thus this report includes only data for the four stations located in Tbilisi, Kutaisi, Batumi and Zestaphoni. The small number of existing monitoring stations does not provide for an adequate assessment of air quality within the entire area of these four cities. Therefore, in order to have real picture of the air quality in Georgia, further expansion and modernisation of the air monitoring network is required. This will allow for improved assessment of the population affected by poor air quality, and in determining the measures necessary for their protection.

The Main Polluter of ambient air is motor transport emissions. As for the industrial emissions, after there have been installed dust treatment high effective systems at Rustavi and Kaspi Cement plants, the main source of pollution stays Zestaphoni ferrous-alloys plant. In order to decrease emissions from the transport sector levels, joint actions from several authorities are necessary. These include measures such as further optimisation of traffic; establishmenting an age limit for imported cars; the gradual phasing in of stricter motor fuel quality and vehicle emission requirements in combination with enforcement of these requirements; and initiatives such as the development of electric transport systems.

II/2. 1. INTRODUCTION

Protection of ambient air from pollution caused by man-made factors is considered an important task all over the world.

It should be noted that the amount of fossil fuel (coal, peat, natural gas, different oil products) exploited during the twentieth century is greater than that consumed during all the previous centuries. Combustion processes are the main source of substances which cause air pollution: carbon dioxide (CO_2), nitrogen dioxide (NO_2) and sulphur dioxide (SO_2) , solid particulates, non-methane volatile organic compounds (NMVOC), benzapirene and dioxin-furans etc. When contaminants reach a certain concentration in the air, they can have a negative impact on human health and the environment. The link between increased mortality rates and increased pollution levels has been established. Toxic substances which get into air together with exhaust gases are particularly harmful for human health.

State Regulation

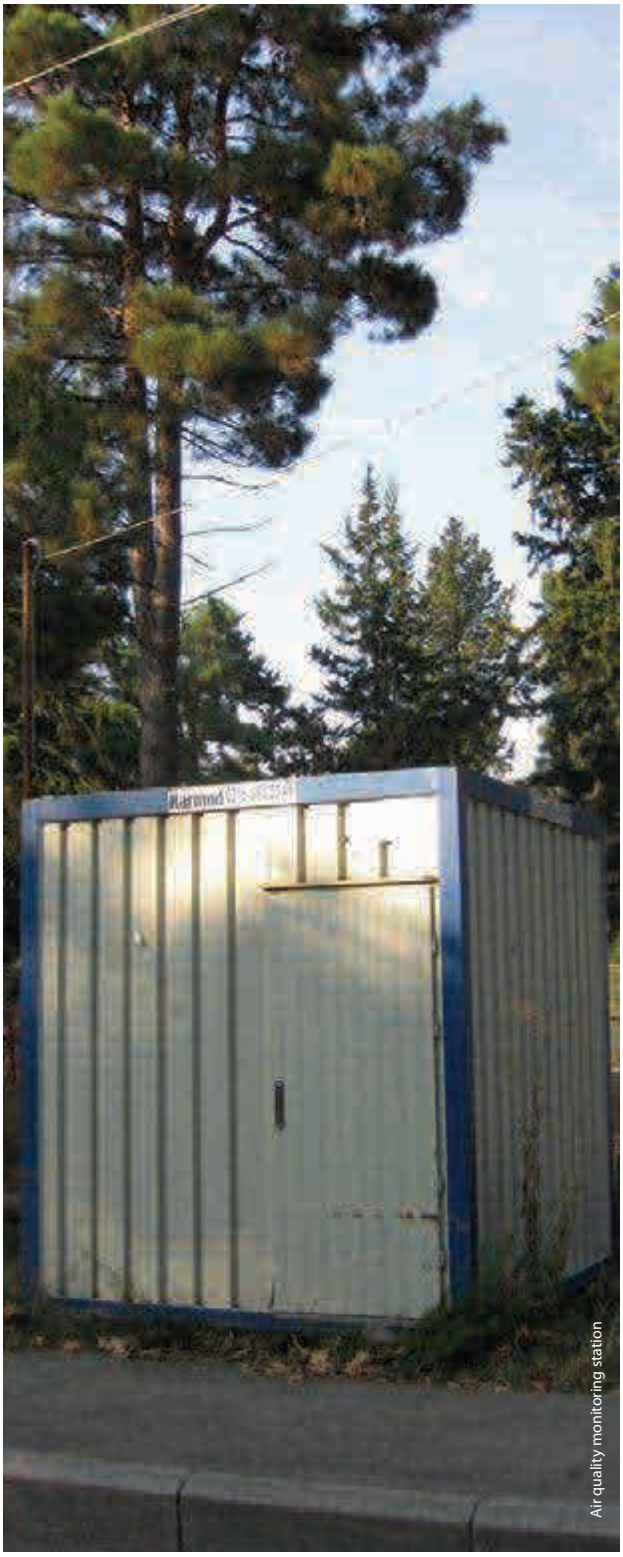
Air protection and related issues are regulated by the Law of Georgia on Protection of Ambient Air and by 15 sub-laws adopted according to the provisions of the Law.

For the purpose of air protection, Georgian legislation defines the Maximum Allowed Concentrations (MAC) of harmful substances in ambient air. These standards together with those of the World Health Organization (WHO) and the EU are given in Table 2.1. It is assumed that if a concentration of a substance is lower than the indicated standard, it is not harmful for human health even in case of life-long exposure.

Calculation and determination of emission limits for air polluting industries is based on the maximum permissible concentrations of harmful substances. Such limits are defined individually for facilities subject to environmental impact permits (the limits are defined during the permitting process), while the emission norms of the remaining small enterprises, as well as motor transport are established by relevant technical regulations.

The content of different harmful additives in petrol and diesel fuel (lead content in petrol, sulphur content in diesel, etc.) is regulated by decrees of the Government of Georgia.

The Maximum Allowed Concentration of harmful substances in ambient air represents the maximum concentration of that substance (averaged for a specific time period) which does not affect people's health or the environment over regular periodic or lifetime exposure. The list of these limits, their types and values are defined by the Order #38/n (February 24, 2003) of the Minister of Labour, Health and Social Protection of Georgia on "Approval of Environment Quality Norms" and Order #297/n of the Minister of Labour, Health and Social Protection (August 16, 2001) on Amendments to the Order. It should be noted that this document is practically repeating the main provisions and the norms stated in the Soviet Era document of similar content. Accordingly, in some cases the national limits do not correspond with the EU norms and WHO recommended standards. Therefore the air quality national norms need to be revised in line with EU Legislation.



Air quality monitoring station

Name of harmful substance	Maximum permissible concentration mg/m³			Concentration averaging period
	According to National legislation	Recommendation of the WHO	According to EU Legislation	
$PM_{2.5}$	-	0.01	0.025	1 year
	-	0.025	-	24 hours
PM_{10}	-	0.02	0.04	1 year
	-	0.05	0.05	24 hours
Particulate matter (total)	0.5	-	-	30 min
	0.15	0.12	-	24 hours
Nitrogen dioxide	-	0,2	0.2	1 hr
	-	0.04	0.04	1 year
	0.04	-	-	24 hours
	0.085	-	-	30 min
Sulphur dioxide	-	0.5	-	10 min
	-	-	0.35	1 hr
	-	0.05	-	1 year
	0.05	0.02	0.125	1 day
	0.5	-	-	30 min
Carbon monoxide	-	100	-	10 min
	-	10	10	8 hr
	-	30	-	1 hr
	5	60	-	30 min
	3	-	-	1 day
Lead compounds	-	0.0005	0.0005	1 year
	0.0003	-	-	1 day
	0.001	-	-	30 min
Ground level ozone	-	0.12	0.12	8 hr
	0.03	-	-	1 day
	0.16	-	-	30 min

Table 2.1 Maximum permissible concentrations of harmful substances in ambient air

II/2. 2. AIR QUALITY IN GEORGIA

Since the Soviet period, the following parameters of polluting substances have been measured by the air quality monitoring programme:

- Maximum one-time concentration (measured within 20 -30 min, mg/m³);
- Mean daily and annual concentrations (mg/m³).

Air quality is assessed by comparison of measured concentrations with the appropriate standards. In particular, mean monthly and mean annual concentration values are normally compared to daily mean MACs. Mean measured concentrations for a 20-30 min measurement period are compared to 20-30 min MAC (maximum allowed one-time concentration).

The National Environmental Agency under the Ministry of Environment Protection conducts the State Monitoring programme for Air Quality. At the moment, air quality measurements are conducted at seven measurement stations located in five cities: Tbilisi, Kutaisi, Batumi, Zestaphoni and Rustavi. Three of these stations were installed at the end of 2009, therefore this report presents only data for the other four stations.

Air quality is measured 3 times a day and only on working days (sampling is not automated). The following pollutants are monitored in Tbilisi; dust, carbon monoxide, nitrogen and sulphur dioxides, and lead; in Kutaisi; dust, sulphur dioxide, nitrogen monoxide and nitrogen dioxide; in Batumi; dust, nitrogen and sulphur dioxides; and in Zestaphoni, dust, nitrogen dioxide, sulphur dioxide and manganese dioxide. Ground level ozone monitoring commenced in 2010 in Tbilisi, and carbon monoxide in Kutaisi and Batumi.

Figures 2.1-2.6 show the trend for the last 5 years for ambient air pollutants at monitoring stations in Tbilisi, Kutaisi, Zestaphoni, and Batumi. As previously mentioned, the data is based on a single monitoring location in each city and cannot be considered representative of the air quality of a whole city, but only of the district in which the monitoring took place. The districts for each city are as follows: Tbilisi - Agmashenebeli Avenue, Zestaphoni – Kvaliti settlement, Kutaisi – Nikea district, Batumi – the port adjacent territory.

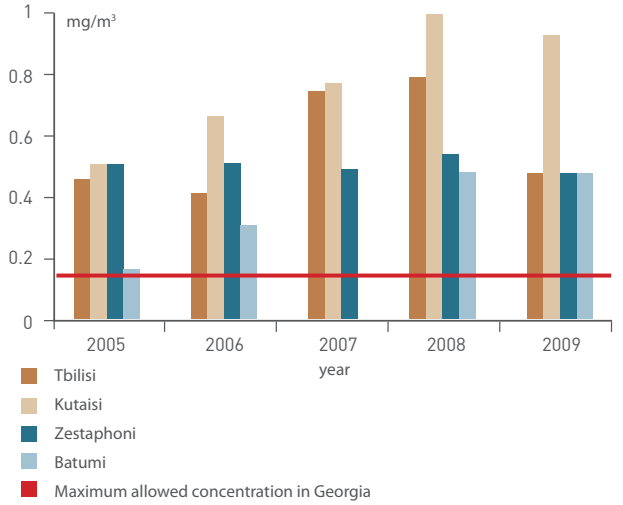


Figure 2.1 annual concentration of dust in cities of Georgia
Note: the EU MAC not indicated as the EU legislation establishes MACs only for specific fractions of dust (see Table 2.1)

Solid particulates, often called dust, gets into the ambient air as a result of various processes, such as fuel combustion (coal and oil) and cement production.

Inhaling some types of solid particulates suspended in the ambient atmosphere may cause irritation of the respiratory tract (bronchial tubes, lungs).

Dust consists of particulates of different size. The finest particulates are PM_{10} – particles of aerodynamic diameter 10 micrometers and less, and $PM_{2.5}$ – particles of aerodynamic diameter 2.5 micrometers and less. The smaller the particles, the deeper they penetrate into the human organs and the more harmful they are.

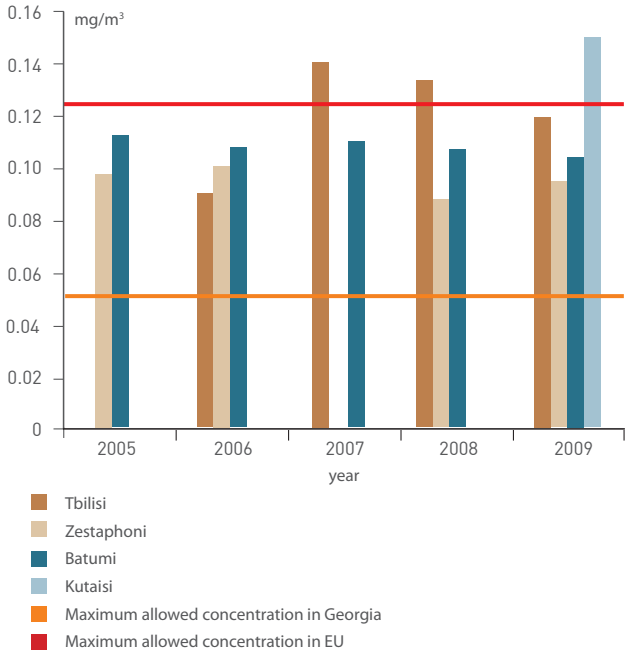


Figure 2.2 Mean annual concentration of sulphur dioxide in cities of Georgia.

Sulphur dioxide gets into ambient air due mainly to the combustion of sulphur containing fuel. The main sources are power stations working on coal, or masut, boiler rooms, metallurgical plants, and diesel motor vehicles . Levels of Sulphur dioxide higher than the permissible levels irritate the upper airways of the respiratory tract. Harmful impact on nasopharynx and mucous membranes can occur.

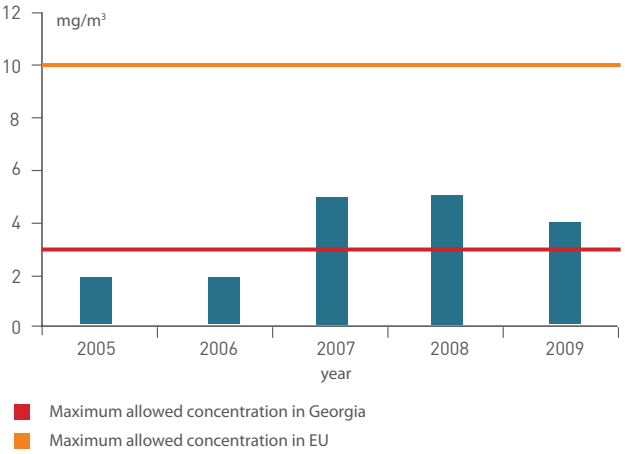


Figure 2.3 Mean annual concentration of carbon monoxide in Tbilisi

Carbon monoxide is a product of incomplete combustion. The main sources are motor vehicle exhausts (generated in the process of incomplete combustion due to insufficient temperature, or due to malfunction of the air supply system of the internal combustion engine). It is also emitted from energy production plants in particular those using, oil and coal combustion, and from the metallurgical industry. It suppresses transportation of oxygen by blood

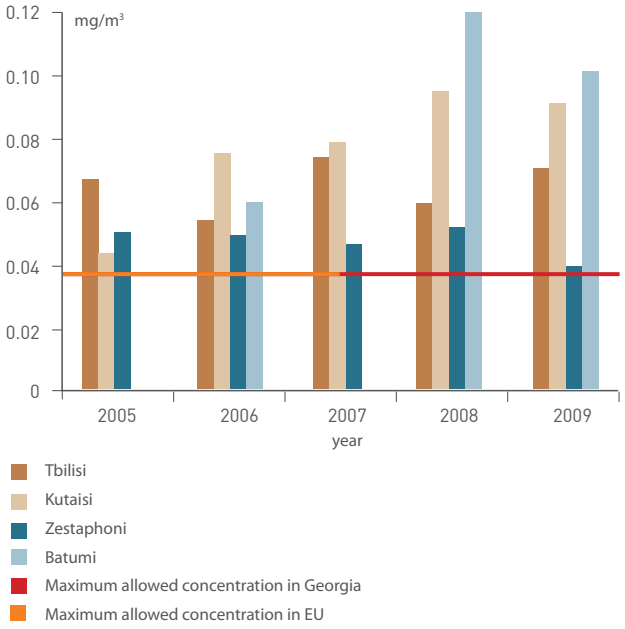


Figure 2.4 Mean annual concentration of nitrogen dioxide in cities of Georgia

Note: the MAC for this polluter is the same in Georgia and the EU.

Nitrogen dioxide and monoxide are the products of fuel combustion at a very high temperature in abundance of oxygen. The main sources are motor vehicle exhausts, emissions from power stations and the burning of solid waste.

At high concentrations in ambient air nitrogen dioxide can irritate the lower airways of the respiratory tract, especially the lung tissue.

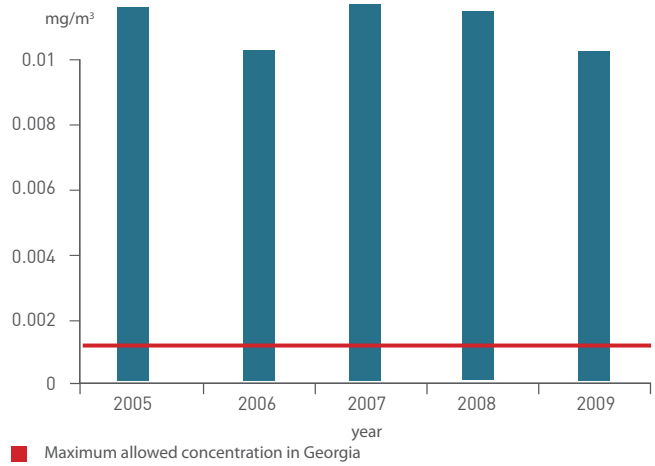


Figure 2.5 Manganese dioxide mean annual concentrations in Zestaphoni

Note: no MAC is established for this substance by EU legislation

Manganese dioxide is a highly toxic substance, the main source of which is metallurgical industry. Manganese dioxide has an impact on the central nervous system.

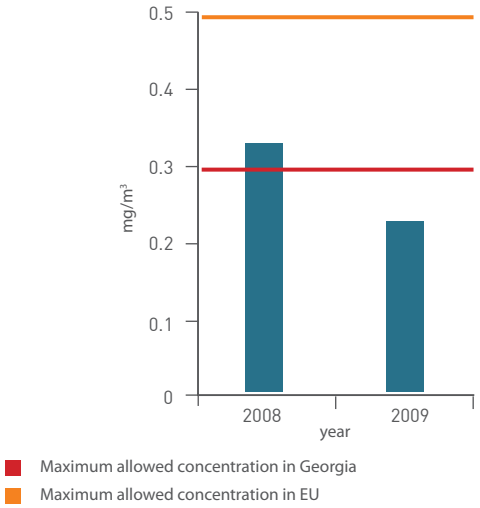


Figure 2.6 Mean annual concentration of lead in air in Tbilisi

The main sources of lead and **lead** containing substances in ambient air are: motor vehicles (burning of leaded petrol) and metallurgical plants.

Poisoning impact of lead is revealed at molecular and cellular levels. It impairs nervous, mental and physical development.

The figures show that during the last 5 years the concentrations of harmful substances in ambient air exceeded the permissible levels, although trends appear to be decreasing over the last 2-3 years.

Dust, nitrogen dioxide and sulphur dioxide concentrations are above the maximum allowed level in Tbilisi and Kutaisi. The main polluting sources in these towns are considered to be motor vehicles and construction works.

The source of the main pollutant in Zestaphoni, manganese dioxide, is considered to be the metal production company "Georgian Manganese Ltd". Regular monitoring of air quality revealed that the manganese dioxide mean annual concentration substantially exceeds the permissible level (Figure 2.5).

II/2. 3. MAIN CAUSES OF AMBIENT AIR POLLUTION

Ambient air pollution is mainly caused by emissions from motor vehicles, the energy and industrial sectors. The main source of pollution in urban areas is undoubtedly motor transport. It should be noted that during recent years, fuel consumption by motor transport has increased, and consequently, emissions of harmful substances into air have also increased.

Industry

The main sources of air pollution within the industry sector of Georgia always were the cement production in Rustavi and Kaspi, Ferro-alloys production in Zestaphoni, and metallurgical plants in Rustavi and Kutaisi.

Recent installation of modern dust abatement systems on the cement plants has reduced emissions to acceptable levels resulting in 75% reduction of dust emissions in the country in 2009 compared to previous years. An emissions reduction programme is also underway for the Zestaphoni Ferro-alloys plant which will involve the installation of a dust abatement system. As a result of those measures from 2013 the air quality in Zestaphoni is expected to meet the existing norms.

Energy Sector

The Energy sector (electricity production) in Georgia comprises three big plants located in Gardabani municipality working mainly on natural gas. These are: JSC "Energy Invest", Ltd, "Mtkvari Energetika" and JSC "Tbilsresi". Since the municipal power companies were dissolved in the 1990's, the heat distribution systems in big cities and other settlements has virtually been eliminated. People now use individual heating systems working mostly on gas and wood.

Volatile organic compounds (VOC's), carbon monoxide (CO) and solid particulates (dust) are the main pollutants from the energy sector. Changes in the emissions from this sector are mainly caused by changes in the fuel consumption patterns (coal, kerosene, mazut, natural and liquid gas etc.), where coal and mazut are considered dirtier fuels and natural and liquid gas considered to be cleaner fuels.

Motor Transport

The transport sector is the main source of air pollution in Georgia. The main emissions from the sector include carbon monoxide (CO), hydrocarbons (volatile organic compounds and methane), nitrogen oxides (NO_x), sulphur dioxide (SO_2), soot, benzapirene and carbon dioxide (CO_2).

The motor transport sector is the main cause of the country's emissions of nitrogen oxides (NOx) and sulphur dioxide (SO_2). Accordingly these pollutants are present in areas with intensive traffic: big cities and transit roads. The most acute situation is observed in Tbilisi, where almost one third of the total transport fleet is based.

The impact of transport is described in more detail in chapter 17. Some of the main issues are detailed bel-

low. Emissions from the transport sector are governed by a number of issues for example:

- the average age of the national fleet and the emission standards set for vehicles;
- how vehicles are maintained and checked to ensure they comply with emission standards,
- fuel quality standards (e.g. sulphur content) and the overall composition of the fleet e.g. petrol versus diesel;
- traffic management, i.e. whether traffic is free flowing or whether there is significant congestion and;
- General use patterns, e.g. how many people use private transport versus public transport, etc.

In Georgia the public transport system is not sufficiently developed and as a consequence a significant proportion of the population uses private vehicles as the preferred mode of transport. As a result, the number of private vehicles has grown rapidly over the past decade and has almost doubled in the last five year period (see Figure 2.8). Most of the cars purchased are second-hand cars imported from aboard and the average age of the fleet in Georgia is 10-15 years. Diesel engine cars are very popular (see the sharp increase in diesel fuel consumption in Figure 2.7). Roadworthiness testing of vehicles is not in operation at the moment in Georgia and as a result many cars on the roads are in bad mechanical condition. Periodic testing of exhaust gases has also been suspended. Some low quality fuels available on the market can cause damage quickly to the catalytic converters of vehicle exhausts. Car owners tend to have the damaged catalytic converters removed and not replaced, resulting in higher emissions from the vehicle. Traffic management is still problematic in the cities of Georgia and traffic jams happen quite often. All of these factors lead to high emissions from motor transport in Georgia.

It should be noted that a number of measures were implemented recently for improvement of public transport in Georgia. For example approximately1000 buses were purchased by the Tbilisi city; The discount system introduced to attract people to the public transport ("Metroman" cards in Tbilisi providing travel price discount for metro and bus users); Alternative roads are being constructed for traffic optimisation in Tbilisi; and a new design of crossroads has been introduced which has significantly reduced traffic congestion in Tbilisi.

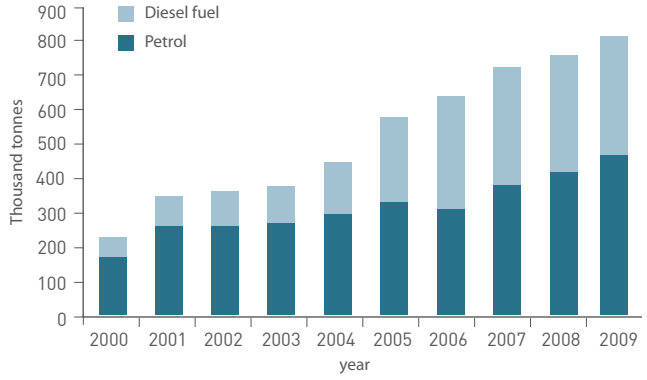


Figure 2.7 Motor fuel consumption in 2000 - 2009

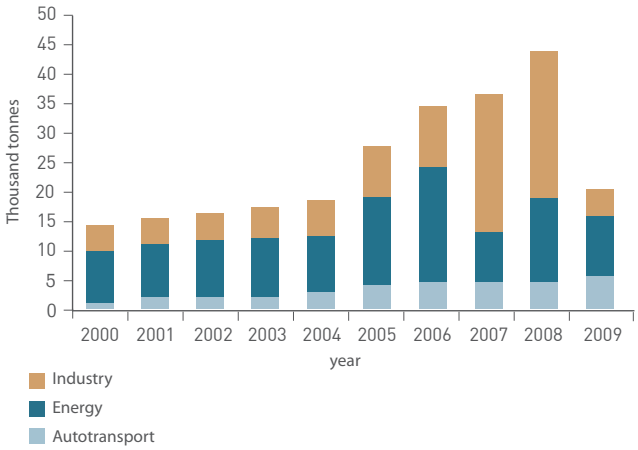


Figure 2.9 Dust emissions from the main sectors of the economy

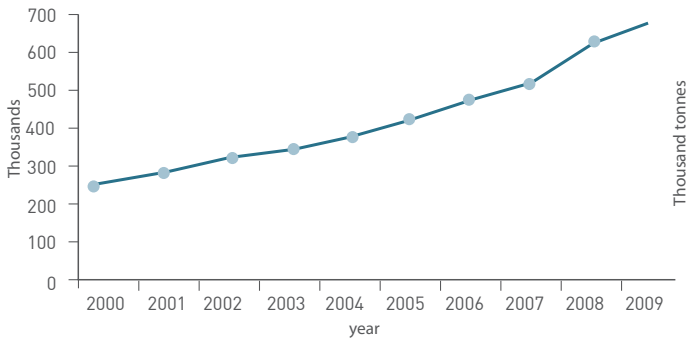


Figure 2.8 Number of cars registered in Georgia (2000 – 2009)

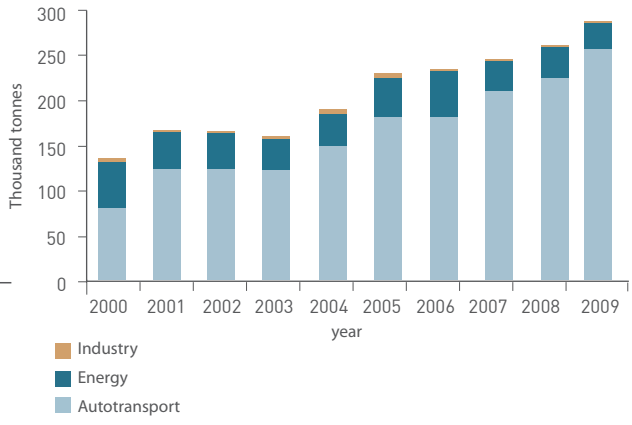


Figure 2.10 Carbon monoxide emissions from the main sectors of the economy

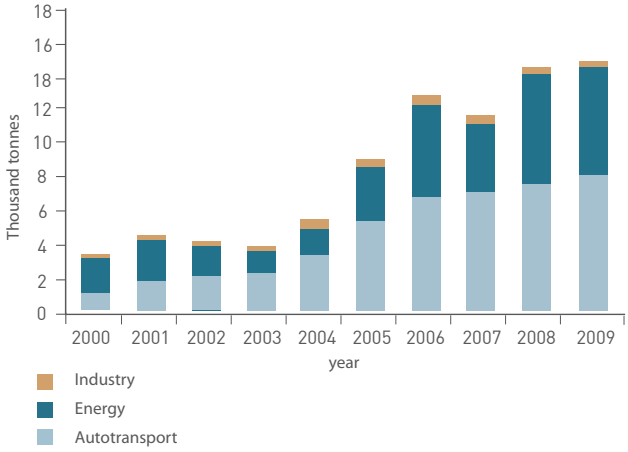


Figure 2.11 Sulphur dioxide emissions from the main sectors of the economy

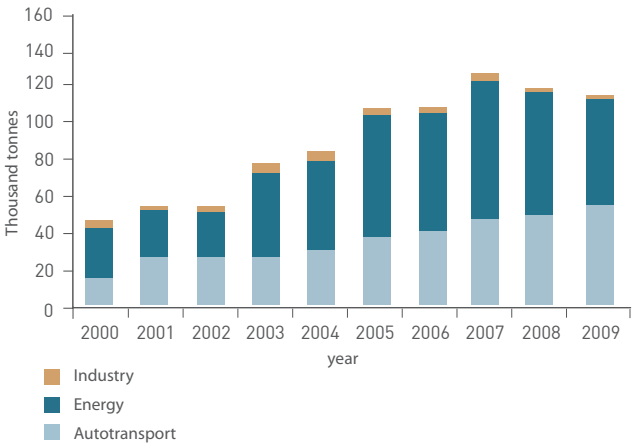


Figure 2.13 Emissions of volatile organic compounds (VOCs) from the main sectors of the economy

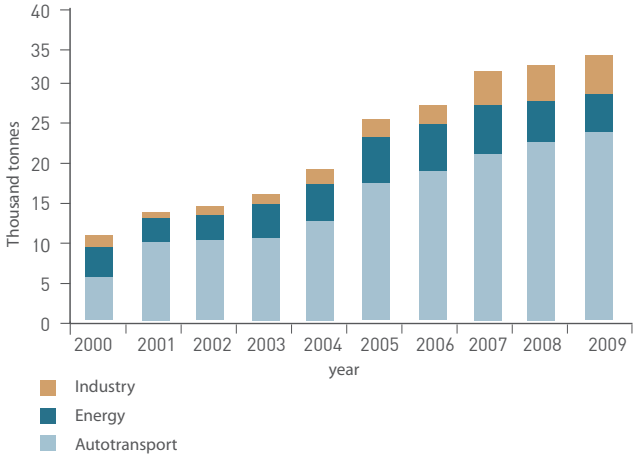


Figure 2.12 Emissions of nitrogen oxides from the main sectors of the economy

Figure 2.9 shows that up to 2008, the main source of dust in air was industry, mainly the cement plants in Rustavi and Kaspi. In 2009, those plants were equipped with modern air filters which significantly decreased their emissions. Hence, from 2009, the picture changed.

Figure 2.13 shows that the main source of VOCs in air is the energy sector, mainly due to methane losses from gas distribution systems. Figures 2.10 -2.12 show that the main source of the carbon monoxide, sulphur dioxide and nitrogen dioxide in air is the transport sector, namely exhaust gases of motor vehicles. With the rising number of vehicles on our roads, these emissions will continue to grow. However, if the quality of fuel is improved and vehicle emissions standards are harmonised with EU requirements and are properly enforced, significant emission reductions may be achieved which may offset the increasing trend in private car ownership.

Interaction of Harmful Substances

As previously described, pollutants emitted into the near-earth layer of the ambient air (troposphere) have direct negative impacts on human health and ecosystems in general. In addition to their effects as single pollutants, some pollutants interact to form more harmful substances for human health and ecosystems. Two of these so called "secondary" pollutants are of particular concern; tropospheric ozone (O_3) and fine particulate matter (PM_{10} - solid particulates less than 10 microns).

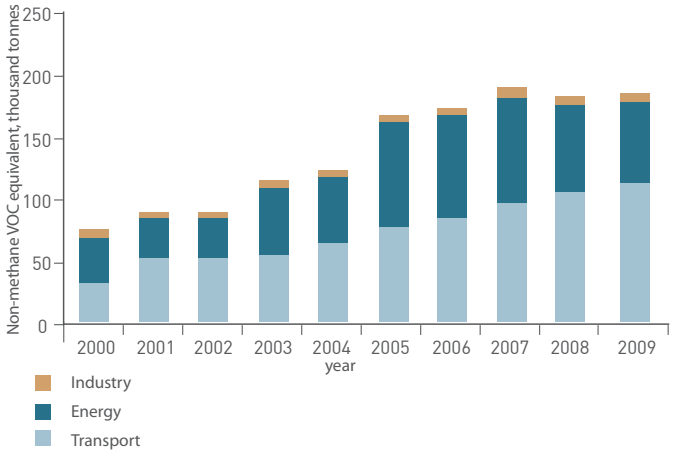


Figure 2.14 Annual emission of gases with ozone generation potential by sector

Ground level ozone is generated as a result of photochemical reaction between hydrocarbons, oxides of nitrogen, and oxygen. It is one of the main components of smog – a big problem in all big cities. Ground level ozone affects human health, crops and vegetation. High levels of ozone can damage the respiratory system.

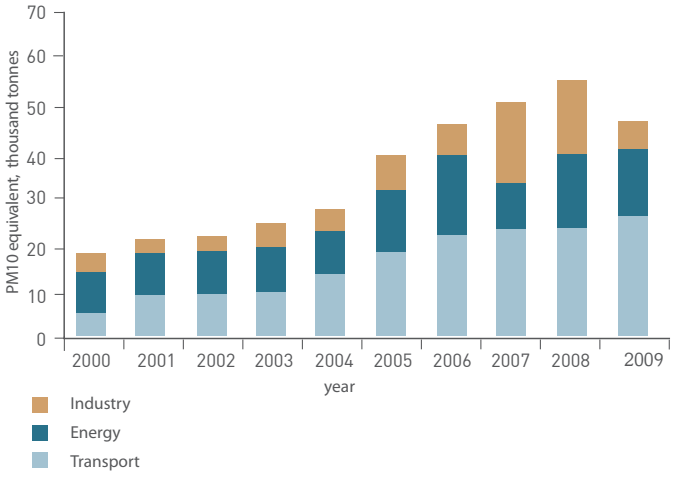


Figure 2.15 Annual emission of gases with potential to generate fine suspended particulates by sector.

Fine dust particulates (PM_{10}) smaller than 10 micrometers represent the mixture of organic and non-organic compounds of different origin. It is one of the most harmful substances which causes respiratory tract diseases. It can penetrate deep into the lungs and remain there.

II/2. 4. MAIN CHALLENGES

Results obtained from the existing air quality monitoring show that concentrations of the main pollutants in all four cities in which monitoring takes place exceed the allowed levels. The small number of monitoring locations in the existing network does not allow a comprehensive assessment of air quality even within the limits of these cities. To have the real picture of air quality in the country the installation of at least one measuring point in urban areas for each 100 thousand citizens is desirable (also taking into account the level of pollution). In addition to the existing set of pollutants monitored, the monitoring programme should be expanded to include parameters such as small particulate matter (PM_{10} and $PM_{2.5}$).

Three new monitoring stations were installed in late 2009, two in Tbilisi and one in Rustavi. However additional coverage is required to provide more comprehensive monitoring in accordance with international requirements and standards. Improvements in the monitoring network will provide more detailed and reliable data which will allow the decision makers to better plan and implement measures for air quality improvement.

Despite the insufficient monitoring data it is clear that the transport sector is the primary source of air pollution in Georgia. Emission of polluting substances from this sector is increasing year to year and this trend is expected to continue. The acting national standards for fuel quality and motor vehicles emissions are lower than for those in EU legislation. Unfortunately the economic situation within Georgia does not allow for the immediate adoption of standards comparable to those within the European Union. Therefore the gradual improvement of these standards is foreseen to, step by step, harmonise them with EU standards.

It is also desirable to facilitate electric transport development. The public transport system should be improved to become more attractive for people and to slow down the increase in the number of private vehicles. Improving public awareness of this would also be of benefit.

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CLIMATE CHANGE

Global climate change is one of the most acute problems in the world today. Due to human activity emissions of so called "greenhouse gases" (GHG) into the atmosphere cause "global warming", resulting in the current process of global climate change, which has been documented all over the world.

The adverse impact of climate change is also being experienced in Georgia. Frequent natural disasters and changed climatic parameters affect the quality of natural resources and consequently the economy.

Georgia, as a party to *United Nations Framework Convention on Climate Change (UNFCCC)* and its *Kyoto Protocol*, is commited to follow the convention principles and, as far as possible, should undertake the relevant measures to reduce GHG emissions and adapt to climate change.

II/3. 1. INTRODUCTION - CAUSES AND EFFECTS OF CLIMATE CHANGE

The present phenomenon of climate change was identified in the 1970's, when a rising trend of the world mean annual temperature, in addition to the growing frequency of climatic catastrophes were noted. It is scientifically proven that climate change takes place worldwide, evidenced by the rising of mean temperature which leads to increased frequency and intensity of rainfall, which in its turn gives rise to an increase frequency of many natural disasters such as flooding and landslides.

The adverse impacts of climate change can be seen in many different ways; melting of glaciers in the mountains; thinning of ice sheets in the oceans, so called "heat waves" and droughts on the one hand, and heavy rainfall on the other; rising sea level, increased frequency of storms, floods, landslides, avalanches, tsunami, and strong hurricanes. Climate change influences the natural ecosystems, some of which may not be able to adapt to the changing conditions and may be degraded; increased risk of human diseases and epidemics are also expected. It is predicted that the negative impacts of the "Greenhouse effect" will become more and more intensive and diverse as the century progresses. This makes immediate action necessary to solve the problem.

It is assumed [2] that in contrast to other climate change periods which have occurred in the past, that this period of climate change is caused by human activities, such as intensive industrial and agricultural activities. In particular, GHGs emitted into the atmosphere as a result of industrial activities cause changes in the composition of the atmosphere which impedes the loss of heat from the earth surface, causing the warming effect. The main greenhouse gasses (GHG) of note are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and others.

The use of fossil fuels (coal, oil, gas) has an especially important role in GHGs emission. In the last decades of twentieth century, fossil fuel consumption significantly increased, and this increasing trend continues.

Until the 1990's, the majority of GHG emissions were emitted by developed countries which have historic responsibility for the current period of climate change and its consequences. But as developing countries such as China, Brazil, India, South Africa and others aim to develop their economies as quickly as possible, often through the ways, which are easier for them, namely almost not taking into account environmental issues and because they do not have modern energy-efficient, renewable and other types of clean, but expensive technologies, in the last decade the ratio of emissions between developed and developing countries has changed, with the contribution by developing countries increasing year to year. At the moment, the contribution of GHG's by developing countries exceeds that of the developed countries.

Georgia is one of 192 countries who are parties to the UNFCCC, which defines the main principles of international activities. The Parties must protect the climate system for the benefit of present and future generations, on the basis of equity and in accordance with their com-

Gas	Life-time (years)	Global warming potential (time interval 100 years)
CO_2	variable (50-200)	1
CH_4	12±3	21
N_2O	120	310
HFCs		
HFC-23	264	11700
HFC-32	5.6	650
HFC-125	32.6	2800
HFC-134	10.6	1300
HFC-143	48.3	3800
HFC-152	1.5	140
HFC-227	36.5	2900
HFC-236	209	6300
HFC-245	6.6	560
PFCs		
CF_4	50000	6500
C_2F_6	10000	9200
C_3F_8	2600	7000
C_4F_{10}	2600	7000
C_6F_{14}	3200	7400

Table 3.1 Classification of gases according to their stability and global warming potential.

There are six greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6).

These gases absorb infrared rays reflected from the earth surface and turn them back to the earth thus causing the so called "greenhouse effect" and rising temperatures.

The contribution of carbon dioxide to the total amount of GHGs is 63%, methane content is 24%, nitrous oxide 10%, and other gases 3%. The relative contribution of these gases to the greenhouse effect depends not only on the amount, but also on their specific heat potential.

Global warming potential (GWP) is a measure of how much a given mass of a greenhouse gas is estimated to contribute to global warming. It is a relative scale which compares the gas in question to that of the same mass of carbon dioxide (whose GWP is by convention equal to 1).

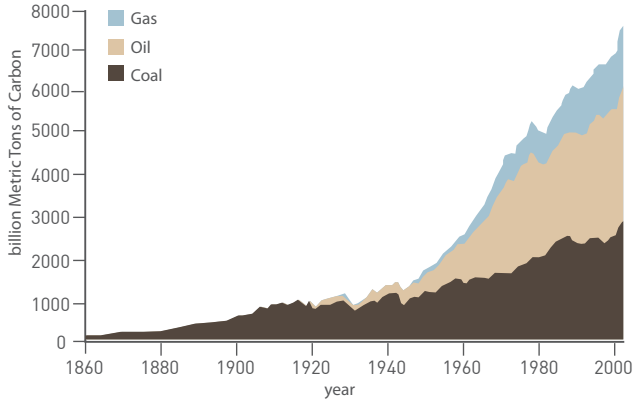


Figure 3.1 Emissions of carbon from fossil fuels. Source: Carbon Dioxide Information Analysis Center (CDIAC) http://cdiac.esd.oml.gov/trends/emis/em_cont.html

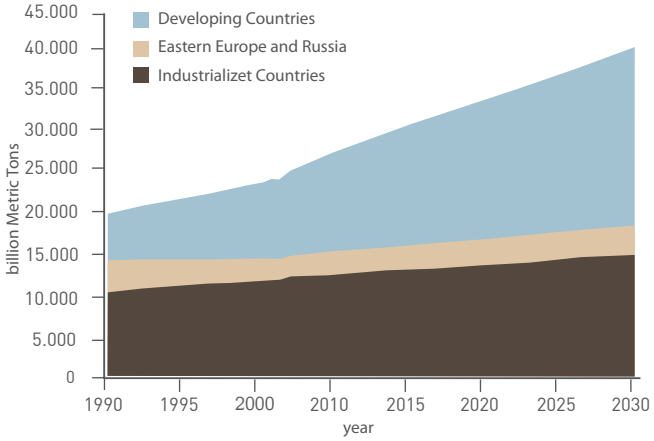


Figure 3.2 The projected share of developed and developing countries in carbon dioxide emissions. Source: Ministry of Energy of USA, 2007

mon but differentiated responsibilities and respective capabilities. The Convention specifies two approaches to dealing with the climate change issue: the reduction of emission of greenhouse gases as a means to abate/mitigate the causes of the climate change; and adaptation to the changed climate and its impacts. The developed country Parties should take the lead in combating climate change and the adverse effects thereof. The Convention defines different obligations to different signatory countries according to the level of their development (Annex 1 countries, which are mainly developed countries and non-Annex 1 countries, mainly developing countries. There are also countries in transition some of which are included in Annex 1, and others who are not. Georgia is non-Annex 1 country). This difference is a reflected in the Kyoto Protocol, which regulates economic issues related to GHG emissions. In particular, the Protocol defines quantitative targets for the reduction of GHG emissions for developed countries and defines the mechanisms (so called Kyoto Flexible Mechanisms: Emission Trading, Joint Implementation and Clean Development Mechanism) to facilitate the implementation of these targets.

Georgia, as a non-annex 1 Party is only eligible to participate in the ***Clean Development Mechanism (CDM),*** one of the *flexible mechanisms of the Kyoto Protocol.* The CDM allows developed countries to meet a part of their commitments by introducing cleaner technologies in developing countries, that will result in less GHG emissions. Georgia is conducting considerable work to determine possible areas where emissions can be reduced, and to develop and implement appropriate projects within the framework of the CDM. Particular focus has been given to energy, transport, industry (Nitrogen production, Cement production, Iron and Steel production etc.), agriculture and waste sectors.

II/3. 2. CLIMATE CHANGE IN GEORGIA

Research [1] has shown changes of the main climatic parameters (mean and extreme air temperatures, average annual precipitation, relative humidity, precipitation patterns, winds) across all of Georgia. In particular, statistical data from meteorological stations show an increase of mean and extreme air temperatures, in addition to changes in rainfall amounts and rainfall patterns in both western and eastern Georgia.

Hydrometheorological observations' network in Georgia

In Georgia, systematic observations of climatic parameters have been carried out since 1844 and hydrologic parameters, since 1905. In 1980's, the observation network covered all areas of the country, including high mountains. The Tbilisi station is part of a global observation network.

Hydrometeorilogical stations equipped with special facilities are used for climatic observations, that collect data on climatic parameters (temperature, precipitations, humidity etc.) at different locations throughout the country. The data collected is analyzed in the hydrometeorological centre. On the basis of data collected over many years it is possible to forecast future trends. Based on this information and other statistical data, studies are conducted to predict future climatic conditions.

In the last 20 years the number of hydrometeorological stations has been significantly decreased in Georgia. Nowadays only 40 stations operate. As a result of less data available the conclusions made might be not as comprehensive. Legal entity of public law of the Ministry of Environment and - the National Environmental Agency is the body responsible for the hydrometeorological network and observations.

According to statistical data, the frequency of natural disasters during two last decades has increased considerably in Georgia, which is indicative of climate change. The frequency of heavy precipitation has increased with dramatic consequences. Natural disasters such as landslides, avalanches, river floods, and tornados, all associated with climate change, have also increased. Seasonal changes are also evident, as is the process of desertification evident in some areas. The specific reasons for these phenomena have not yet been studied. The most likely explanation for the dramatic climate changes which have been observed are a probably due to a large variety of ecosystems, and the landscape of the country, high mountains, the abundance of water resources, proximity to the sea etc.

Investigations to date have revealed a number of regions especially sensitive to climate change.

The Black Sea Coastal Zone

Coastal zones worldwide are particularly sensitive to the impacts of climate change, and the Georgian coast is no exception. Rising sea levels along the coastal line, frequent heavy storms, increased amount of sediments brought by rivers to the sea, and changes of the surface water temperature are already evident. The estuary of the river Rioni near Poti city is being particularly impacted, by both flooding as a result of sea level rise and sedimentation of the estuary delta. According to the latest investigations [1], the Black Sea Coastal zone is the most vulnerable system in Georgia.

Lower Svaneti (Lentekhi Municipality)

Precipitation has increased during the last decades and precipitation patterns have changed becoming more frequent and heavy for shorter periods. As a result more frequent and heavy flooding, landslides, mudslides, and

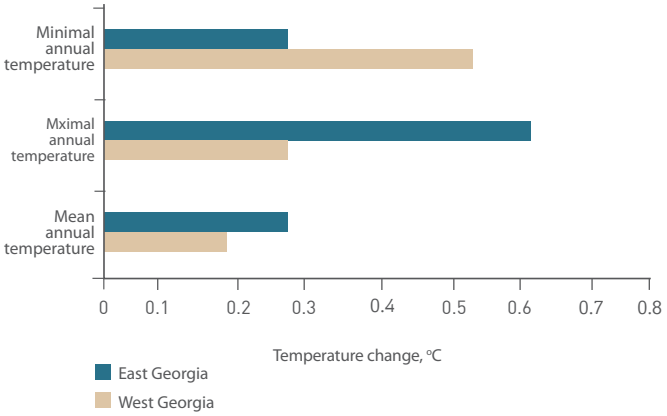


Figure 3.3 Change of air temperature in Georgia (comparison of average figures for periods 1900 to 1960 and 1957 to 2006)

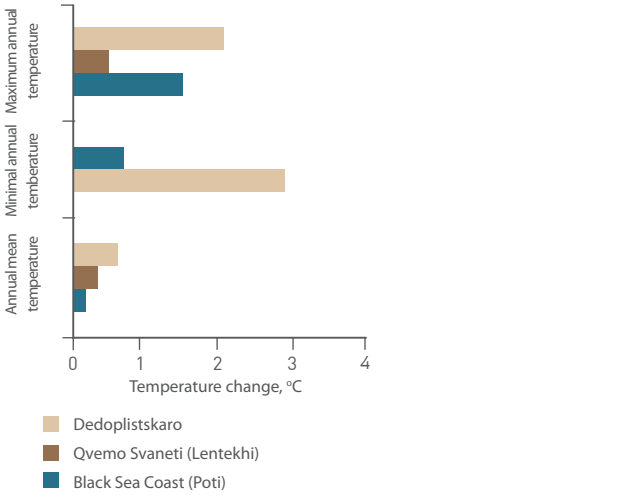


Figure 3.5 Changes in average temperature in priority regions from 1955 to 2005
(Comparison between mean parameters for 15 year periods of 1955-1970 and 1990-2005).

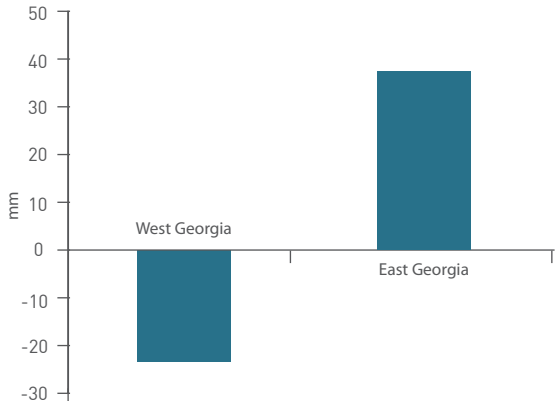


Figure 3.4 Change of annual precipitation (comparison of average figures for the periods 1900 to 1960 and 1957 to 2006).

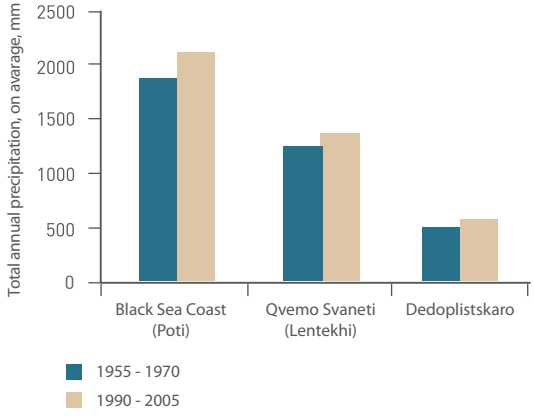


Figure 3.6 Changes in annual total precipitation in priority regions from 1955 -2005
(Comparison of mean parameters of 15 year periods of 1955 to1970 and 1990 to 2005).

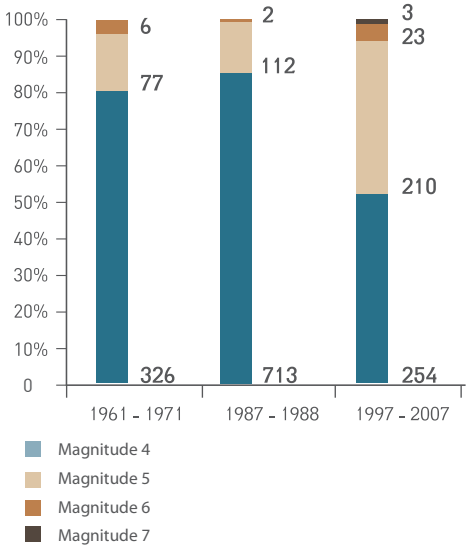


Figure 3.7 The number and type of storms in the Georgia Black Sea Coastal Zone

avalanches are observed. Increased levels of soil erosion, have impacted significantly on agricultural production in the district.

Dedoplistskaro Municipality

Here, the negative impact of climate change is evident in the growing frequency of droughts, decrease in water resources, and soil degradation. The felling of the wind break belts and the failure of a significant proportion if the irrigation system which was not maintained, due to the economic crisis at the end of the twentieth century, resulted in additional problems for the agricultural sector and economics of this very important region.

In addition to the problems described in the Black Sea coastal zone, Lower Svaneti region and Dedoplistskaro district, there may be other regions of Georgia where the impacts of climate change are not sufficiently understood. Indeed, frequent floods caused by increasing water levels in rivers take place in almost all regions. The melting of glaciers and associated issues is also a key area where urgent investigation is required.

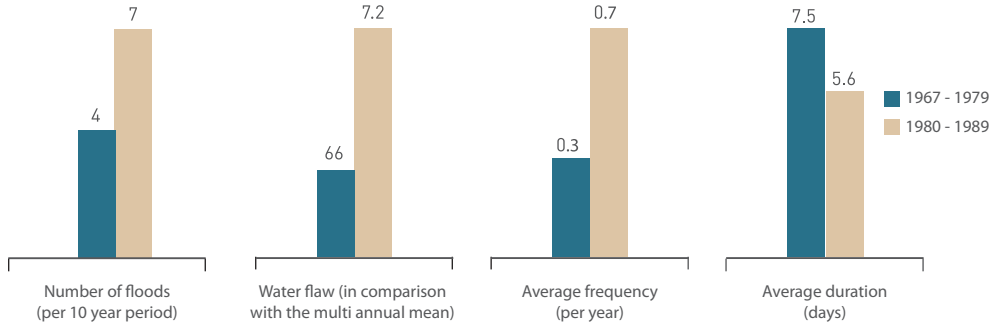


Figure 3.8 Flood parameters in the riv. Tskhenistskali basin

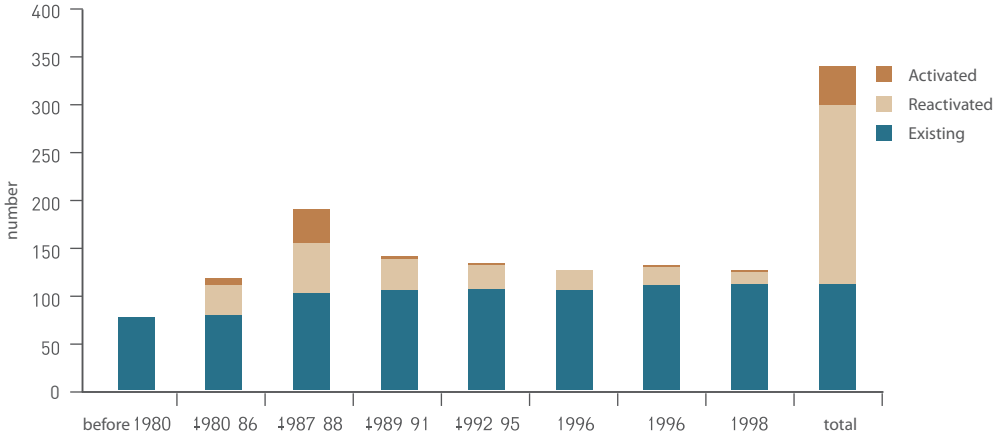


Figure 3.9 Landslide statistics for sensitive lands of the Lentekhi district, 1980 – 1998

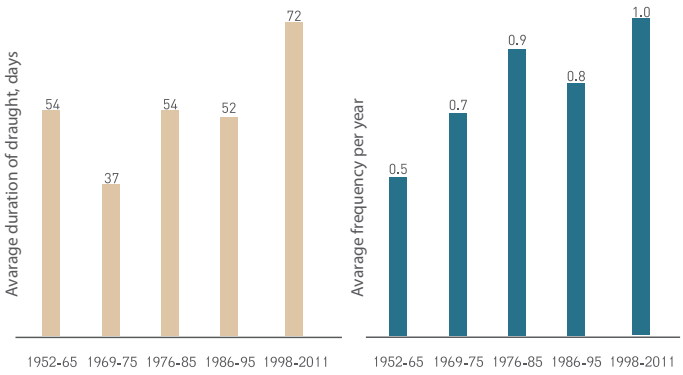


Figure 3.10 Drought statistics for the Dedoplistskaro district

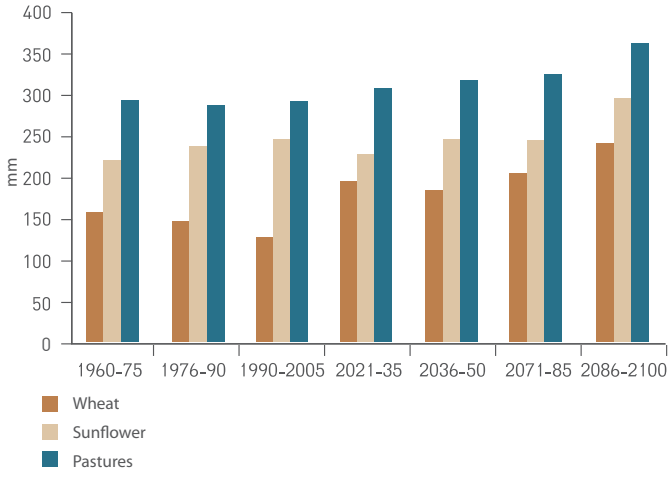


Figure 3.11 Water shortages in agriculture
Note: Water shortage assessed using the water resource management model (WEAP).

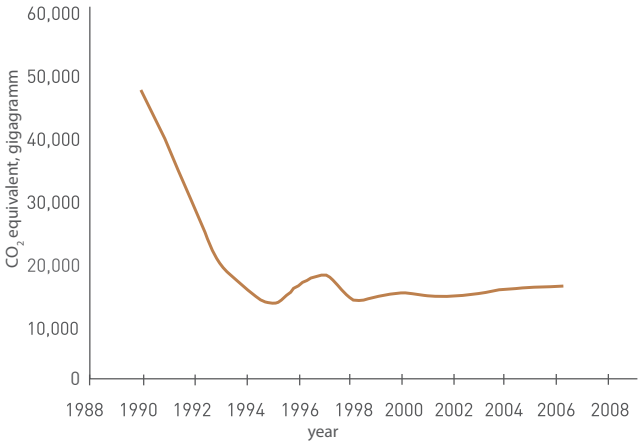


Figure 3.12 Trend of greenhouse gases emissions in Georgia, 1990 – 2006.

The role of forests in GHG emissions is specific: Depending on the age and prevalent species, forests can either absorb, or emit the GHGs. As GHG sinks, the forests play a special role in combating climate change. It is calculated that the global climate change problem could be solved by the forests alone.

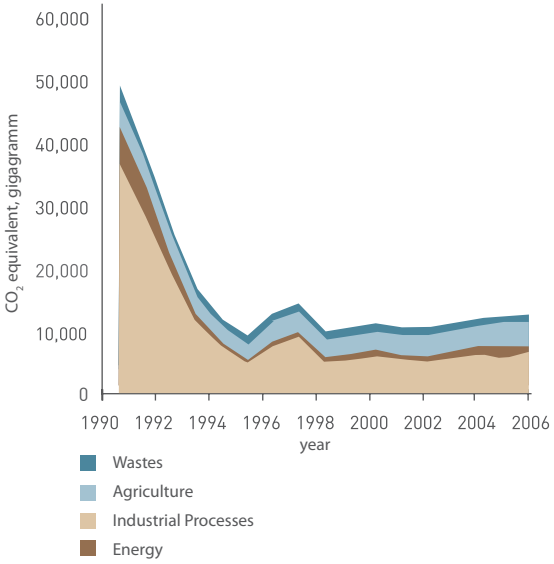


Figure 3.13 Greenhouse gases emissions by sectors, 1990 – 2006.

Note: Classification of sectors given in this and the next diagrams follows the IPCC Classification for inventory of GHG emissions, according to which the energy sector covers the whole field of fossil fuel consumption including transport, while the waste sector – covers landfills and discharged waters, which generate greenhouse gases.

II/3. 3. GEORGIA'S CONTRIBUTION TO THE WORLD GREENHOUSE GASES EMISSIONS

In the second part of the 1990's, GHG emissions in Georgia decreased on average by factor 4 due to the political changes and collapse of the country's economy. The energy crisis was of particular importance in this respect, as the use of fossil fuel was significantly decreased. In addition many heavy industries also became unsustainable in the new economic climate.

Despite a GDP growth of 9-11% during 2003-2007 the GHG emissions from Georgia in 2006 still remained at one quarter of that during the 1990's.

The energy crises and political cataclysms of the last decade of the twentieth century in Georgia caused the uncontrolled felling and use of trees, resulting in a significant level of deforestation. Despite that, the GHG inventory of 2000-2006 showed that forests in Georgia still remain significant "sinks" of greenhouse gases. The results of the GHG inventory of 2000-2006, taking into account the forests, are presented in Figure 3.14.

The figures show that the energy sector in Georgia, like in other countries, is the primary source of GHG emissions. During the 1990's, emissions from the energy sector were significantly reduced compared to the beginning of the decade. The current trend of GHG emissions from the energy sector is growing.

At present the share of Georgia's contribution to the world's GHG emission is very small, less then 0,01%. Studies carried out in preparation for the Second National Communication, showed that by 2025 emissions from the energy sector will increase by factor 3 as compared to 2006 levels (though it will still be half that of 1990 emissions). The studies also explored two different scenarios for GHG emissions reduction: the first scenario assumes the existence of only uncoordinated private projects in the energy sector resulting in a 12% reduction by 2025 (compared with "business as usual" level); the second scenario implies the existence of a government policy and implementation of governmental programs for GHG emission reduction which will result in a 24% reduction by 2025.

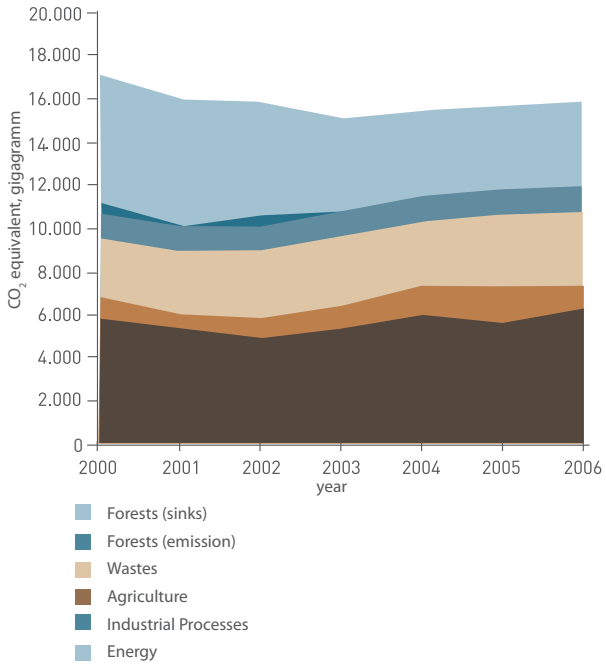


Figure 3.14 Greenhouse gases emissions by sectors (including forests) 2000 – 2006

The most appropriate ways to reduce GHG emissions in Georgia are:

- Replacing fossil fuel with renewable energy sources for electricity and heat generation and heat consumption, as well as raising energy efficiency in the energy sector as a whole (from abstraction to the final use);
- In the transport sector, replacement of gasoline and diesel fuel with liquid gas (having less global warming potential) and the optimization of traffic schemes;
- The introduction of new technologies in the industry sector as well as energy saving materials in construction works;
- The use of waste heat from various industries.

One of the Kyoto Protocol mechanisms, the CDM provides significant possibilities for reduction of the emissions in Georgia.

Adaptation to Climate Change

In addition to the reduction of greenhouse gases emissions, the UNFCCC foresees the necessity to undertake special measures to ensure adaptation to the consequences of climate change. It is necessary to conduct rapid rehabilitation measures to deal with the impacts of the climate change process and to increase resilience to it in Georgia. As a rule, such measures incur considerable expenditure. One of the most important tasks in the field of climate change is the timely identification of especially vulnerable regions, sectors, and ecosystems, determining appropriate adaptive measures and programmes for these areas, and securing adequate funding for their implementation. The vulnerable regions identified in Georgia's Second National Communication to the UNFCCC (2009) are the Black Sea coastal zone, Dedoplistskaro and Lower Svaneti municipalities, as outlined above. For each of those regions, adaptation strategies have been developed listing urgent measures to reduce the climate change induced risks in these regions.

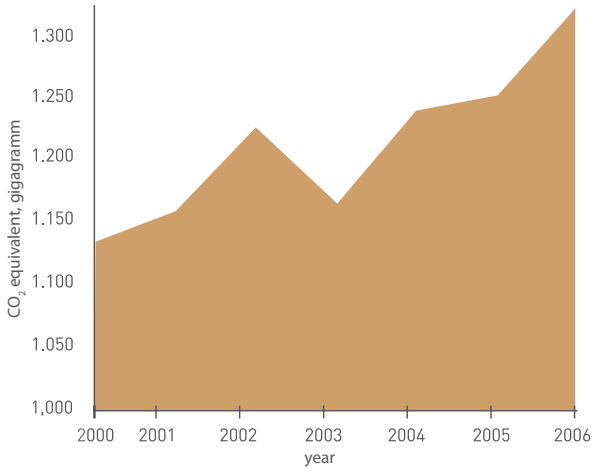


Figure 3.15 Greenhouse gases emission from the transport sector

In 2008, the German organization for technical assistance GTZ financed a project for the rehabilitation of lands affected by climate change in Dedoplistskaro municipality. It is necessary in the future that the National Adaptation Programmes of Action is developed as part of the National Development Programmes of Action based on an assessment of the existing circumstances and resources required. The National Adaptation Plan will outline a timeline of specific measures for selected priorities taking into account the availability of financial and technical resources.

The Clean Development Mechanism (CDM) gives Georgia the possibility to implement GHG reduction projects to support the sustainable development of the country. It is potentially a key source of funding for such projects. The income from selling the "reduced emissions" , or so called "Carbon Credits" represents a new type of environmental investment. The "Reduced Emissions" are transferred to the developed country which finances the project and which can present them as part of its emission reduction obligations within the Kyoto Protocol.

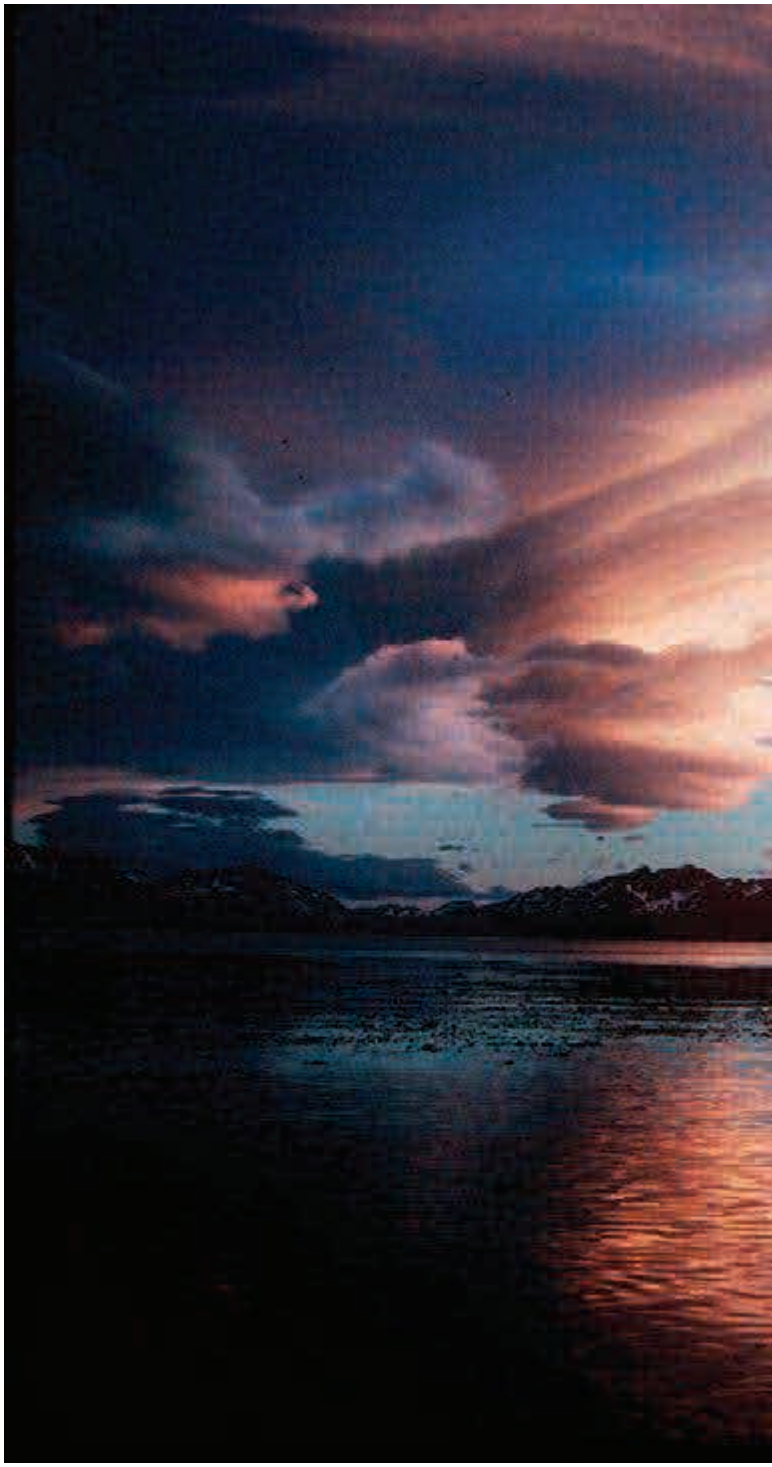
II/3. 4. MAIN CHALLENGES

Investigations have shown considerable alterations of climatic parameters in Georgia since the beginning of the twentieth century. These changes are impacting ecosystems, resulting in degradation of their quality and decreasing their economic value. In Georgia, like elsewhere in the world, extreme weather related events such as storms, hurricanes, floods, avalanches, landslides, heat waves, have become more frequent, and are associated with the processes of climate change.

Investigation revealed that the areas most sensitive to climate change in Georgia are the Black Sea coastal zone, the Dedoplistskaro municipality and Lower Svaneti Region (Lentekhi municipality). It is necessary to take immediate adaptation measures in these regions.

Given the acute nature of the consequences of climate change, and the country's official position submitted to the UNFCCC secretariat, Georgia has identified adaptation to climate change and its adverse impacts as a national priority in the field of it's Climate Change Policy. The National Adaptation Programmes of Action (NAPA), which is under development will assist the country in undertaking the necessary measures and in finding the necessary funds. The development of NAPA is a significant task and demands the engagement of the scientific, economic, financial, and technical sectors.

With regard to climate change mitigation measures, Georgia, as a party to the UNFCCC and its Kyoto Protocol, is ready to undertake appropriate measures to reduce GHG emissions albeit that its share of overall global emissions is low. This decision was justified by the official declaration to join the so called "Copenhagen Accord" adopted in Copenhagen in December 2009. The more intensive use of the Clean Development Mechanism over the next three years period is considered a priority for the purpose of reducing the GHG emissions.



References:

1. Georgia's Second National Communication to the UNFCCC, Tbilisi, 2009;
2. IPCC 4th Assessment Report, 2007;
3. Nakicenovic, N.et. al. Special Report on Emissions Scenarios. IPCC, Cambridge, 2000
4. Position of Georgia before the United Nations Climate Change Conference (COP 15);
5. Association of Georgia with the Copenhagen Accord (official letter with the attachment II).

WATER PROTECTION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III/4

FRESH SURFACE WATERS

Georgia has an abundance of fresh water resources. However, due to discharges of untreated municipal wastewater, large amounts of nutrients enter the water bodies causing intensive growth of microorganisms and algae (a process called eutrophication) which might result in a decrease of dissolved oxygen levels and seriously impacts the water ecosystems. As of yet, the process of eutrophication has not been noticed in Georgian rivers, possibly due to the high flow rates and low water temperatures.

Water quality in Georgian lakes is not monitored on a regular basis. Monitoring conducted in 2009 at three Tbilisi recreational lakes has shown levels of the microbiological contamination which exceed allowable limits in some instances. This underlines the need to establish a regular system of lake water quality monitoring and establishing an information system to keep bathers aware of water quality in recreational lakes. The sources of recreational lakes contamination should also be identified and researched.

The rehabilitation of the sewage network, including the construction of new wastewater treatment plants, and the construction of new modern landfills are underway throughout the country to reduce the impact of pollution from these sources on water bodies.

III/4. 1. INTRODUCTION

Georgia has an abundance of fresh water resources. This is due to the mountainous territory of the country and abundant levels of precipitation. The mean annual precipitation value within Georgia is 1,338 mm, and the mean annual precipitation volume is 93.3 cubic km. This places Georgia first among the Soviet Republics in terms of abundance of water resources, while on a European basis is exceeded only by Norway, Switzerland and Austria. The annual amount of renewable fresh water resource per capita in Georgia is 14,000 cubic meters. Figure 4.1 shows Georgia's ranking compared to other countries in this regard.

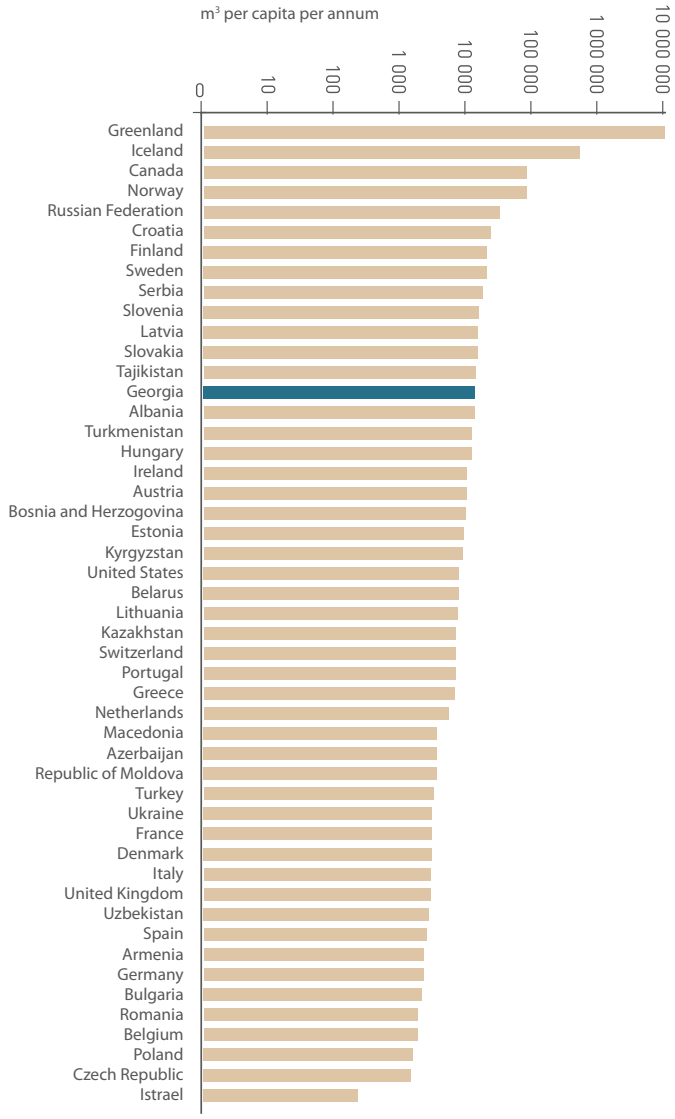


Figure 4.1 Fresh water annual renewable resources per capita in European and some other countries

Source (for data of the countries other than Georgia): http://unstats.un.org/unsd/environment/waterresources.htm

There are over 26 thousands of rivers with total channel length of some 60,000 km. 99,5% of the total number of the rivers are short rivers with a length less than 25 km. The majority of which are short mountain shallow rivers with an average length of 2.3 km. Due to the Georgia's mountainous nature, there are very few rivers with a long channel length or large basin size. Only 273 rivers are more than 25 km long.

The annual mean total flow of the river network is approximately 61.5 billion cubic meters, 52.7 billion of which arise within the territory of Georgia.

The Likhi mountain range effectively divides the Georgian territory into two large river basins, the Black Sea and the Caspian Sea basins. These river basins have unequal volumes of water resources. The annual mean total flow of rivers in the Black Sea Basin is approximately three times that of the rivers in the Caspian Sea basin.

The main rivers of the Black Sea basin are the Rioni, Chorokhi and Enguri. The main rivers of the Caspian basin are Mtkvari and Alazani.

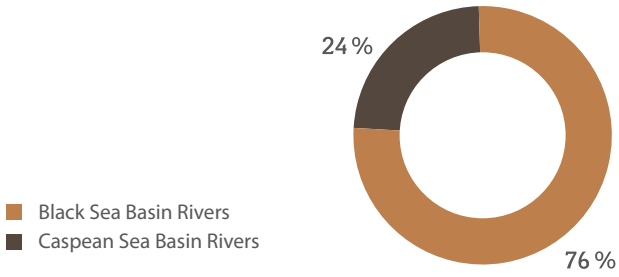


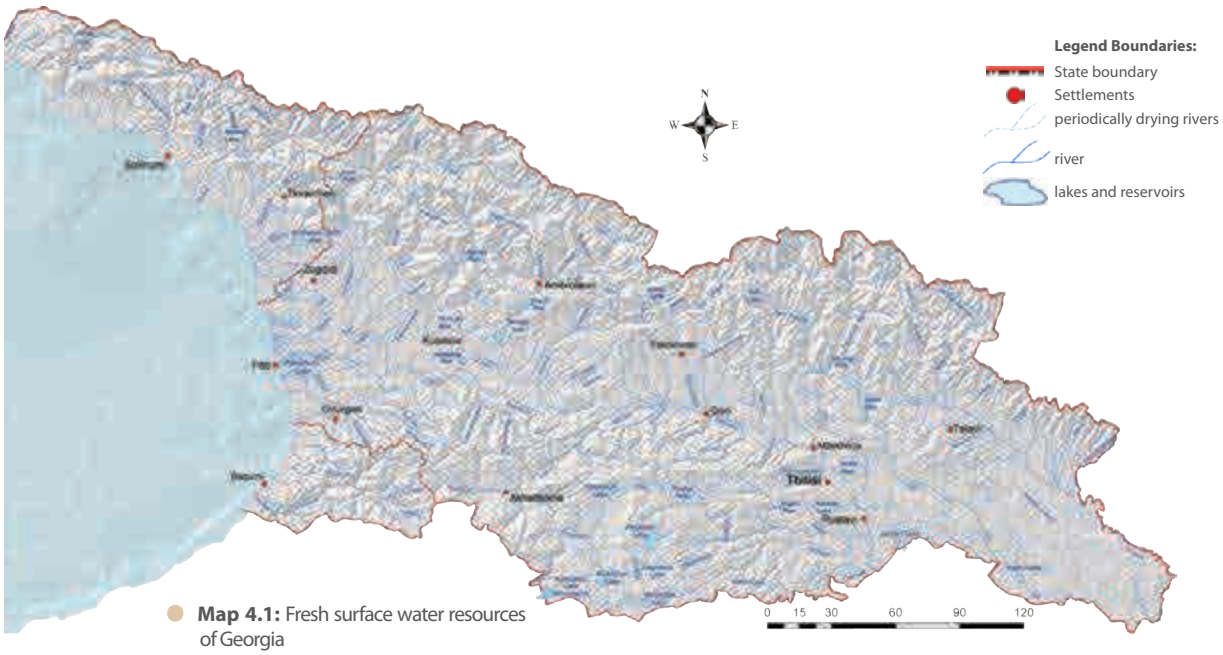
Figure 4.2 Distribution of annual total flow between the rivers of the Black Sea and the Caspian Sea basins.

There are 860 lakes in Georgia with a total surface area of 175 km^2 and a total volume of 400 million cubic meters. Most of the lakes are small in size, with an area less than 1 km^2. Lake Paravani has the biggest surface area, 234 km^2, while lake Tabatskuri contains the largest volume of water 221 cubic meters.

There are 43 artificial water reservoirs created for hydro energy, irrigation and drinking purposes. Thirty five reservoirs are located in the Caspian Sea basin, with total volume of 1,700 cubic m, while only eight reservoirs are located in the Black sea basin, with a total volume of 1,470 cubic m.

There are 734 glaciers with the total area of 511 km^2, which accumulate 30 billion cubic meters of ice. On average 5% of this supply participates in annual water circulation (1,5 billion cubic meters). The rest of it has accumulated over centuries, although it has been subject to change. During the twelfth to nineteenth century, the size of these glaciers increased due to increasing humidity. The peak was reached around the 1850's, when the total area of the glaciers was 850 km2 with a volume of 39 billion cubic meters. Since then the glaciers have been decreasing, but at varying rates. The most significant receding of the glaciers was observed between 1940 to 1955, when the Gergeti glacier receded at a rate of 50 m/year.

In recent past, Georgia had 2,560 km^2 of wetlands, today it has been reduced to 627 km^2.



Map 4.1: Fresh surface water resources of Georgia

Legal Base for the Protection of Fresh Surface Water Resources

Fresh surface waters are a natural source of drinking and irrigation waters. At the same time, they represent an integrated part of our ecosystem and are natural habitats for many species of flora and fauna.

We use water from rivers and lakes for many reasons, primarily irrigation and municipal purposes, and thereby decrease the amount of this resource in ecosystems. In addition, we discharge wastewaters into the water bodies from many different types of activities. The water ecosystem is capable of neutralizing a certain amounts of polluting substances, though over-pollution or over-consumption of water resources can seriously damage, or even destroy the ecosystem. To prevent such situations it is necessary to undertake appropriate measures for the protection of surface waters.

The State provides for the protection of water resources through the regulation of discharges from activities that can have impact on the receiving waters. These regulations are based on setting standards for various parameters in the receiving water environment which are appropriate for the protection of the natural ecosystem, and potential use of the water resource, for example as a drinking water supply.

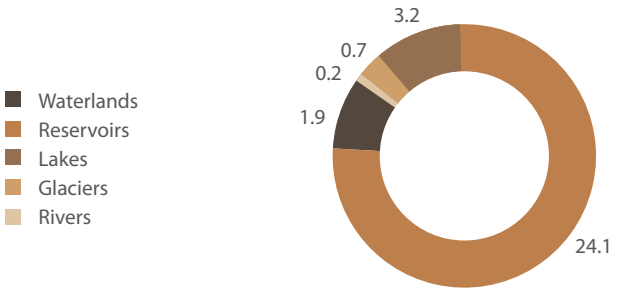


Figure 4.3 Water reserves in different fresh surface water bodies in Georgia (cubic kilometres)
Note: for rivers the annual average water content in river channel is indicated

In Georgia water quality standards are defined according to the different categories of water use:

- "Drinking-economic water use": these are the water bodies which are used for drinking, or food production purposes;
- "Economic-household water use": these are the water bodies used for recreational, or irrigational purposes, or the water bodies, located within the limits of settlements;
- "Fish farming water use". This category comprises the water bodies, or their parts, which are significant for rehabilitation of fish stocks, fishery, and fish migration. This category is in turn divided into three categories: 1. Highest, 2.First, 3. Second categories, according to fish species inhabited the water body and its special characteristics (how rare they are, how sensitive they are to environmental conditions, how valuable they are from economic point of view etc.).

For the drinking-economic and economic-recreational water bodies categories, the water quality standards are defined as maximum concentrations of polluting substances permissible for human health in the river waters. They are defined in "Sanitary Rules and Standards for the Protection of Surface Waters from Pollution"[1]. The ecologic norms for pollutants in surface waters are established by "the Rules of Protection of Surface Waters of Georgia from the Pollution"[2]. This regulation defines maximum permissible concentrations of polluting substances in water bodies significant for human heath, as well as for fish farming purposes. The standards imposed by these regulations

[1]approved by the Order #297/m (August 16, 2001) of the Minister of Labour, Health and Social Protection of Georgia
[2]approved by the Order #130 (September 17, 1996) of the Minister of Environment Protection and Natural Resources of Georgia

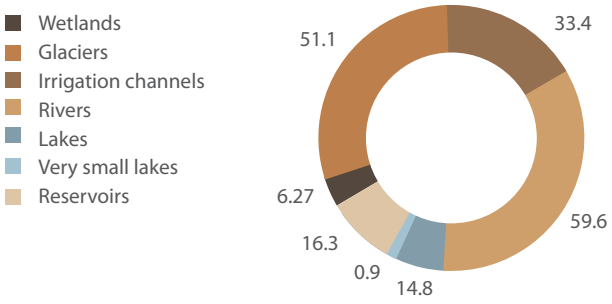


Figure 4.4 Area of fresh surface water bodies in Georgia (square kilometres)

broadly comply with EU standards, defined by the Directives 2006/7/EC (concerning the management of bathing water quality), 2006/44/EC (on the quality of fresh waters needing protection or improvement in order to support fish life), and 98/83/EC (on the quality of water intended for human consumption).

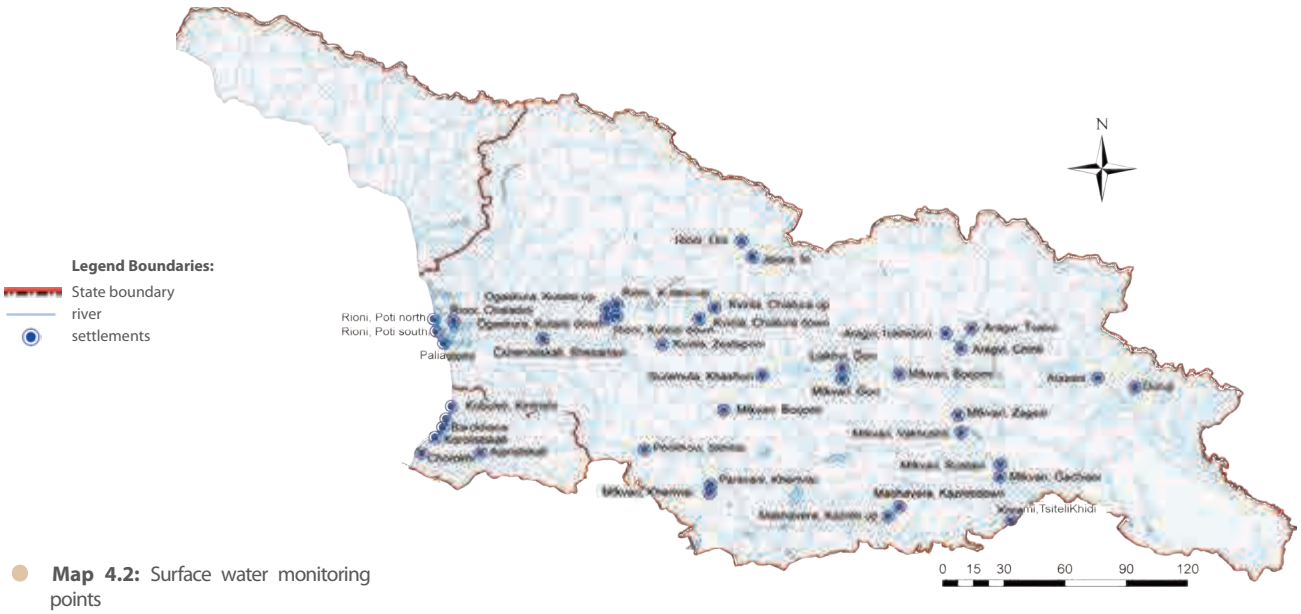
Water bodies are not as yet formally divided into the listed categories. In practice, the maximum permissible concentrations that are most commonly applied are those used for human health protection purposes. These standards are much less stringent as compared with the standards set for the protection of fish species and ecosystems. This is natural, as fish species, and especially fries, are much more sensitive to water purity that human beings. However, the active legislative norms related to the protection of fish and ecosystems are those remaining from the Soviet era and often are unreasonable and inadequate. Therefore, the relevant EU norms, which are more realistic, are used in Georgia for the protection of fish and ecosystems (moreover, Georgia envisages full harmonization of active norms with the EU standards).

Accordingly, two standards are included in the figures provided in this chapter on water quality, the standard set for health protection and the EC standard set for the protection of water ecosystems (fish).

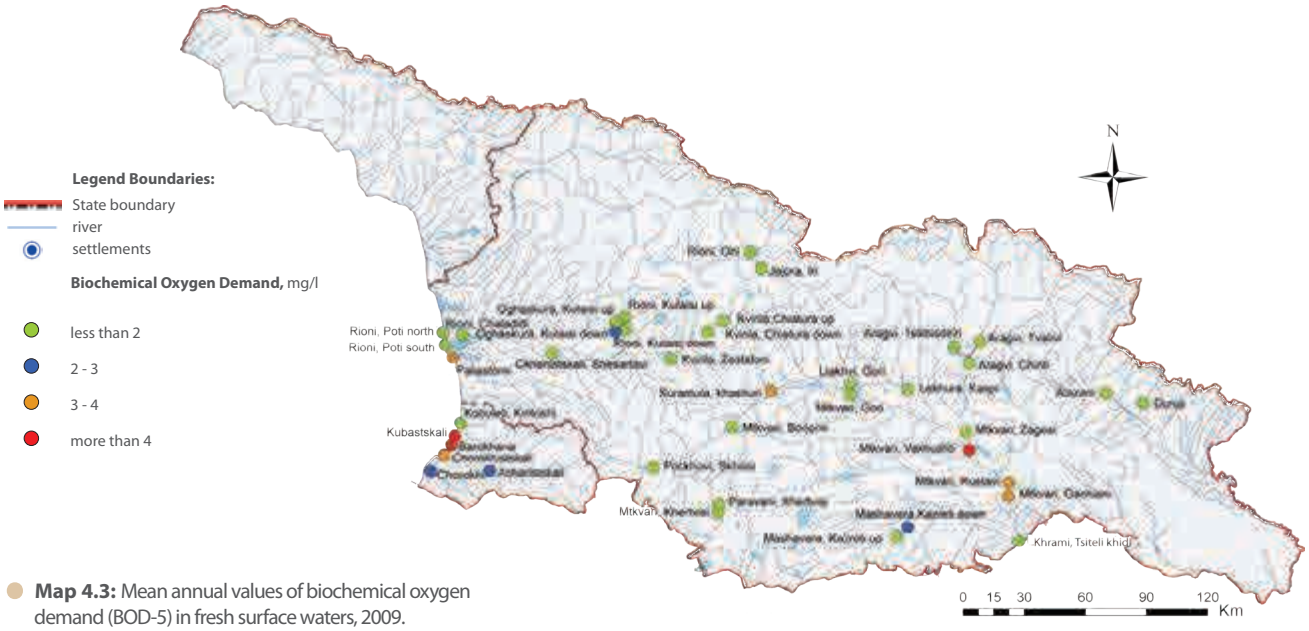
The State regulates the activities of water users in order to maintain water quality standards. The level of regulation depends on the risk of pollution to the water environment posed by certain activity. In order to carry on an activity, which has the potential to cause a significant impact on the environment it is necessary to obtain an Environmental Impact Permit. The applicant must prepare an Environmental Impact Assessment (EIA) that examines all of the potential risks to, and impacts on the environment, and show that all appropriate measures are undertaken to minimize the identified risks and impact on the environment (including water ecosystems). Low risk activities are subject to technical regulations on water abstraction and discharge. The State conducts a national water quality monitoring to determine if water bodies within the state are complying with the relevant standards.

III/4. 2. QUALITY OF FRESH SURFACE WATER

The National Environmental Agency undertakes monitoring of fresh surface water quality within Georgia. Monitoring is conducted at 39 locations of 22 rivers and at one location in Paliastomi Lake. The sampling frequency is once per month. Samples are analysed for 33 different parameters. The monitoring of bathing areas, Lake Ku, Lake Lisi, and Tbilisi Sea, commenced in May 2009. This monitoring includes microbial in additional to physical-chemical parameters. This monitoring takes place during the bathing season and data is made available to the public through the internet.



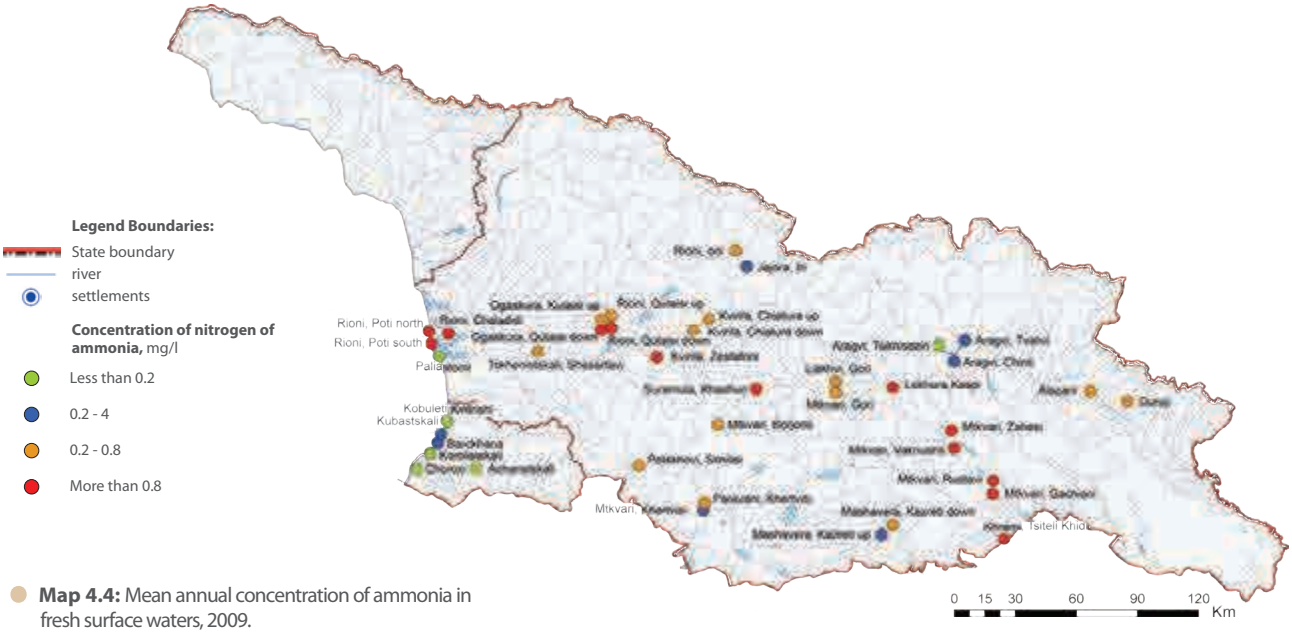
Map 4.2: Surface water monitoring points



Map 4.3: Mean annual values of biochemical oxygen demand (BOD-5) in fresh surface waters, 2009.

Biochemical Oxygen Demand is an acknowledged indicator of water pollution by organic substances. It represents the amount of oxygen consumed by aerobic microorganisms in water over a specified time while degrading organic substances dissolved in these waters. The higher the BOD value, the higher the water pollution with organic substances.

Measurements of BOD are usually conducted over 5, 7 or 10 days. Accordingly the parameter is called BOD-5, BOD-7 or BOD-10.



Map 4.4: Mean annual concentration of ammonia in fresh surface waters, 2009.

Nitrogen containing ions (ammonia, nitrite, and nitrate ions) get into water bodies in different ways, though the main source is untreated or partially treated municipal wastewaters. Another significant source of nitrogen containing ions is waters which run-off from agricultural lands that have been enriched with nitrogen fertilizers.

Ammonia and nitrite ions are extremely toxic for fish, while nitrate ions are less toxic. When ammonium ions enter water (especially in the highly oxygenated rivers), they are transformed to nitrite, and later into the nitrate ions.

Nitrogen containing ions promote active growth of water microorganisms and algae. This process is known as eutrophication of water bodies, and results in an imbalance of the ecosystems and a decrease of oxygen content in the water (especially in lakes) that can cause the fish kills.

Main parameters of water quality in water bodies of the Black Sea basin

Monitoring points:

- Rioni - Kutaisi up
- Rioni - Kutaisi down
- Rioni - Tchaladidi
- Rioni - Poti - North
- Rioni - Poti - South
- Rioni - Oni
- Kintrishi
- Korolistskali
- Kubastskali
- Bartskhana
- Tchorokhi
- Adjaristskali
- Djodjora - Iri
- Kvirila - Chiatura up
- Kvirila - Chiatura down
- Kvirila - Zestaphoni
- Ogaskura - Kutaisi up
- Ogaskura - Kutaisi Down
- Tskhenistskali
- Paliastomi
- Limited Permitted Leven in Georgia
- Limited Permitted Leven in EC

Note: for the components described here, except the dissolved oxygen, the permitted limit of concentration means maximum allowed level. While for the dissolved oxygen it means minimum allowed level.

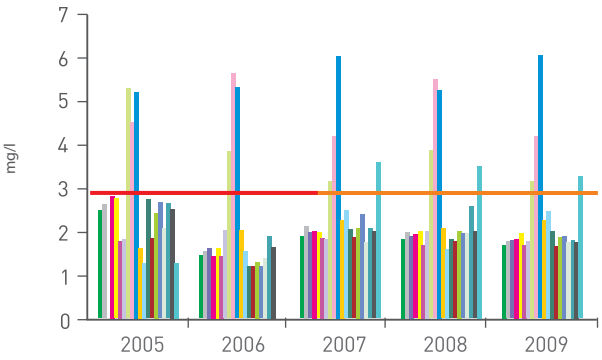


Figure 4.5 Biochemical oxygen demand (BOD-5)

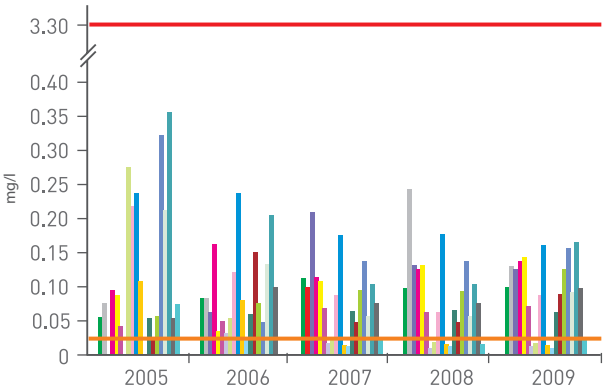


Figure 4.6 Concentration of nitrite ions

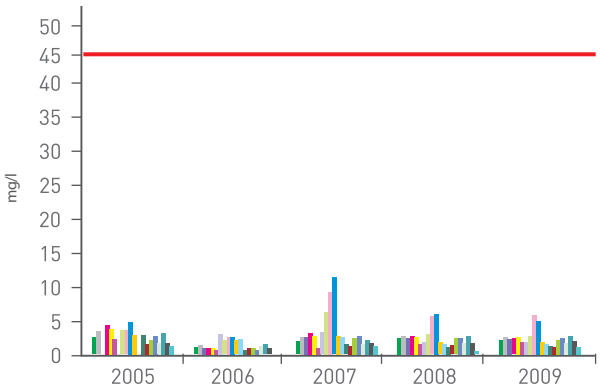


Figure 4.7 Concentration of nitrate ions (no MAC in EC legislation)

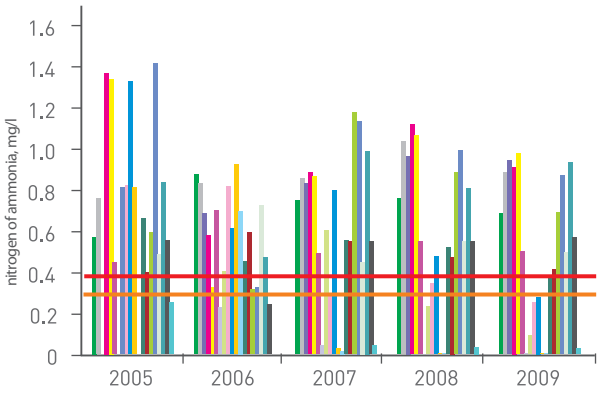


Figure 4.8 Concentration of ammonia ions

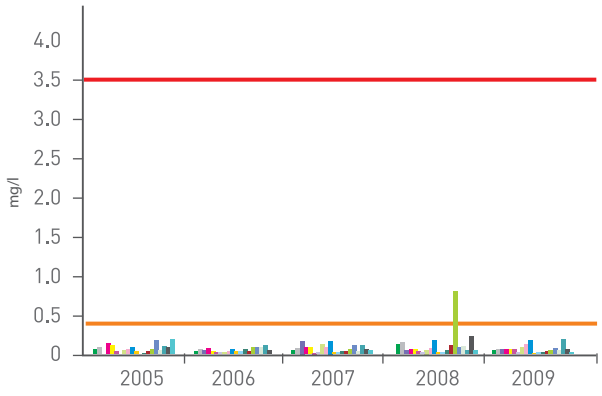


Figure 4.9 Concentration of phosphate ions

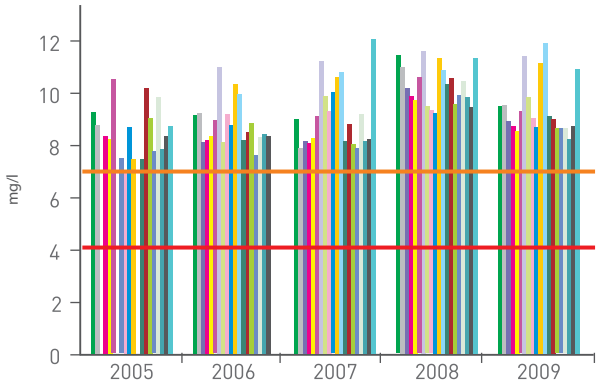


Figure 4.10 Concentration of dissolved oxygen

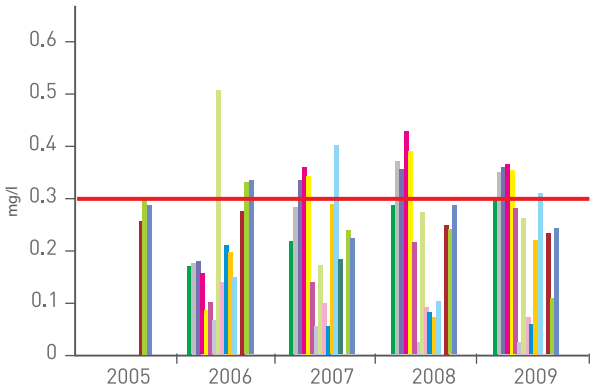


Figure 4.11 Concentration of iron ions

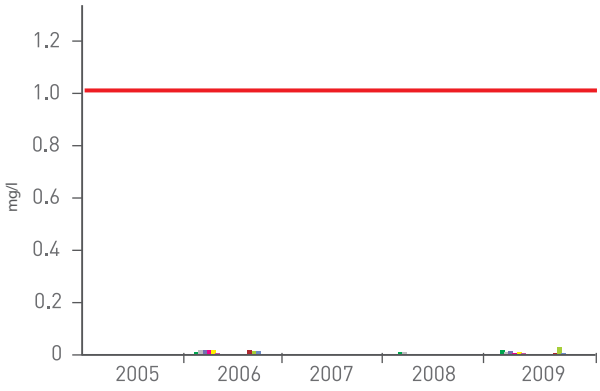


Figure 4.12 Concentration of zinc ions

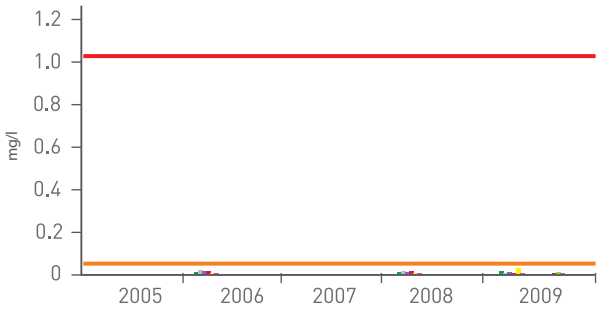


Figure 4.13 Concentration of copper ions

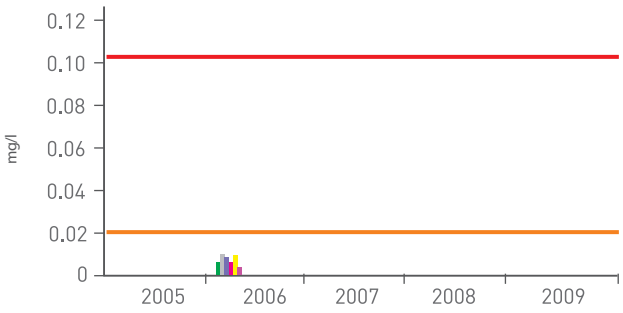


Figure 4.14 Concentration of nickel ions

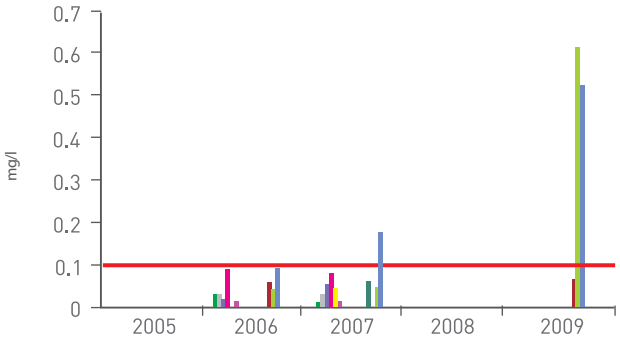


Figure 4.15 Concentration of manganese ions

The results of monitoring show that the concentrations of ammonia in Georgian water bodies exceed the standards established for protection of human health, while concentrations of nitrite ions exceed acceptable standards for waters to support fish life. It should be noted that due to the rapid flow in Georgian rivers, oxygen concentration is quite high in all rivers monitored and comply with the requirements for supporting even the most sensitive fish species. This may be the reason why fish kills caused by water pollution have never been observed in Georgia.

The data show that the highest values for biochemical oxygen demand (BOD) are observed in the river Mtkvari downstream (within the limits of Tbilisi and further), in the river Suramula, and in the rivers of Adjara. The concentration of ammonium ions is quite high in almost all monitoring locations, except Aragvi upper stream and all the rivers of Adjara. It is important to note that the recorded concentrations of ammonia are not dangerous for human health.

There appears to be no obvious source of iron discharges into water bodies and as such elevated levels of iron found at various locations are considered to be naturally occurring. Consequently, the existing norms should be revised. The same can be said for manganese levels in the upper stream of river Mashavera.

Main parameters of water quality in water bodies of the Caspian Sea basin

Monitoring points:

- Aragvi - Tsikhisdziri
- Aragvi - Chinti
- Aragvi - Tvalavi
- Duruji
- Alazani
- Mashavera - upper
- Mashavera - down
- Liakhvi - Gori
- Pharavani - Khertvisi
- Photskhovi - Skhvilisi
- Suramula - Khashuri
- Lekhura - Kaspi
- Mtkvari - Khertvisi
- Mtkvari - Borjomi
- Mtkvari - Gori
- Mtkvari - Vakhushti
- Mtkvari - Zahesi
- Mtkvari - Rustavi
- Mtkvari - Gachiani
- Khrami - Tsiteli Khidi
- Limited Permitted Level in Georgia
- Limited Permitted Level in EC

Note: for the components described here, except the dissolved oxygen, the permitted limit of concentration means maximum allowed level. While for the dissolved oxygen it means minimum allowed level.

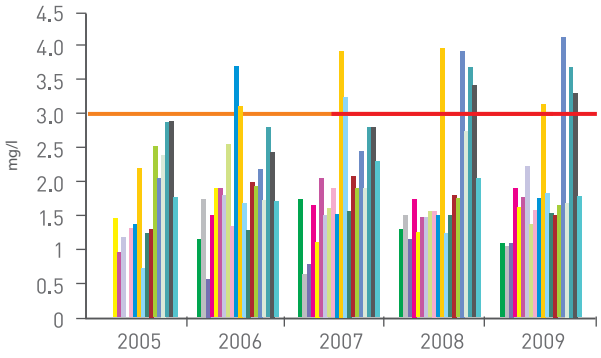


Figure 4.16 Biochemical oxygen demand (BOD-5)

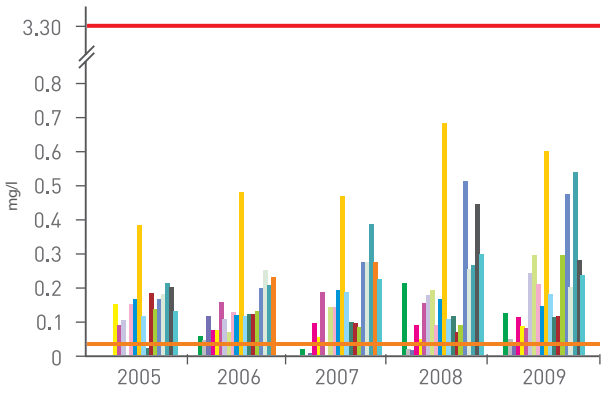


Figure 4.17 Concentration of nitrite ions

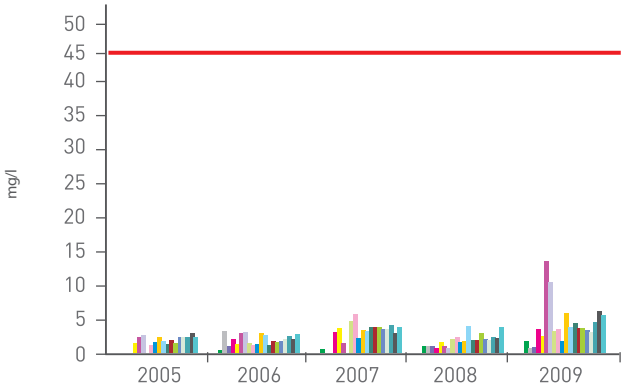


Figure 4.18 Concentration of nitrate ions (no MAC in EC legislation)

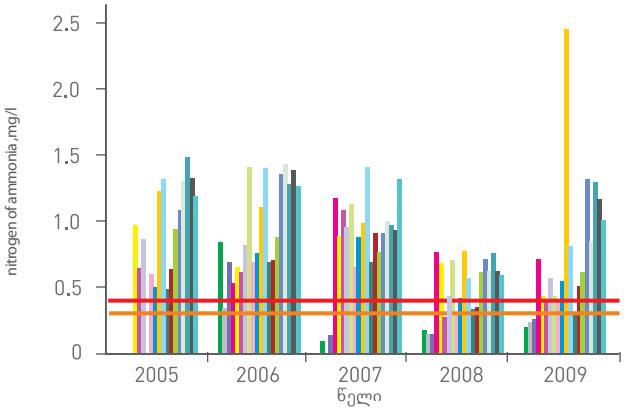


Figure 4.19 Concentration of ammonia ions

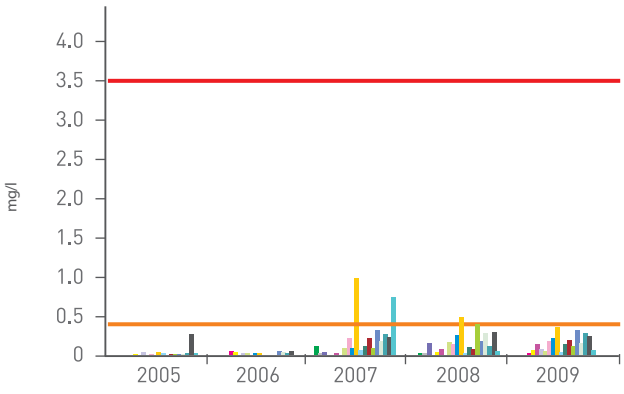


Figure 4.20 Concentration of phosphate ions

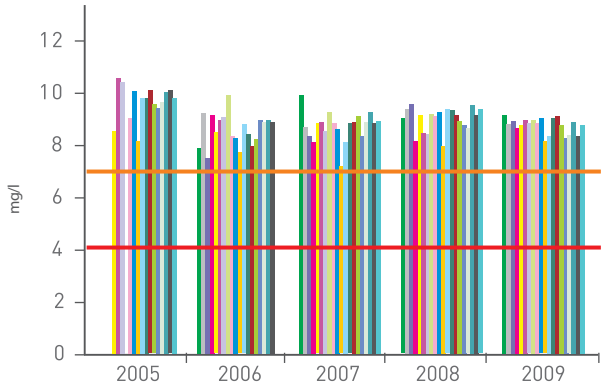


Figure 4.21 Concentration of dissolved oxygen

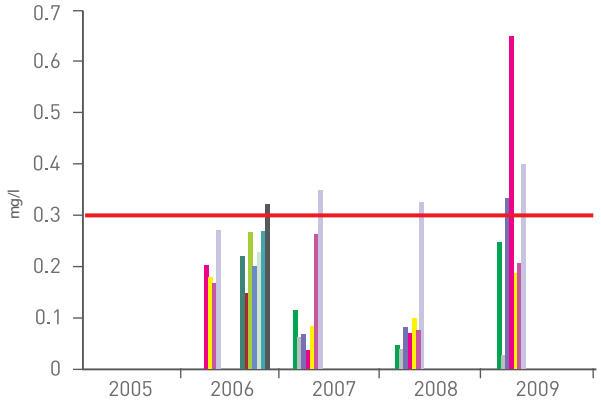


Figure 4.22 Concentration of iron ions

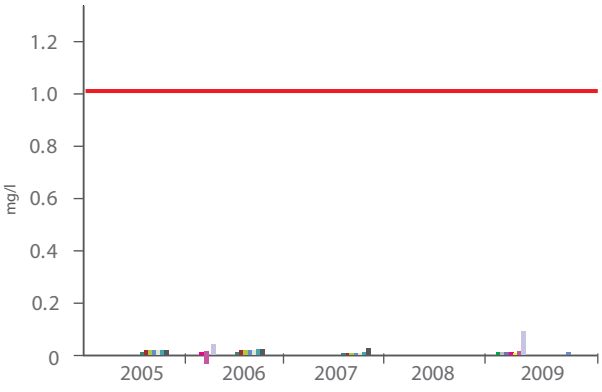


Figure 4.23 Concentration of zinc ions

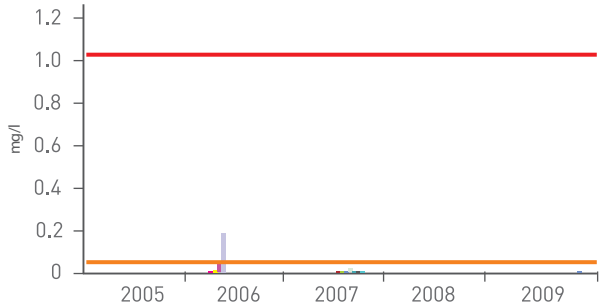


Figure 4.24 Concentration of copper ions

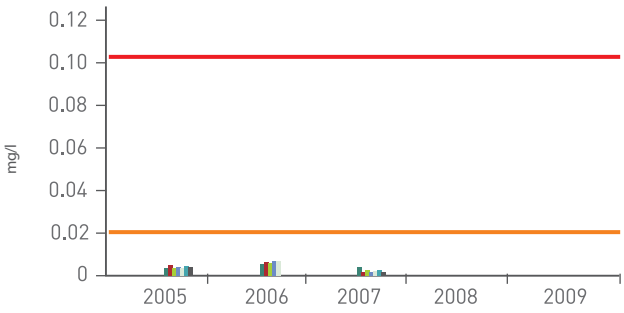


Figure 4.25 Concentration of nickel ions

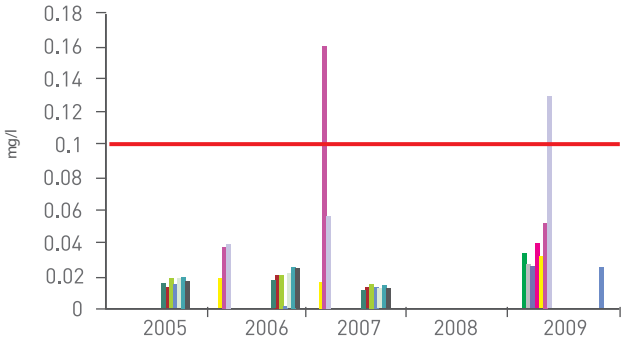


Figure 4.26 Concentration of manganese ions

The concentration of heavy metals is quite high in the rivers Kvirila (manganese) and Mashavera (copper). These high concentrations are caused by discharges and runoff from industrial processes.

According to the existing information [2], contamination of the Lukhunustskali and Tskhenistskali rivers with arsenic compounds; however these substances are not currently monitored under the National Water Monitoring Programme.

Arsenic is an extremely toxic substance, which if inhaled or swallowed can cause serious poisoning or death. Small concentrations can cause blindness, paralysis, and cancer.

Levels of microbiological pollution (E. coli) exceeded appropriate standards on a number of occasions during the 2009 bathing season (from May until September). The water at Lisi Lake was shown to be of particularly poor quality, with samples taken failing to meet the required standard, indicating that bathing in that lake is not safe for human health.

Escherichia coli is a bacteria generally found as a normal and harmless part of the intestinal flora of the human beings and many other animals. However, in other parts of the body it can cause serious diseases, such as urinary tract infections, bacteremia, and meningitis. Pathogenic cultures of E. coli, which get into the gastrointestinal tract can cause acute diarrhea, especially in children under 5 years).

Human excrements from untreated municipal wastewaters or animal wastes are considered the primary sources of Escherichia coli in water bodies.

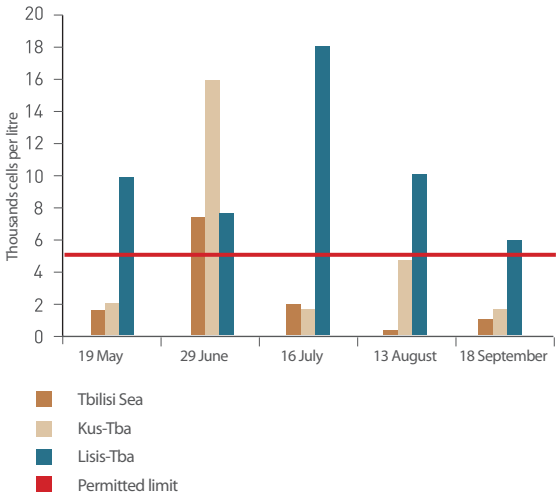


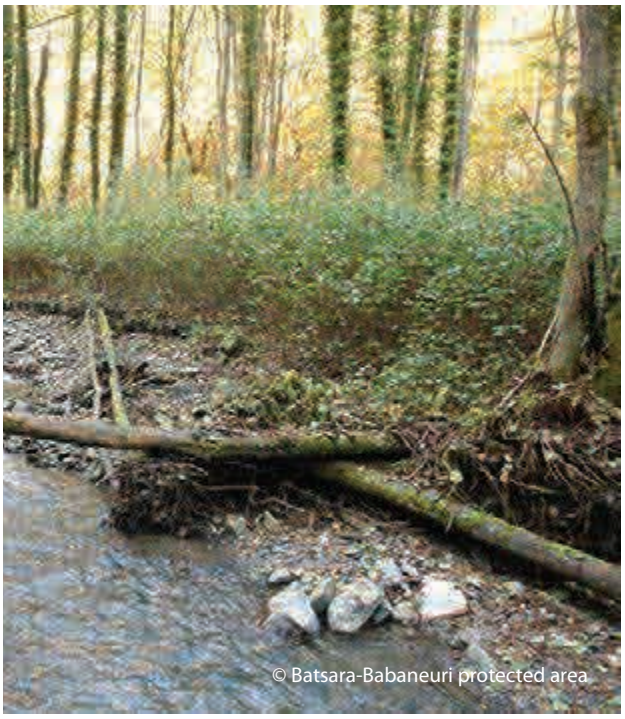
Figure 4.27 Numbers of the bacteria E. coli in the recreational lakes of Tbilisi at certain days during the 2009 bathing season

III/4. 3. CAUSES OF SURFACE WATER POLLUTION

Untreated municipal wastewater discharges into the rivers, and diffused pollution from agricultural lands are considered as the main sources of ammonia and nitrite pollution in Georgia's rivers. In addition, illegal landfills which are often located at river banks, are significant polluters of rivers. The liquid substance which arises from the degradation of wastes, leachate, toxic to aquatic life. It contains high levels of nutrients and heavy metals, and, depending on the type of wastes disposed of at the landfill may contain significant quantities of other hazardous compounds. .

Arsenic containing wastes that were produced during the Soviet period (1933-1997) are the sources of arsenic pollution of the rivers Lukhunistskali and Tskhenistskali. The arsenic mining and processing plants were located in the villages Uravi (Ambrolauri district) and Tsana (Lentekhi district). Hundreds of tonnes of arsenic containing waste were produced by these activities and were stored on these sites and the adjacent territories. At the moment the mining activities have ceased, the plants are completely depilated and the waste is spread over an area of 20 ha in Uravi and 4-5 ha in Tsana.

In 2007-2009, period the reasons for the microbiological pollution of Tbilisi recreational lakes are considered to relate to the underdevelopment of the recreational zones, including an insufficient number of toilets and litter bins, the absence of adequate fencing for domestic cattle, pollution of beaches by tourists, in addition to cases of illegal discharges of wastewaters, for example in the Tbilisi Sea.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III/4. 4. MAIN CHALLENGES

Forty urban areas of Georgia have sewage systems in place, most of which need to be rehabilitated. A significant number of large scale projects aimed at improving the sewage networks and the instillation of wastewater treatment systems in many towns in Georgia are currently at different stages of development. However, given the extensive works which must be carried out at a National level, and the amount of investment required, it will be some time before all sewerage systems will be upgraded to meet the new standards. For instance, 56 million GEL has been spent in 2009 for rehabilitation of sewage systems in different regions of Georgia.

The existing surface water quality monitoring network covers only a small number of the water bodies in Geor-

gia. It is questionable whether such a small monitoring network gives an accurate picture of the quality of the overall water environment in Georgia. It is necessary to extend the monitoring network to include known hot spots, such as rivers Lukhunistskali and Tskhenistskali, where pollution with arsenic is suspected.

While all samples taken from the monitoring network are analysed for 33 standard physical/chemical parameters, this analysis does not include some important families of compounds such as pesticides. It is important that the monitoring is expanded to include such chemicals to give an complete picture of the pollution loads coming from various economic sectors including agriculture, industry and mining etc. For this reason, from 2010 monitoring of the 2000/60/EC Water Framework Directive priority substances are being introduced (including harmful agricultural chemicals). Hence, the monitoring results should be more informative in the future.

Georgia actively cooperates with neighbouring countries with the aim of improving the water quality monitoring system of surface water bodies. Regular joint monitoring of trans-boundary rivers (Mtkvari, Khrami, Debeda, Alazani) is conducted together with Azerbaijan and Armenia. Regular meetings are conducted and information exchanged to protect trans-boundary rivers and lakes (Kartsakhi, Jandari).

In order to achieve and maintain appropriate water quality, Georgia intends to amend the existing administration principles of water resource management and introduce an integrated river basin management approach.

Integrated Water Resources Management is a process of managing of both water and associated land resources which does not impact an ecosystems sustainability and provides maximum social and economic welfare.

One of the main principles of Integrated Water Resources Management is a Water Basin Management Principle. This means the water resource within the hydro-graphic boundary of a river basin are managed in a holistic way taking into consideration the land use, morphology and other pressures within the catchment.

References:

1. Georgian water resources, Gia Khmaladze, 2009
2. Identification and Evaluation of Pollution Sources (Hot Spots) in the River Rioni Basin, CENN, 2008


© Imereti Caves Protected Areas

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GROUNDWATER

Georgia is one of the richest countries in the world in terms of groundwater resources. Groundwater resources per capita exceed the world average by 2.5 times. Moreover, not all of Georgia's groundwater resources have been identified yet.

Georgia does not have a monitoring programme of fresh groundwater in place at the moment, however an assessment of groundwater carried out in 2000, revealed contamination of groundwater with organic and inorganic substances. Therefore the recommencement of a groundwater monitoring programme is especially urgent in regions where the groundwater is used intensively. The most important of these are Tskaltubo, Alazani, and Marneuli-Gardabani artesian basins.

III/5. 1. GEORGIA'S GROUNDWATER RESOURCES

Georgia's underground hydrosphere has a full spectrum of both the classic and rare hydrogeological systems and environments including anomalies. This is the reason for the presence of groundwater belonging to the main, rare and unique categories (fresh, mineral and thermal).

According to the hydrogeological zones, in Georgia there are artesian basins and pressured (confined) groundwater systems, which contain porous, fractured, and fractured/karstic aquifers. They are abundant, renewable and of high quality (Map 5.1).

Map 5.1 Hydrological zones in Georgia

I Groundwater zone of crystal substrate of the Main Caucasus

II Zone of pressured groundwater systems of the South slope of the Main Caucasus

II_1 Abkhazian fractured pressured water system
II_2 Svanetian crack pressured water system
II_3 Mestia-Tianeti fractured and fractured/karstic pressured systems
II_4 Kazbegi-Mtatusheti fractured pressured system
II_5 Crack ground water district of Kelasuri crystal massive
II_6 Fractured ground water district of Keli-Kazbegi lava formations

III Artesian basin zone of Georgian belt

III_1 Fractured and fractured/karstic artesian basin of Bzipi
III_2 Porous, fractured and fractured/karstic artesian basin of Kodori
III_3 Fractured and fractured/karstic artesian basin of Samegrelo
III_4 Fractured and fractured/karstic artesian basin of Racha-Lechkhumi
III_5 Porous, fractured and fractured/karstic artesian basin of Kolkheti
III_6 Porous and fractured water artesian basin of Guria
III_7 Porous, fractured and fractured/karstic artesian basin of Tskaltubo
III_8 Porous, fractured and fractured/karstic artesian basin of Argveti
III_9 Porous, fractured and fractured/karstic artesian basin of Kartli
III_{10} Porous, fractured and fractured/karstic artesian basin of Alazani
III_{11} Porous and fractured water artesian basin of Iori-Shiraki
III_{12} Porous and fractured water artesian basin of Marneuli-Gardabani
III_{13} Fractured and fractured/karstic artesian water basin of Dzirula crystal massive

IV Zone of pressured water systems of Adjara-Trialiati fold mountain zone

IV_1 Fractured pressured water system of Adjara-Imereti
IV_2 Fractured and fractured/karstic pressured water system of Trialeti
IV_3 Fractured and fractured/karstic pressured water system of Tbilisi
IV_4 Fractured water artesian system basin of Akhaltsikhe

V Groundwater zone of Artvini-Bolnisi belt

V_1 Fractured water system district of Akhalkalaki lava sheet
V_2 Javakheti East slope fractured ground water district

There is wide variation in the characteristics of groundwater in Georgia, both in terms of their chemical and aerial composition and their temperature. They are widely used for drinking and medicinal purposes, as well as a heat resource.

According to the mineralization and temperature parameters groundwater is generally divided into the following groups:

1. Fresh drinking waters (mineralization not exceeding 1.0 g/l)
2. Mineral waters (mineralization over 1.0 g/l)
3. Thermal waters – healing (20-35^{0}C), thermo-energetic (40-108^{0}C)

Fresh groundwater

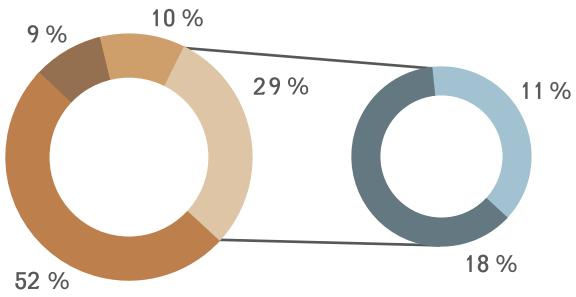
Groundwater is the safest and best protected source of high quality drinking water in Georgia. These waters comprise 60-70% of total drinking water resources of Georgia.

Fresh drinking groundwater is divided into two groups according to mineral content; ultra-fresh waters – 0.2-0.3 g/l (mainly distributed in South Georgia) and water with a mineral content of 0.3-1.0 g/l which is found throughout Georgia.

Over one hundred fresh groundwater aquifers have been mapped in Georgia and have an estimated production capacity of 18 billion cubic meters per year (573 m^3/sec). They are distributed quite unevenly within the hydrogeological regions of the country (Figure 5.1).

According to national legislation, it is not allowed to exploit more than half of the total amount of fresh groundwater resources which in this case is approximately nine billion cubic meters per year (285.5 m^3/sec).

The regions of Abkhazia, Samegrelo-Svaneti, Tianeti, Kakheti, Guria-Imereti have very good groundwater resources while the Samtskhe-Javakheti, Racha-Lechkhumi and Qvemo Kartli regions have poor groundwater resources.



- Zone of pressured groundwater systems of the South slope of the Main Caucasus
- Zone of pressured water systems of Adjara Trialiati fold mountain zone
- Groundwater zone of Artvini Bolnisi belt
- Artesian basin zone of Georgian belt
- Eastern submergence
- Western submergence

Figure 5.1 Fresh groundwater resource distribution by hydrogeological regions

Drinking and healing mineral waters

Georgia also has an abundant supply of mineral groundwater. This is natural water with a mineral content of not less than 1g/l, containing gases with a high content of rare elements, biologically active components and specific healing properties (temperature, radioactivity).

The main feature of these mineral waters is that they have healing properties for people when used internally or externally.

There are over 2,000 groundwater sources (springs and wells) with a total yield of 160,000 cubic meters per day. These waters are divided into three groups according to their mineral content; 1 to 5 g/l, 5 to 10 g/l, and more than 10 g/l.

Total mineral water resources in Georgia is estimated at 50 million cubic metres per day.

Thermal waters

Over 200 single and multiple sources of thermal waters (40-108°C) have been recorded in Georgia with a total output of approximately 160,000 cubic metres per day. Eight are natural springs and 200 sources are drilled boreholes.

According to studies carried out, the total thermal water resource is estimated to be in the order of 350-400 million cubic metres per year.

III/5. 2. CONSUMPTION OF GROUNDWATER

At the moment only one third of known fresh groundwater resources has been surveyed in detail, while the exploitation supply approved by the Supply State Commission is approximately 4.2 billion cubic meters per year (145 m^3/sec) (Fig 5.2). At present only a small portion of this amount is used. According to data from the 1980s (when groundwater was most used) the proportion of industrial use of approved groundwater resources was 12% for mineral waters, 4% for thermal waters and 2% for fresh waters.

In 2008, 427.9 million cubic meters of fresh groundwater were used in Georgia, of which 425.3 million cubic meters were used for drinking water supplies, and 2.6 million cubic metres for industrial purposes. In addition it is estimated that 5% of the urban population and 65% of the rural population use the ground water from individual wells and springs.

At present 45 mineral water deposits have been studied in detail. The resource approved by the State Commission comprises 76.2 thousand m^3/day. One quarter of this is used in balneology. Half of the water is used for three purposes; balneology, drinking-healing and industrial bottling. Some water is used for bottling only. The most popular are the so called "table" waters with balanced mineral content and no biological or other specific properties. The waters "Kazbegi", "Utsera", "Mestia" differ from the usual drinking waters used by most of the population by their natural quality and ecological purity.

The waters of special use are those with healing properties. They are very popular in Georgia as well as abroad: "Borjomi", "Nabeglavi", "Sairme", "Mitarbi", "Phlate", "Likani", "Zanavi", "Kokotauri", "Kvibisi" and others. These waters are used both in-situ at healing institutions as well as for bottling.

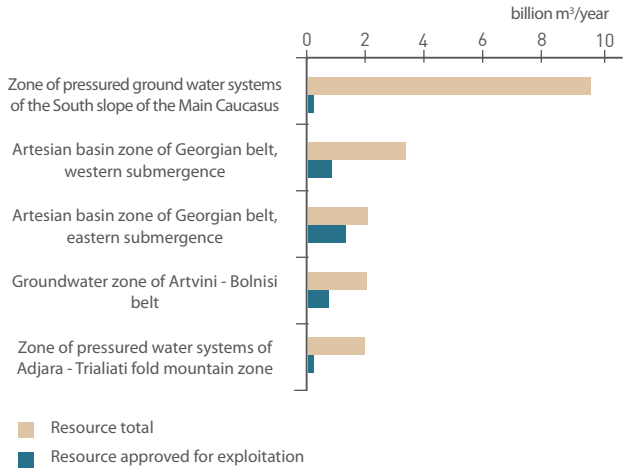


Figure 5.2 Ratio of fresh groundwater resources to approved exploitation supply and their distribution by hydrogeological region.

From the balneological point of view, mineral water for external use (healing baths) is important. It's use is broad: diseases of circulatory system, peripheral nervous system, skeleton and muscular system, gynaecology, skin, otolaryngology etc. These waters are "Tskaltubo", "Menji", "Tsaishi" and others.

The State Supply Commission has approved the exploitation supply of 126 thousand cubic metres per day of thermal waters (15 deposits), which is 20% of the total estimated resource.

Geothermal waters are used according to their temperature parameters in industry, agriculture, for public water consumption and thermal baths (Tbilisi-Lisi, Okhurei, Zugdidi-Tsaishi).

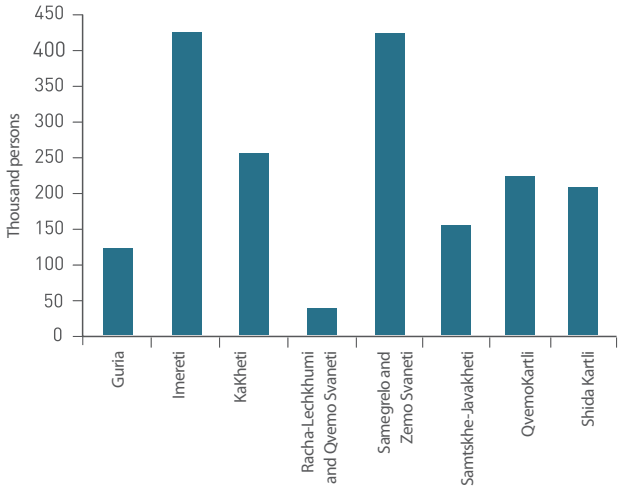


Figure 5.3 Population of Georgian regions which abstract fresh drinking water from individual sources.

III/5. 3. GROUNDWATER POLLUTION LEVEL

Although groundwater is considered to be naturally protected from most human impact, pollution of this water has been observed. Pollution is due to hydraulic connection of the groundwater with polluted surface waters, landfills or stocks of industrial wastes, fertilised agricultural lands, industrial facilities etc.

The groundwater (in the first instance – the fresh water) is considered polluted if its natural quality is altered as a result of either natural pollution or human activities.

A large proportion of the Georgian population use wells and springs abstracted from high watertables as a source of drinking water. These sources are much less protected from pollution than the artesian or pressured water basins.

The lowlands and the intermountain regions (Kolkheti Lowland, Kartli Valley, and the left bank of the river Alazani, etc), include the country's industrial zones and over eighty per cent of our major settlements, are at risk of pollution (especially the more shallow subsoil waters and the pressure waters in proximity to the land surface).

In 2000, an analysis of different pollution sources was conducted based on data for 707 samples (carried out in 1970-1990). The findings of this study concluded that the quality of groundwater in Georgia has undergone qualitative changes in terms of deterioration of their quality. No monitoring of groundwater is carried out in Georgia at the moment.

III/5. 4. CAUSES OF GROUNDWATER POLLUTION

The general state of the environment has a direct influence of the status of groundwater. The environmental quality of soils, surface waters, ambient air and rainfall all have an impact on groundwater quality. Environmental pollutants enter groundwater during the water cycle. Pollutants from soils are carried down to groundwater by percolating rainwater. Pollutants from surface waters also percolate down to the watertable. Airborne pollutants such as dust are dissolved by the rain, and deposited onto the soil which then percolate into the groundwater.

The groundwater is mainly affected when pollutants from wastes, agricultural lands and polluted surface waters get into the aquifers. As a result groundwater is polluted by microelements, non-metals, oil products and pesticides. Pesticides are of most concern as they are persistent in water and the environment, they are toxic and can travel long distances.

The ecological state of groundwater is highly dependent on the conditions and protection level of the aquifers. According to the characteristics and position of the water-bearing horizons groundwater is divided into: subsoil water (gravitational, non-pressured (unconfined) water of the upper near-surface horizon) and artesian water (pressured water of inter-layer horizons).

The level of their pollution highly depends on the natural geological protection of those waters.

The subsoil waters are most easily polluted, as they have no natural overlying protection or 'roofing'. If the unsaturated zone above the watertable is thin, industrial wastewaters as well as polluted water from agricultural lands can easily reach the watertable.

Groundwater pollution occurs mostly in areas where groundwater is derived from infiltration of rivers or where little protection is provided by the overburden (thin soils and subsoils) and rock layers over the groundwater aquifer. These aquifers are very sensitive to the surface water quality, because they are in direct hydraulic continuity with surface water.

The pressured groundwater horizons are usually much less polluted especially in the high pressure area.

III/5. 5. MAIN CHALLENGES

Existing groundwater monitoring data from 1970-1990, show that groundwater used for drinking water endured quantitative and qualitative alterations at a local as well as regional scale. As a result, the quality of drinking water used by some of the population did not meet the state standards and requirements.

Since 1990 a groundwater monitoring programme has not been operational in Georgia, hence, no recent data on the quality of groundwater is available. Gradual restoration of the monitoring programme is on the agenda. Monitoring should be restored first of all in Samegrelo, Tskaltubo, Alazani, Kartli, and Marneuli-Gardabani artesian basins. These priority areas have been selected based on the following criteria:

1. The population of these basins relies heavily on groundwater as a drinking water source;

2. There is a high risk of groundwater pollution;

3. These regions have a high population density as well as a well developed agriculture and industrial sector.

This will require an assessment of the old monitoring network to establish its suitability for current needs. Where additional monitoring locations are required they should be selected to ensure that the network coverage is adequate to provide sufficient data to determine the sources and scale of groundwater pollution in Georgia. Based on the monitoring data, it will be possible to develop recommendations for improving the quality of water supply bodies and for the designation of appropriate locations for drinking water abstraction points.

III/6

BLACK SEA COASTAL WATERS

The Black Sea is especially sensitive to the impacts of human activities because of its unique natural features. During the 1970's to 1980's, the Black Sea ecosystem was seriously damaged due to chemical pollution and overexploitation of biological resources. Since 1992, all Black Sea coastal countries have been trying to protect and improve the marine environment of the Black Sea, and their efforts have resulted in some progress. Eutrophication levels have decreased in the sea to some degree, which has prompted a recovery of the ecosystem. However, there is still much to do to achieve a real improvement in the state of the Black Sea.

The main source of pollution of Georgian coastal waters is untreated waste waters discharged into the sea. The quality of waters at recreational beaches generally meets the required bathing water standards, although there are some exceptions. The construction and rehabilitation of sewerage systems and waste water treatment plants is underway along the entire coastal line of Georgia. These works will significantly decrease the pollution of the Georgian marine coastal waters.

III/6. 1. INTRODUCTION

The Black Sea represents a unique water body. It is an almost closed sea, which has the largest basin in the world. The basin area is 1.9 million km^2 and it covers nearly one third of the territory of Europe. Up to 300 cubic km of water flow from the rivers into the sea annually.

One of the specific features of the Black Sea is that the water layers in the sea differ by their salinity. In particular, the upper layer, at a depth of 100 to 150 m, is less salty. It's salinity is 1.8%, while the world ocean salinity is 3%, and accordingly it is lighter in weight than the lower layer which extends from approximately 150m to 2,200m in depth. The layers do not mix with each other. These two layers also comprise the Bosporus, the narrow strait connecting the Black Sea with the Mediterranean Sea. Approximately 300 cubic km of the comparatively salty water of the Mediterranean Sea enters the Black Sea via the lower stream of the strait every year, while 600 cubic km of less salty water flows out from the Black Sea through the upper stream into the Sea of Marmora and then into the Mediterranean Sea.

The rare natural conditions which exist in the Black Sea giver rise to its unique biodiversity. The sea is rich with living organisms, among which 150 species are relict and 240 endemic. There are 350 species of algae and 2,000 species of fauna. Salmon, Kolkhic sturgeon, Atlantic sturgeon, mullet, horse mackerel, mackerel, beluga and some other species deserve special attention.

The Black Sea borders Georgia from the East, and 315 km of the coastal line on Georgia's territory. Georgia's territorial waters comprise 6,785 km^2. The Black Sea area has a strong influence on climatic conditions experienced throughout Georgia.

State Regulation

The Black Sea is an international water body bordered by six countries. Protection of the marine environment and maintaining the ecological balance can be reached only by joint efforts of all these six countries. In 1992, the Black Sea countries (Bulgaria, Turkey, Romania, Russian Federation, Georgia, and Ukraine) developed the Convention on Protection of the Black Sea against Pollution (Bucharest Convention), which was ratified by all six countries in 1994.

The implementation agency of the Bucharest Convention is the Commission for the Protection of the Black Sea Against Pollution, which consists of the representatives from all six countries. The permanent Secretariat is located in Istanbul (Turkey).

The Strategic Plan was developed in 1996 for the purposes of implementation of the Convention. Progress in implementation of the Convention was assessed in 2002 and 2007. A new Action Plan developed in 2009, together with international measures aimed at the protection of the sea, envisages the development and implementation of the national strategies for all Black Sea countries.

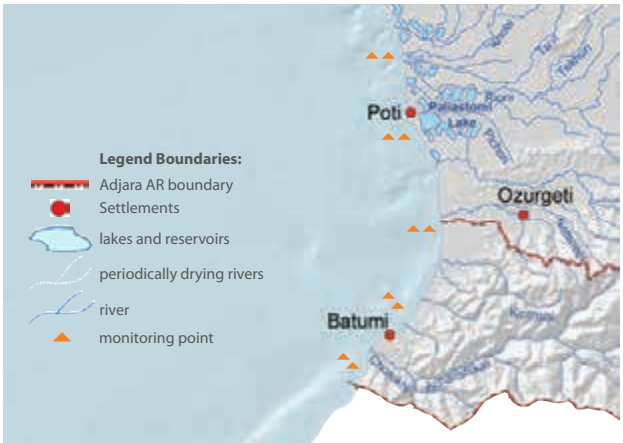
Besides that, national norms to protect the quality of the Black Sea coastal waters in Georgia, were defined by Order #297 of the Minister of Labour, Health, and Social Protection of Georgia (August,16, 2001). The regular state monitoring of water quality ensures compliance with the required standards. Where non-compliances are detected, investigations are conducted on the causes and corrective and preventative measures are undertaken.

III/6. 2. CURRENT STATE

Black Sea International Monitoring

In 2006 the Commission for the Protection of the Black Sea Against Pollution made the decision to create a joint monitoring system for the Black Sea water quality and marine environment. For these purposes, the Black Sea Integrated Monitoring and Assessment Program was developed. The programme comprises 120 observation stations, five of which are located in Georgia: a station in the River Chorokhi estuary, one near Batumi, one between Tsikhisdziri and Kobuleti, one in the River Supsa estuary and one more near Poti (see Map 6.1).

Sampling is conducted on a seasonal basis, at these stations in Georgian territory at a point in the sea located at 1 mile (1.85 km) from the coastal line, at two depths (5m and 20m). The physical parameters of the samples are evaluated on site, while the chemical and biological (phyto and zooplankton) composition were evaluated in Batumi, at the Environmental Pollution Laboratory of the National Environmental Agency Monitoring Centre and the Laboratory of Marine Ecology and Fish Monitoring, accordingly. The monitoring results are sent to the Black Sea Commission every year.



Map 6.1 Sea coastal monitoring stations on Georgia territory, 2006-2009

Monitoring of Georgian Coastal Waters

Since 2007, the Department of Environment Protection of the Adjara Autonomous Republic carries out monitoring of marine water quality to ensure the quality of Georgian coastal waters for the protection of human health. To do so, specialists go to sea by boat once a week and take water samples at eight points along the marine coastal zone: Kobuleti central beach area, Mtsvane Kontskhi, Makhinjauri, Bartskhana River mouth, Batumi central beach, Sarpi, Kvariati, and Gonio. Field monitoring of the following parameters is undertaken: oxygen content, pH, temperature, salinity and oxygen saturation.

Monitoring of bacteriological parameters in the Ajara coastal zone has been also carried out since 2010. These measurements are conducted within the framework of the target program of the Department of Environment Protection of Adjara Autonomous Republic on the basis of an agreement concluded between the Department and the Laboratory of the Ministry of Agriculture of the Adjara Autonomous Republic.

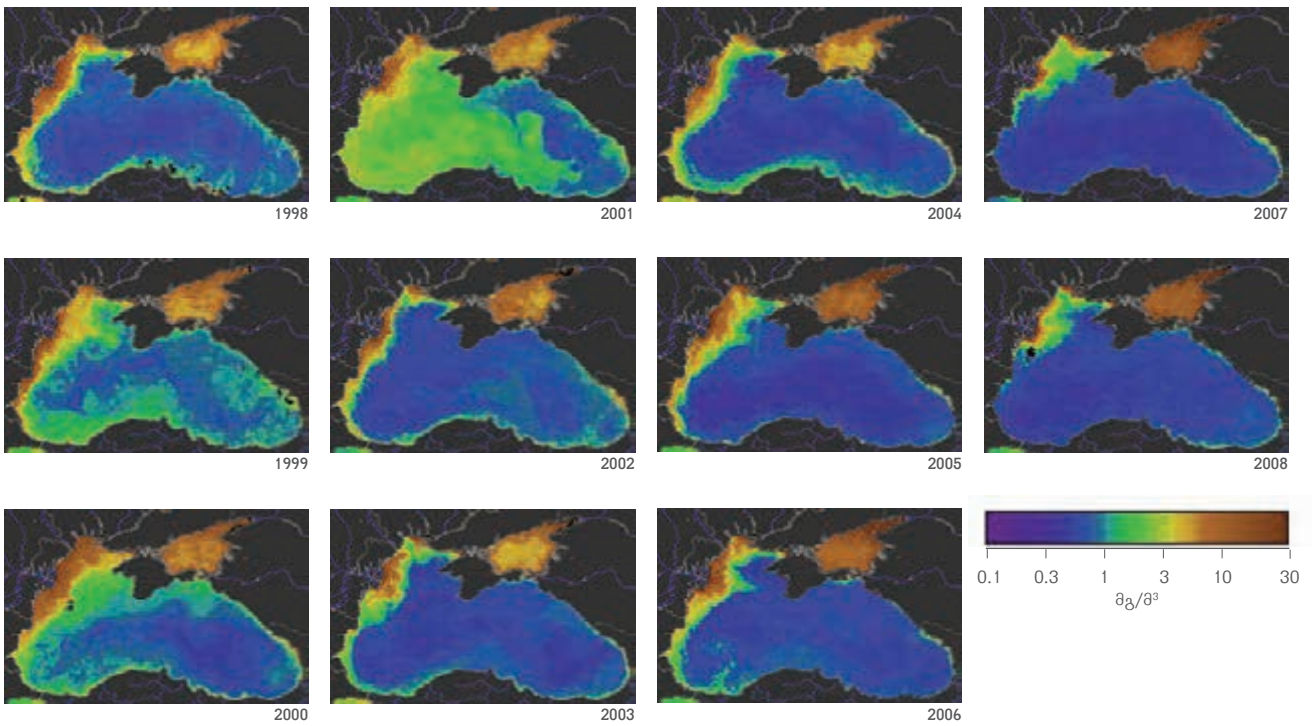
State of the Black Sea Marine Environment

The Black Sea is very sensitive to anthropogenic impacts due to the large water drainage basin and its limited connectivity with the world ocean. During the last decades the Black Sea became one of the most degraded regional seas on the planet due to the influence of human activities.

According to a report prepared by the Black Sea Commission [1], the Black Sea ecosystem was seriously damaged over the period 1970 to 1980 because of the large amounts of nutrients carried by the rivers into the sea, which lead to the high level of eutrophication. These processes were especially intensive at the North-West coast of the sea, though the eutrophication was also evident at the Eastern part in Georgian coastal waters. Eutrophication caused severe degradation of what was previously a very rich ecosystem; the seabed organisms were destroyed; and the composition of marine flora and fauna species has changed. The commercial value of marine species has also decreased. For instance, where 26 commercial species were registered in 1960, today only four species have a commercial value.

According to the Black Sea Strategic Action Plans of 1996 and 2009, apart from eutrophication, the reasons for degradation of the sea include chemical pollution (including oil spills), overexploitation of marine fauna, and invasive alien species.

Since 1995, pollution with nutrient substances has decreased. Chlorophyll concentrations in marine coastal waters have also decreased (Map 6.2) which points to reduction of eutrophication levels. Since then, the ecosystem has begun to improve. However, in 2005, concentrations of the nutrient substances in coastal waters were still twice as high as of the background levels observed in 1960. It is accepted, that the Black Sea ecosystem may never fully recover [1], but the joint efforts of the coastal countries can significantly contribute to the improvement and stabilization of its general state.



Map 6.2 Chlorophyll mean concentration in the Black Sea in June of 1998-2008. Source: Internet-portal Oceancolour http://marine.jrc.ec.europa.eu/

State of Georgian Coastal Waters

According to monitoring data for Ajara coastal waters (Figure 6.1) the highest oxygen content values between 2007 and 2008 were observed in the waters of Gonio-Sarpi and Mtsvane Kontskhi. The lowest values were observed in July-August in river estuaries. In the area of Kobuleti and Batumi central beaches the value was between 5.0 and 5.5 which are considered to be an average concentration.

Regarding bacteriological analyses undertaken in Batumi central beach aquatic area, total coliform bacteria concentrations varied between 620 and 7,000. In the port area these values reached 2,100 to 2,400. In Mtsvane Kontskhi, 2,400 to 3,900, in Sarpi, 230 to 5,000, in Gonio, 130 to 1,300, and Kobuleti central beach area, 620 to 5,000. These values mostly are within maximum permissible limits. The high values observed in the port area (mostly in Bartskhana River estuary) might be determined by high background pollution of marine waters by organic substances specific for such areas. The other parameters of bacteriological pollution were similarly within the norm limits, while faecal coliforms, faecal streptococci, staphylococcus aurous and other pathogenic bacteria have not been found in any coastal waters.

The results of the biomonitoring, shows a positive trends taking place within the Black Sea ecosystem. In 2006-2009, the phyto plankton of Georgian coastal waters were much more diverse compared to 1980s. Six main groups of plants are presented: Diatoms (Bacillariophyta), Dinoflagellatts (Dinophyta), Green (Chlorophyta), Blue-green (Cyanophyta), Yellow-green algae (Xantophyta) and Cromista (Chromophyta). The Diatoms are presented with the most species (see Figure 6.4) as well the highest number of individual plants. The increase of number of species and organisms of this group, as compared to Dinoflagellatts, reflects reduced anthropogenic impact on the sea ecosystem. It should be noted though that in some areas (Riv. Tchorokhi, Batumi, Supsa) that local eutrophication is observed during the warm months of the year. Especially the aquatorial waters of the River Supsa where quite high numbers of Blue-green and Yellow-green algae has been observed. An additional indicator of the local eutrophication is the dominance

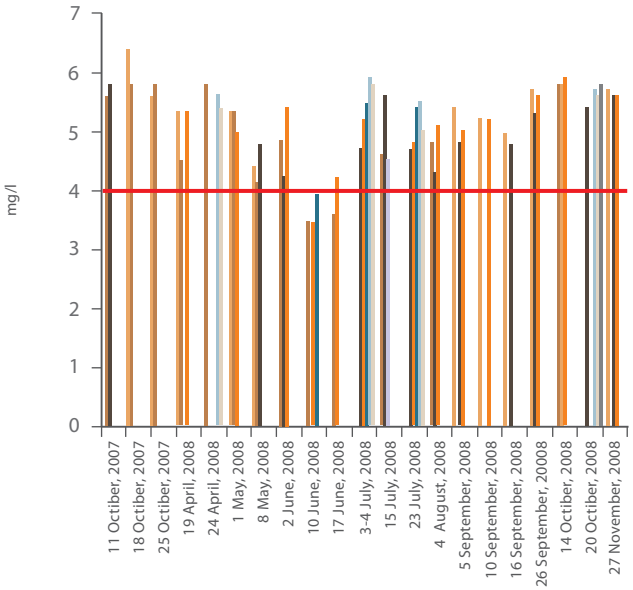


Figure 6.1 Oxygen concentrations in Adjara coastal waters (should not be less than allowed level)

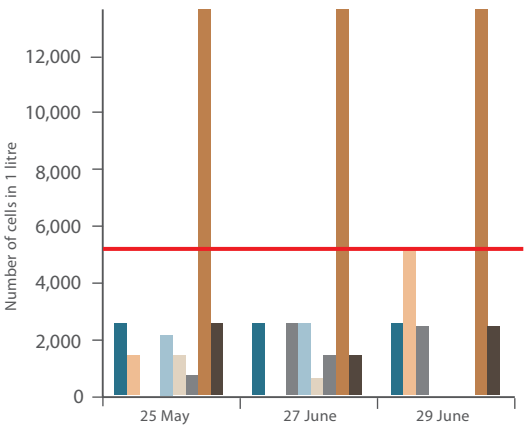


Figure 6.2 Numbers of Lactose-positive coliform bacteria in Adjara coastal waters; beginning of the bathing season of 2010 (should not exceed the allowed level).

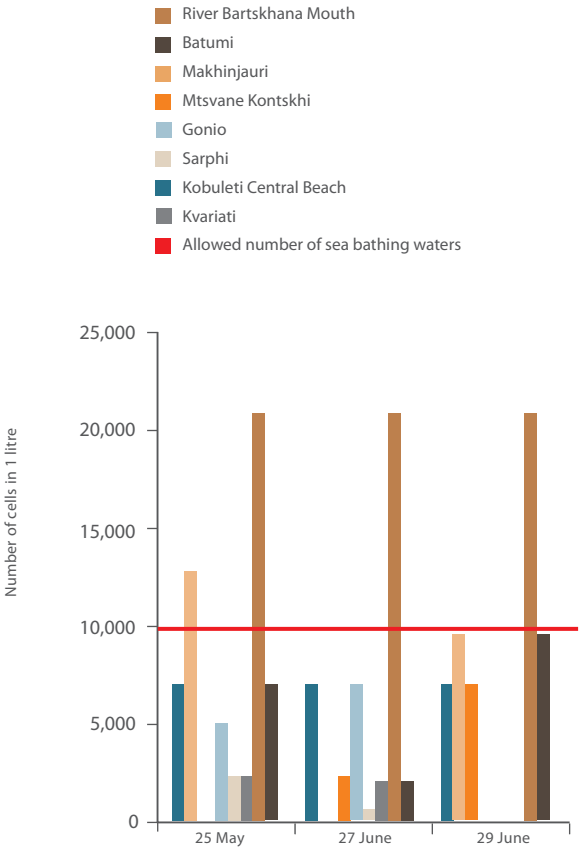


Figure 6.3 Total coliform bacteria in Adjara coastal waters in the beginning of the 2010 bathing season(should not exceed the allowed level)

of the fagothrophic species of dinoflagellates, Noctiluca scintillans (so called "Sea Sparkle"), in the estuaries of the rivers Tchorokhi and Supsa.

The total number of phyto-plankton in Georgian coastal waters experience ordinary seasonal fluctuations. During spring and summer their number is 1.4 to 2.3 billion cells/m^3 on average, while in autumn and winter the number is 0.2 to 1 billion cells/m^3 (Figure 6.5).

The Zooplankton composition also showed improvements in Georgian coastal waters during 2006 to 2009. Forty Zooplankton species from eight taxonomic groups have been observed. The biomass of Zooplankton is mostly made up of larvae of polychaetes, nematodes, mollusca, fish and other species. The predominant species are crustaceans (Crustacea) and rotifers (Rotatoria) (See Figure 6.6).

It should be noted that during the last decades the fauna of the Georgian coastal waters was significantly affected by introduction of alien species into the natural ecosystem. During the 1980s, the Black Sea was strongly influenced by the presence of comb jellyfish Mnemiopsis leidyi introduced from the Atlantic Ocean within ships ballast waters. The jellyfish fed on plankton and competed with such fish as Black Sea anchovy, mackerel and others, resulting in substantial reduction in their numbers. Another species, the Beroe ovata was introduced around the end of the 20th century, again from ship ballast waters. The presence of the Beroe ovata, which itself eats comb jellies has reduced their numbers, which in turn has led to the growth of plankton biomass. As a result, the number of fish is increasing and the ecological balance is being restored

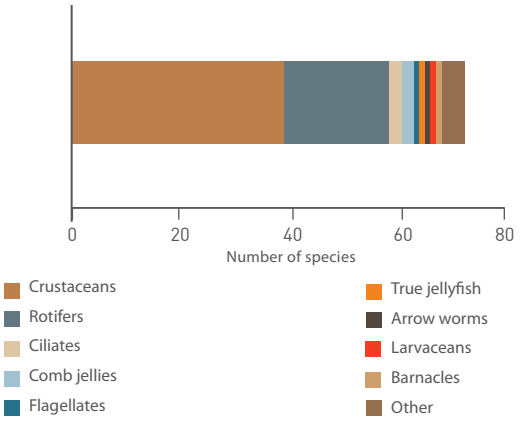


Figure 6.6 Number of species of zooplankton in the Georgian Black Sea Coastal zone (2006-2009)

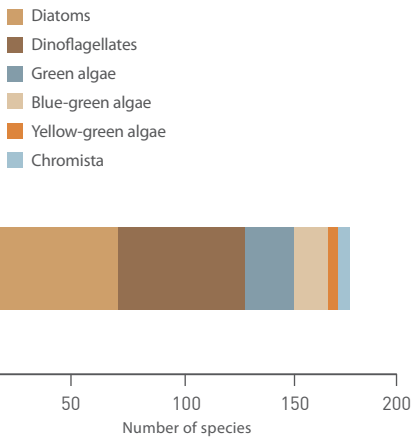


Figure 6.4 Number of species of phyto-plankton in Georgian coastal waters (2006-2009)

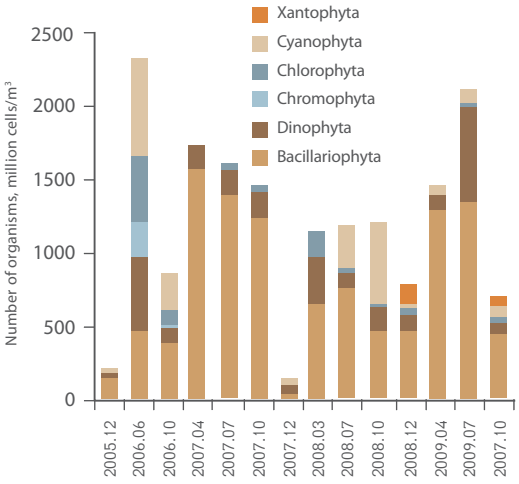


Figure 6.5 Number of phyto-plankton groups in the Georgian coastal waters (2006 -2009)

Picture 6.1 Mnemiopsis leidyi

Picture 6.2 Beroe ovata

III/6. 3. POLLUTION CAUSES

Analysis of monitoring data has shown that the main sources of pollution of the Black Sea are the water consuming enterprises (especially municipal services), as they do not have proper waste water treatment facilities, or because of improper operation of the existing treatment plants. Poor operation of waste water treatment plants were detected in Adjara. The polluter was the Adlia treatment plant of the Batumi sewerage system, where the treatment processes had effectively ceased.

III/6. 4. MAIN CHALLENGES

In order to address the four main problems of the Black Sea environment, eutrophication, over exploitation of living resources, chemical pollution, and habitat degradation, the following four long term goals have been defined in the Black Sea Strategic Action Plan of 2009:

1. To protect the exploitable biological resources through the introduction of sustainable use technologies and the rehabilitation of stocks;

2. To conserve and manage the Black Sea coastal and marine biodiversity and habitats. In particular, the protection of endangered species, as well as the implementation of preventative measures to protect against invasive species;

3. To decrease eutrophication;

4. To provide high water quality ensuring human health protection, good recreational conditions and ecosystem safety. This pertains to both land and marine based pollution sources.

According to the Strategic Plan for the implementation of the Black Sea Action Plan, Black Sea countries should adopt the following approaches within their territories:

- Integrated Coastal Zone Management;
- Ecosystem approach;
- Integrated River Basin Management.

Georgia is currently developing national strategies for the introduction of these approaches. The first draft of the national strategy on Integrated Coastal Zone Management and the relevant law has already been developed. A new Law on Water is being prepared to introduce an Integrated River Basin Management System approach, and in line with which, river basin management plans will be prepared for each river basin.

Efforts to improve the environmental conditions of the Black Sea coastal zone of Adjara have been successful, and have significantly increased the tourist potential of the region. A modern biological treatment facility was installed in Batumi airport in 2007. Works to improve the waste water treatment plant at Ltd BatFarma have

also been conducted, resulting in a significant reduction in the pollution load reaching the Black Sea. Ltd Batumi Oil Terminal also undertook many different measures to eliminate pollution with oil products. As a result, the quality of the river Bartskhana and the adjacent costal area which were previously subjected to oil pollution incidents have been significantly improved.

Municipal development programs are underway in Batumi and Kobuleti, in addition to the construction of the local sewage pipe-line of the Sarpi-Kvariati-Gonio-Akhalsopeli, which will be connected to the Adlia waste-water treatment plant. At this point, the entire coastal area will be covered by the sewage network. This program will significantly contribute to decreasing pollution of the marine environment by municipal water sources.

Integrated Coastal Zone Management means such a management of the coastal territory which ensures:

- integration of terrestrial and marine components of the territory in time and space (so called "Spatial integration")
- Interconnection of different stakeholders, spheres and branches of economy (so called "horizontal integration")
- Inter linkages of management at different levels (so called "vertical integration")

Integrated Coastal Zone Management makes possible the optimal balancing of environmental, economic, social, cultural and recreational interests ensuring the sustainable development of the coastal zone.

Notwithstanding the successes to date and the significant reduction of marine pollution achieved due the measures undertaken, it is necessary to continue to strengthen the monitoring of discharges from enterprises along the marine coastal line and all surface water bodies. It is also necessary to improve the level of state control to ensure compliance with the requirements of water protection zones for small rivers. The improvement of self-monitoring by enterprises is also necessary. Special attention should be given to the introduction of new more modern energy efficient waste water treatment technologies.

The implementation of these measures can result in a significant improvement of the quality of the marine coastal zone and surface waters within the region in general.

References:

1. State of the Environment of the Black Sea (2001-2006/7), Commission on the Protection of the Black Sea Against Pollution, 2008;
2. Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea, Sofia, Bulgaria, 17 April 2009.

III/7

WATER RESOURCES USE

Fresh surface water resources in Georgia are mainly used for energy generation, irrigation, and as a source of drinking water. In general, water abstraction in Georgia is conducted on a moderate scale and as such has little effect on the ecology of water bodies.

Drinking water in Georgia is primarily abstracted from ground water sources, for both public and private supplies. The quality of drinking water in the supplies of many regions does not comply with national standards. The main causes identified for poor drinking water quality relate to out-dated water supply system, and not the quality of the ground water abstraction source. Programmes aimed at the improvement of drinking water supply systems are underway in many regions in Georgia and will lead to significant improvements in the quality of drinking water supplies.

III/7. 1. INTRODUCTION

Water resources are used for many different purposes. Fresh waters are used for drinking and irrigation, for industrial purposes and energy generation, for bathing and recreational purposes, and for fish farming. Municipal and industrial wastewaters are discharged into receiving water bodies, either rivers or the sea. According to Georgian legislation, these activities must be carried out in a way that does not damage the water ecosystem. Water abstracted from rivers should not be undertaken in amounts that decrease the base level flows to an extent that may be harmful to the water body ecosystems. Wastewaters must be treated appropriately prior to discharge.

III/7. 2. CURRENT STATE

Water Abstraction

The majority of water abstraction from surface water bodies in Georgia is used for electricity generation in hydro-electric power stations (Figure 7.1). Almost half of annual flow of the rivers is used for these purposes, however this still represents less than half of the total energy potential of the rivers in Georgia. Water used for energy generation purposed is discharged back into the downstream river channel practically unchanged. These activities can cause an impact on the river ecosystems at a certain points of the river channel due to decreased water flow.

By contrast, water used for agricultural purposes (mainly for irrigation) is not returned back to the river. One billion cubic metres was abstracted from rivers for irrigation purposes in 2008 (two per cent of the total annual river flow) and these volumes are increasing every year.

Ground waters are mainly used as sources of drinking water (Figure 7.3), although several large cities are supplied from surface water bodies. For instance, drinking water for Tbilisi is abstracted from the river Aragvi (through Jinvali water reservoir) and the river Iori (through the Tbilisi reservoir, also referred to as the "Tbilisi Sea").

Quality of Drinking Water

Around half the population of Georgia is supplied with drinking water through public supply schemes (piped drinking water supplies) (figure 7.5). The remainder obtain drinking water from private supplies, mostly from ground waters, wells and springs.

The quality requirements for drinking water are established by the relevant Technical Regulation. Compliance levels with the standards set in the Technical Regulation are a matter of some discrepancies. According to the data provided by the Water Supply Regional Development Agency, the quality of drinking water is generally compliant with the required standards. However, data from the Food Safety, Veterinary, and Plant Protection National Service show the opposite to be the case, that many samples were non-compliant with the required drinking water quality standards. In particular, increased permanganate oxidation levels were noted as non-compliances for the levels required for residual free chlorine. Breaches of bacteriological standards for *E. coli* or total Coliforms were observed in more than half of samples. Water quality standards observed in Poti, Zugdidi, Martvlil, Senaki, Akhaltsikhe, Dmanisi, Lentekhi, Ambrolauri, Ozurgeti, Bagdati, Tskaltubo, and Zestaphoni municipalities, were considered unsatisfactory. This is considered to be caused mainly by the bad technical conditions of water pipelines and poor operating standards within the supply scheme.

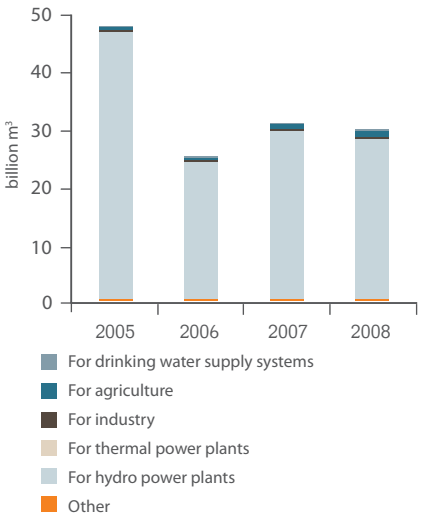


Figure 7.1 Annual water abstraction from surface water bodies

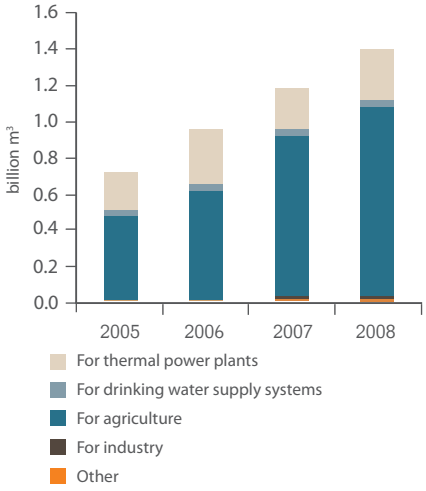


Figure 7.2 Annual water abstractions from surface water bodies, excluding abstraction for hydropower stations

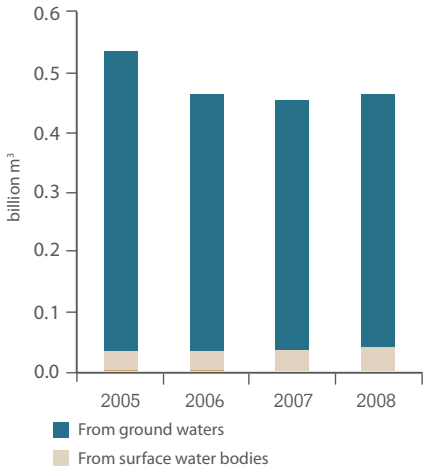


Figure 7.3 Annual abstraction of drinking water

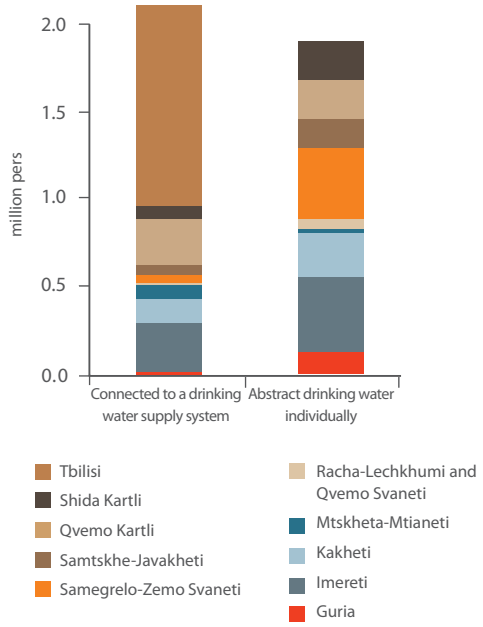


Figure 7.5 Drinking water supply in different regions of Georgia

III/7. 3. MAIN CHALLENGES

Some of Georgia's population still does not have access to a stable and safe drinking water supply. The main challenge in the provision of safe drinking water is considered to be the out-dated distribution network, the majority of which has not been repaired, or upgraded for quite a long time. As a result, there are frequent failures of the water supply pipeline network, that lead to losses of the drinking water, estimated at between 20 to 50% in some towns of Georgia. This also causes interruptions in the continuity of drinking water supplies. Where drinking water pipelines are damaged or ruptured, water in the ground surrounding the pipes can infiltrate into the supply system. This poses a particular risk where out-dated sewage drainage networks leak into the ground, resulting in contamination of the drinking water supply systems. This risk is further elevated where water supply and sewage networks run in close proximity to one and other. This situation affects the quality of the water supplied and increases the risk of water-born diseases.

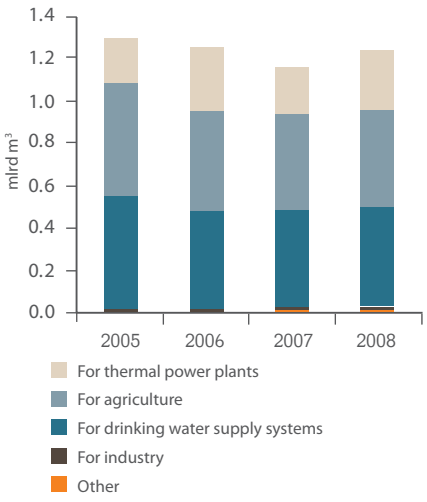


Figure 7.4 Total annual abstraction of fresh waters except for abstraction for hydropower stations

There are a significant number of on-going projects in almost all regions of Georgia aimed at improving the integrity of the water supply systems, reducing water losses, improving the continuity of supply, and improving water quality. It is also necessary to improve groundwater quality monitoring, especially in those regions where the local population use groundwater as a drinking water source without any treatment. The priority areas for investigation in this regard are: Zugdidi, Tskaltubo, Telavi, Marneuli, Gardabani and Gori municipalities.

There are several on-going projects throughout Georgia involving the construction of new wastewater treatment plants, or updating and expanding existing treatment plants. Given the number of sewage systems that need to be upgraded and the costs involved, the renovation project will need to be conducted over an extended period. For example:

- The refurbishment and expansion of the Tbilisi-Rustavi treatment plant including the instillation of full biological treatment is planned to be complete by 2018 .
- The step-by step improvement of the Batumi water supply and sewage system has been underway for several years. Projects on the construction of biological treatment plants have been prepared for all settlements located within the Black Sea coastal

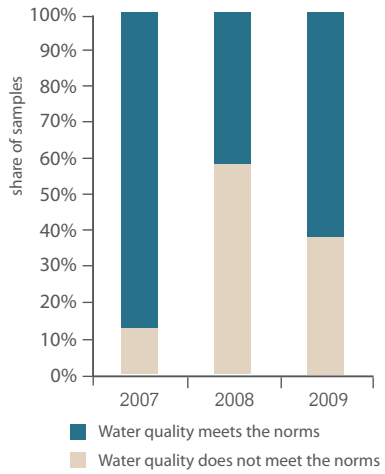


Figure 7.6 Drinking water quality according to the monitoring results of the Food Safety, Veterinary, and Plant Protection Service of Georgia

zone, from the Turkish border up to Batumi.

- A similar incremental improvement programme is also being implemented for the water supply and sewage systems in Poti, Kutaisi, Borjomi and Bakuriani. Plans for the construction of biological treatment plants for the waste waters of Poti Kutaisi, Borjomi and Bakuriani has been prepared and approved. The dates for construction of these plants will be determined when appropriate financial sources have been secured.

- The construction of a biological waste water treatment plant in Ninotsminda is in its final stage.

Notwithstanding the improvement projects outlined above, there are still a number of towns and villages in need of improved waste water treatment systems. The rehabilitation of water supply and sewage systems and the construction of collectors for waste waters and treatment facilities for the popular resorts of Abastumani, Tskaltubo, Ureki, Kobuleti, Sairme, and Shovi, where water is used for recreational and medicinal purposes, is seen as a priority.

IV

PROTECTION OF LAND RESOURCES

IV/8

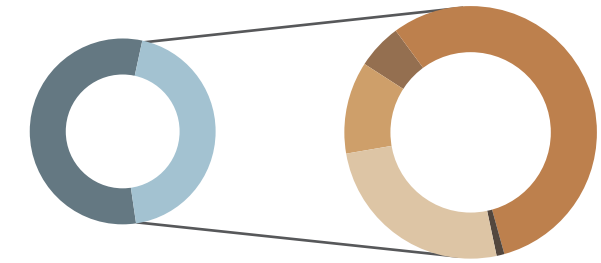
LAND RESOURCES AND SOILS

Protection of land and soil is essential for a small country like Georgia. The over exploitation of land, improper agricultural and irrigation practices, changes in land cover and improper use of agricultural chemicals result in the degradation of land and soil. This results in soil pollution, erosion, structural degradation, and loss of soil fertility. It is necessary to develop a comprehensive national policy for soil protection and land management.

IV/8. 1. INTRODUCTION. LAND RESOURCES AND SOILS OF GEORGIA

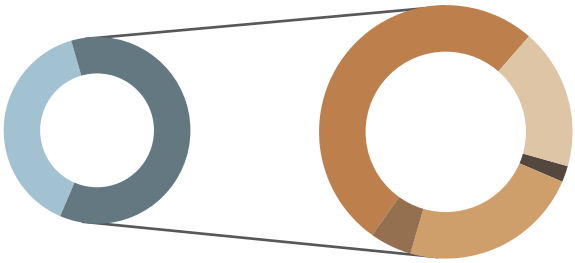
Land resources are limited in Georgia. The territory of the country (without territorial waters) is 69,700 km^2. According to 2005 data, the total area of agricultural lands is 30,200 km^2 of which cultivated lands (arable lands and land under perennial crops) account for 10,700 km^2 (Figure 8.1).

Land in Georgia is divided into two legal categories, land designated for agriculture (40%) and land designated for non-agricultural purposes (60%). The latter includes state and municipal forests (the Forest Fund), protected areas, land covered by water (the Water Fund), urban and industrial areas, and land under roads and other infrastructure. The breakdown by land use type is shown in Figures 8.1 and 8.2.



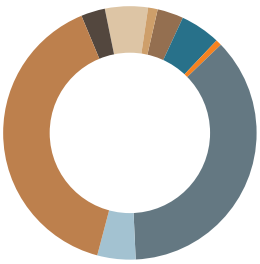
- Lands designated for non-agricultural purposes - 56 %
- Lands designated for agriculture - 44 %
- Pastures - 26 %
- Territories under household constructions - 0.3 %
- Arabel land - 12 %
- Perennial crops - 4 %
- Meadows - 2 %

Figure 8.1 Land use types and categories of Georgia (2005)



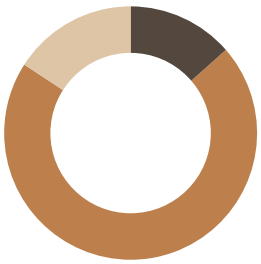
- Lands designated for agricultural purposes - 60 %
- Lands designated for non-agriculture - 40 %
- Forest Fund - 31 %
- Territories of settlements - 1 %
- Water Fund - 11 %
- Other - 13%
- Protected Areas - 4 %

Figure 8.2 Land use type of the territory of Georgia according to the legal status of the lands (including territorial waters with an area of 6,785 km^2), 2005 data.



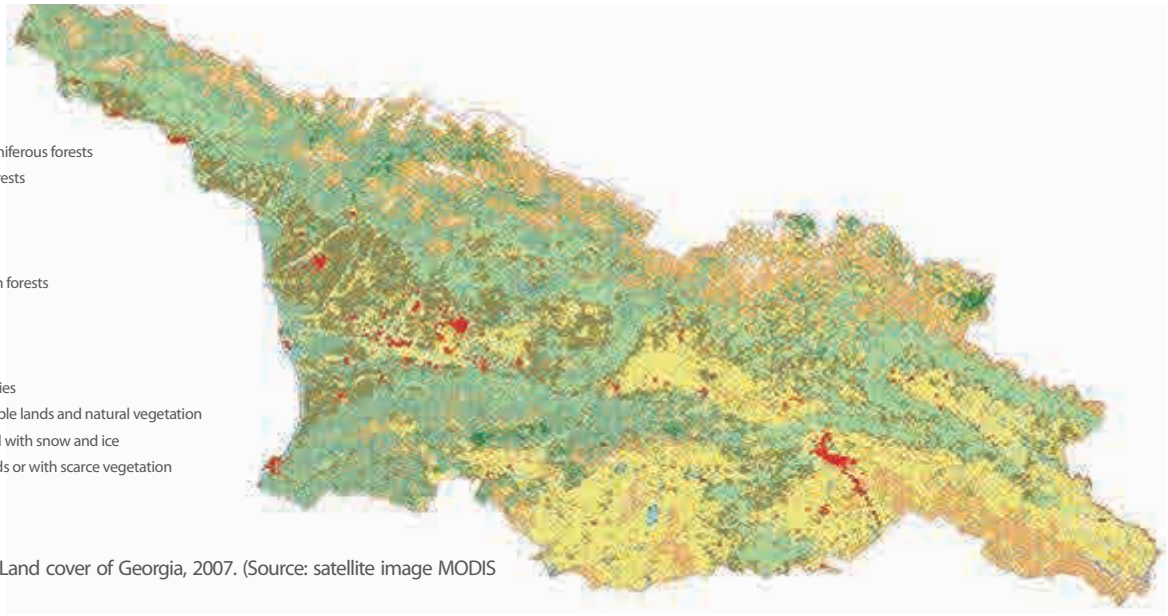
- Fields (arable, meadows, pastures) - 39 %
- Perennial crops - 4 %
- Forests and bushes - 41 %
- lands under water - 3 %
- Rocks, gorges, sands - 4 %
- Cities and towns - 1 %
- Land under industrial, transport and other infrastructure - 3%
- Other non-agricultural lands - 5 %
- Village households - 0.3 %

Figure 8.3 Distribution of lands according to land cover (2004)



- Territoriess of natural-economic use (forests, bushes, meadows, pastures)
- Cultivated territories (arabel land, fruit gardens, vineyards)
- Unusable territories for agriculture and forestry

Figure 8.4 Distribution of lands according to their use/cultivation (2004)



Map 8.1 Land cover of Georgia, 2007. (Source: satellite image MODIS 2007)

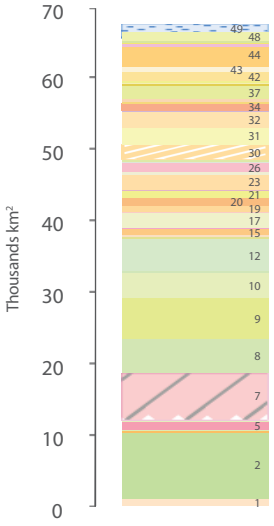


Figure 8.5 Total area of each type of soil in Georgia

Type of soil

1. Primitive mountain-meadow - Leptosols
2. Mountain-meadow soddy - Leptosols, Cambisols and Cryosols
3. Mountain-meadow soddy-peat - Leptosols and Histosols
4. Mountain-meadow bog - Gleysols and Histosols
5. Mountain-meadow chernozem-like - humic Leptosols
6. Mountain-forest-meadow - humic Cambisols
7. Brown forest acid - dystric Cambisols
8. Brown forest weakly unsaturated - eutric Cambisols
9. Brown forest podzolized - dystric Cambisols
10. Yellow-brown forest - chromic Cambisols and stagnic Alisols
11. Brown forest-black - humic Cambisols and Phaeozem
12. Raw-humus calcareus - rendzic Leptosols
13. Raw-humus calcareus - eroded rendzic Leptosols
14. Terra-Rossa - rodic Cambisols and Luvisols
15. Red soils - Alisols
16. Red podzolized soils - stagnic Alisols
17. Yellow soils - chromic and feralic Cambisols
18. Yellow podzolized soils - stargi-feralic Cambisols
19. Subtropical podzol - stagnic Acrisols
20. Subtropical orstein podzol - plintic and stagnic Acrisols
21. Subtropical grey podzol - Gleysols
22. Leached chernozem - Phaeozem and Chernozem
23. Chernozem
24. Vertic chernozem and Vertisols
25. Black - Vertisols
26. Black calcareus - calcic Vertisols
27. Black alkalized and halomorphic - natric Vertisols
28. Meadow-black - gleic Vertisols
29. Meadow-black alkalized and halomorphic - gley-natric Vertisols
30. Cinnamonic leached - calcic Kashtamozem
31. Cinnamonic - eutric Cambisols and calcic Kashtanozem
32. Cinnamonic calcareus - calcaric Cambisols and calcic Kashtanozem
33. Cinnamonic light - calcic Kashtanozem
34. Meadow-cinnamonic - calcaric Cambisols and calcic Kastanozems
35. Meadow grey-cinnamonic - calcic Vertisols
36. Grey-cinnamonic dark - calcic Kastanozem
37. Grey-cinnamonic - calcic Kastanozem
38. Grey-cinnamonic light - calcic Kastanozem
39. Humus sulphate - Gypsosols
40. Solonez
41. Solonchak
42. Alluvial acid - dystric Fluvisols
43. Alluvial saturated - eutric Fluvisols
44. Alluvial calcareous - calcaric Fluvisoils
45. Sitly-bog - Gleysols
46. Peat-bog - Histosols
47. Antropogenis soils - antric Regosols and Anthrosols
48. Strongly eroded soils and bare rocks - bare rocks and Leptosols
49. Glaciers

Map 8.2 Soils of Georgia. (Source: Ministry of Agriculture).

The territory of Georgia can be divided into three main land use types: cultivated lands, natural economic areas (forests, brush woods, hay lands/pastures), and areas unusable for agriculture and forestry (Figure 8.4).

Five climatic belts and eight soil zones can be identified in Georgia. There are 49 soil types concentrated on 10 different soil-forming rocks. The main soil types distributed in Georgia are shown in Figure 8.5, while their location are given on the map of Georgian soils (Map 8.2).

Soils suitable for agricultural use are quite restricted in Georgia, with 65-70% of the country covered by poor soils with insufficient nutrients to provide normal growth and productivity for agricultural crops.

The main agricultural lands suitable for cultivation are

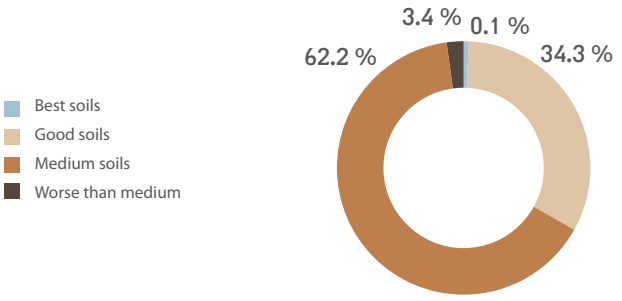


Figure 8.6 Shares of soils of different suitability for the cultivation of the main agricultural crops (quality index) as a percentage of the total area of cultivated lands. Source: 'Soil Atlas for Evaluation of Productivity and Protection of Natural Resources'.

cinnamonic, grey-cinnamonic, black, raw-humus calcareous, subtropical podzol, red, yellow, sitly-bog and soddy-peat soils. Quite a large proportion of agricultural land (6,7%, or 205,000 ha) has less productive and saline soils. Besides that, 8% (300,000 ha) are covered by acid soils and 7,3% (210,000 ha) by boggy soils.

In terms of suitability for crop cultivation, Georgian soils can be characterized as 'good' and 'medium' [1] (Figure 8.6). There is practically no land area containing soils considered 'best' for agricultural use.

In addition to soil quality, the suitability of lands for agricultural purposes is determined also by its altitude. There are 6 vertical zones presented in Georgia as follows:

- I zone (up to 250 m above the sea level) – main distribution area of subtropical perennial cultures in West Georgia (tea, citruses, laurel);
- II zone (250 - 500 m) – horticulture/gardening, viticulture, field crops (mainly maize) cultivation area;
- III zone (500 – 1,000 m) - dominate field crops cultivation, natural pastures, cattle breeding;
- IV zone (1,000 – 1,500 m) - mainly hay lands and pastures; field crops cultivation is weakly developed;
- V zone (1,500 – 2,000 m) – mostly hay lands and pastures;
- VI zone (above 2,000 m) – no agriculture.

State Regulation

From 1992 to 1998, 55% of agricultural lands were privatised free of charge. The land reform of Georgia can be divided into two stages; from 1991 until 1998, there was reform of agricultural lands and from 1999 until 2003 there was reform of non-agricultural lands.

Agricultural lands and those non-agricultural lands that do not belong to the Forest Fund, Water Fund, protected areas, recreational lands, and lands of historical, cultural, natural, or religious monuments, are currently the subject of privatisation.

The use of privatised agricultural lands for non-agricultural purposes is prohibited. This means that the construction of buildings, or the construction and operation of industrial facilities on agricultural land is prohibited, with the exception of a private house or other facility for use by the land owner. If it is necessary to use agricultural lands for industrial, or other urban purposes, the interested party must apply to have the category of use changed and pay the appropriate compensation, from 34,000 to 100,000 GEL per ha, depending on land location. As of 2010, the National Agency of Public Register within the Ministry of Justice was responsible for changing the designation of agricultural land categories, while the Ministry of Environment and Natural Resources of Georgia was responsible for changing of categories of lands designated as recreational areas, or agricultural lands within the administrative boundaries of Tbilisi and Batumi.

Regardless of land category, it is a requirement to remove and store topsoil for reuse for any land that is to be used for industrial or commercial purposes. The removed topsoil cannot be carried away from the site or sold. In case of temporary activity such as the mining of mineral resources, or development of a landfill, the land must be restored and re-cultivated using the stored topsoil.

Regardless of land ownership, all soils are subject to state protection. As such, it is prohibited to:

- Cause any kind of pollution;
- Arrange terraces of slopes without appropriate design and soil selection;
- Deteriorate pastures through over grazing, in particular by maintain higher stocking density than permitted on high mountain pastures;
- Damage the soil cover during forest use;
- Fell or modify shelter belts or damage any other structure put in place for the prevention of soil erosion;
- Use fertilizers, or other agricultural chemicals, which have not been tested, registered and approved for use in Georgia;
- Conduct any other activity that would result in the deterioration of soil quality.

IV/8. 2. STATE OF LANDS AND SOILS

Soil erosion takes place on quite a large scale in Georgia, due to the climate, geology and the mountainous nature of the country. Soil erosion is a natural process, though the severity of the process can be enhanced by human intervention such as the unsustainable use of soil. Erosion can be caused by water or by wind, or by the processes of salinization or water logging (Maps 8.3 and 8.4).

Erosion processes have been particularly enhanced during recent years as result of climate change and frequent natural disasters. There is a widespread trend of decreased soil fertility as evidenced by poor soil nutrient and humus content in all types of soils, observed across the country. According to data of the Ministry of Agriculture (2006), around 60% of agricultural lands are of medium or low productivity. Soil fertility losses are being accelerated by improper use of agricultural lands such as overgrazing, intensive farming, and ploughing of steep slopes. Salination and acidification processes are accelerated by use of acidic nitrous fertilizers.

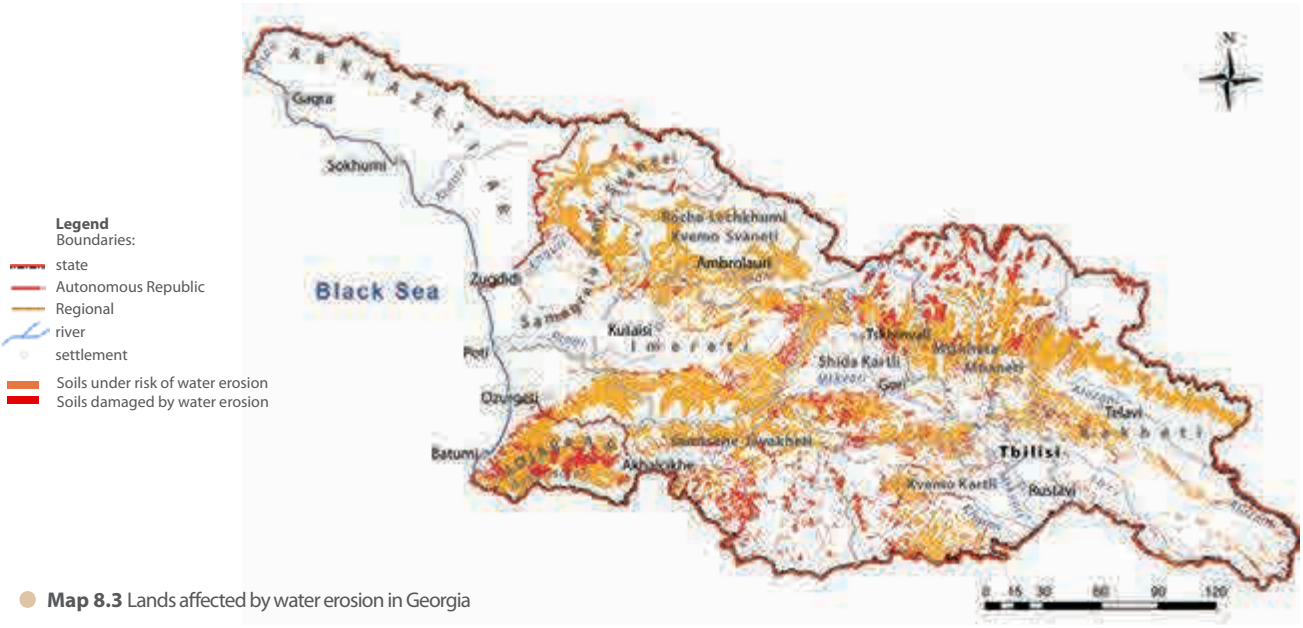
National Strategy to Combat Desertification

One of the most prevalent forms of land degradation is land desertification, which results in the progressive loss of plant cover in dry steppes and semi-deserts. Desertification is on-going in Georgia with the most sensitive districts being Shida and Qvemo Kartli, part of Kakheti (Dedoplistskaro, Signagi and Sagarejo municipalities). Desertification process covers Shiraqi, Eldari, Iori, Taribani, Naomari, Ole, Jeiran-Choli valleys, their watershed ridges, uplands and the most parts of Kakheti ridge slope.

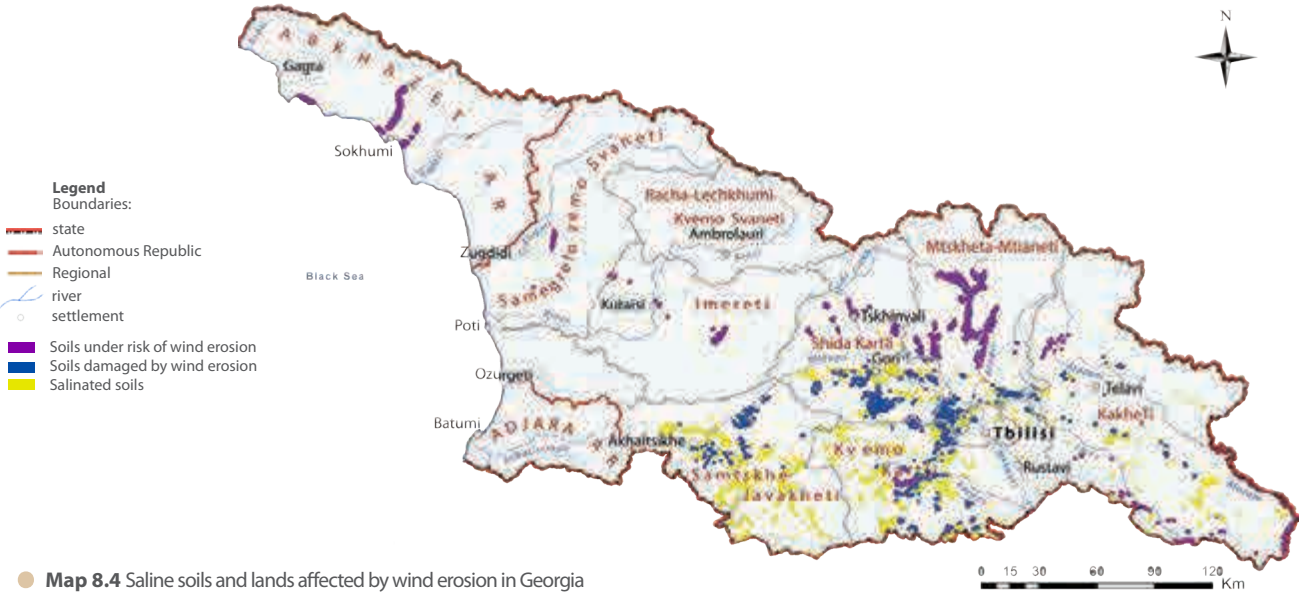
The desertification zone in Georgia starts from an altitude of 300-400m above sea level. The desertification processes also observed in South Georgia in Akhaltsikhe hollow and Shida Kartli within the Kaspi district. In these areas, desertification is due to wind erosion mainly as a result of the destruction of wind shelter belts, increased drought frequency and rising average temperatures in the area over the last decade.

Desertification in Georgia is not solely a result of climatic, geologic and soil conditions, but is also enhanced by erosive processes, both natural and manmade. The following activities are considered to have enhanced the erosion processes:

- The uncontrolled felling of light floodplain forests. These forests were especially damaged in between 1993 and 2003, when they were used by many people as a fuel resource.
- Fires of unnatural or anthropogenic origin. In order to improve the temporary productivity of pastures, shepherds burn off vegetation regularly in spring. This practice also causes a decrease in herb diversity.
- Inappropriate use of irrigation systems. It is not always beneficial to irrigate soil in mountainous areas. Soils can be washed out and lost; gypsum and clay migrate in the direction of the slope and accumulate in the plane, and gypsum can be crystallized out. Plant cover on such damaged lands cannot be recovered. The irrigation systems pumping water up to the altitude 500-600m (using electric energy) were also problematic. From an economic point of view this activity was unreasonable, and after the breakup of the Soviet Union, it was ceased.
- Overgrazing. The semi-arid zone (Iori Plateau and the adjacent areas) in Georgia have traditionally served as winter pasture. Before the Soviet period, pastures



Map 8.3 Lands affected by water erosion in Georgia



Map 8.4 Saline soils and lands affected by wind erosion in Georgia

were managed using the traditional rotation system, which was developed over the centuries ensuring the sustainable use of pastures. This system was created based on community land use that encouraged the shepherds to properly assess the state of pastures. This system was incompatible with the Soviet economy, and private ownership, as well community land use were abolished. The beginning of the degradation processes of the arid and semi-arid pastures coincides with this period. While the sheep droves are again migrating between summer and winter pastures, the situation is still not improved, because the droves stay at the summer pastures for an extended period (8-9 months) leading to over grazing the pastures. As a result, the plant cover becomes degraded, exposing the soil and making it more vulnerable to erosion.

The Convention on Combating Desertification was established in 1994, and Georgia ratified the convention in 1999. Georgia's National Action Program for Combating Desertification was adopted in 2003. This action programme identifies the priority areas under threat of desertification in Georgia. It also defined the main factors causing desertification within these priority areas, and the short and medium term measures (2003-2007)

to combat desertification, the expected outcomes, and implementation dates.

The programme envisages research and analysis of the existing problems, in addition to activities aimed at the preparation of special action plans. In addition, the programme defines special measures to maintain biodiversity based on the pressures associated with desertification.

The programme also envisages measures for the agriculture sector, including, categorisation of existing pastures and determining appropriate stocking densities; support in applying traditional knowledge and experience; development of management principles and plans for arable lands; and developing sustainable use programs for agriculture.

The National Action Program for Combating Desertification has not been fully implemented due to scarce financial resources, however some initiatives are being undertaken. For example, one of the projects aimed at the rehabilitation of degraded lands is being implemented in the Dedoplistskaro municipalities, recognised as one of the most sensitive districts to the climate change and land degradation processes. In particular, the reinstatement of shelterbelts and light forests, which were destroyed in the last decade, is a key aim within the timeframe of this project. This project also aims to re-introduce sustainable management practices of pastures. The project is financed by German Internationl Cooperation Society (GIZ).

IV/8. 3. MAIN CHALLENGES

The Ministry of Agriculture carries out various measures on a regular basis to assess the state of soils and to protect them from erosion. During the period 1998 to 2003, two major programmes were implemented for this purpose: 'The improvement of productivity of saline and acid soils' and 'The protection of soils from erosion processes'. The finances necessary for the implementation of these programmes was limited, and as such the geographic scope of the programmes was restricted. In particular:

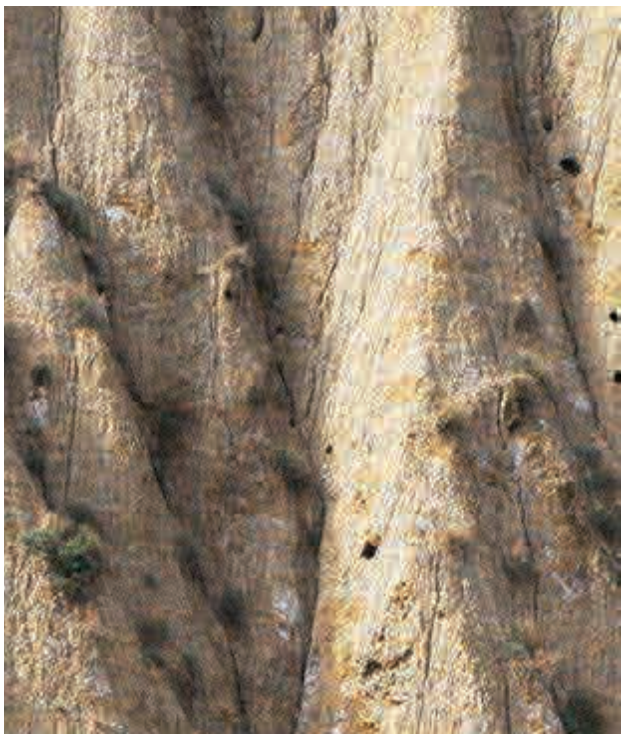
- 80,000 GEL were allotted from the state program in 2004 for the implementation of measures to prevent erosion. To prevent erosion processes, trees were planted on the area of 24 ha in Adjara.
- An information booklet 'Recommendations on Erosion Preventive Measures' has been issued to raise public awareness.

The National Program on Protecting and Enhancing Productivity of the Soils of Georgia for 2003 to 2010 was prepared in 2003, and was aimed at further research, chemical melioration, and erosion protection measures for impoverished and acid soils. Unfortunately, this programme has not been implemented due to lack of financial resources.

The main issues of concern regarding to soils are as follows:

- The overuse of fertilisers without prior soil testing, which causes loss of productivity in almost in all types of soils.
- Acceleration of negative processes in the soils such as salination, secondary waterlogging and acidification which results in removal of thousands of hectares from agricultural use, and the degradation of lands of higher categories to lower categories.
- Acceleration of erosion processes result in losses of thousands tons of productive soil and increases the risk of landslides and development of ravines.

In 2010, the National Environmental Agency within the Ministry of Environment of Georgia commenced a monitoring programme for heavy metals and oil products in soil samples. It is also planned to establish a monitoring programme for soil pollution.



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IV/9

NATURAL DISASTERS

Due to the complicated landscape and specific geographical conditions, natural disasters in Georgia are characterized by high extensiveness, frequency and risk level. During recent decades, a significant increase in the frequency and intensity of hydrological, meteorological and geological natural disasters has been recorded in Georgia. This increase is considered to be the consequence of a negative impact of human activities on the state of environment (such as deforestation, overgrazing of pastures, industrial land use changes without proper evaluation, etc.), coupled with phenomena attributed to global climate change.

In order to minimise the loss of human life and reduce the economic damage, an Early Warning System, based on appropriate monitoring, analysis and forecasting of these phenomena, is under development.

IV/9. 1. INTRODUCTION

Natural disasters cause considerable damage to the economies of countries and often lead to human casualties. Protection of the population's safety, the integrity of infrastructure and land productivity, are the main socio-economic, demographic, political and environmental concerns pertaining to natural disasters all over the world, and in particular in mountainous countries where such incidents are more prevalent. Over the last years, this problem has become more acute due to the implications of global climate change.

Approximately 60% of all types of natural disasters and more than 80% of their damage are caused by extreme weather events. Climate change is causing an increase in frequency and intensity of (hydro- meteorological) extreme weather events, which respectively results in the progression of occurrence of such natural disasters as landslides, floods and mudflows.

State Regulation

Georgia is actively participating in international processes aimed at minimizing the risk of natural disasters and determining appropriate mitigation measures. The World Summit held in Johannesburg (South Africa) under the auspices of the United Nations in 2002 and the World Conference on Disaster reduction held in Hyogo (Japan) in 2005 are of particular importance. Resolutions adopted at these conferences form the basis for development of early warning system, forecast of disasters and disaster risk reduction.

It is noteworthy that United Nations Development Assistance Framework (UNDAF) 2011-2015, the common strategic planning framework for UN development operations and assistance in Georgia, envisages disaster risk reduction as one of the three priorities of assistance. Based on the Hyogo Framework for Action, the document sets targets and contributes to Disaster Risk Reduction national goals through involvement of all relevant stakeholders.

In 2007, the Law on the "Protection of the Territory and Population from Emergency Situations caused by Natural and Technological Disasters" was adopted. In 2010, the President of Georgia, by order #707, approved Georgia's Threat Assessment Document for 2010-2013, which lists natural and man-made disasters among other threats. Likewise, of particular importance is the 2008 National Response Plan on Natural and Man-made Emergency Situations (Presidential Decree #415). It defines roles and responsibilities of state institutions in emergency situations.

IV/9. 2. NATURAL DISASTERS IN GEORGIA

With the potential magnitude of negative impacts associated with natural disasters on the population, agricultural lands and infrastructure, Georgia is one of the countries most sensitive to natural disasters among mountainous regions of the world. Water based erosion, landslide-gravitational and mudflow processes are the most frequent natural disasters of geological character that occur in Georgia.

At the same time, the geographic location of Georgia and its complex topography result in atmospheric conditions that give rise to extreme meteorological and hydrological events. There are frequent floods, flash floods, heavy rains, droughts, avalanches, and strong winds.

Changes in the frequency of natural disasters

According to scientific studies, in light of climate change, the frequency of natural disasters has increased significantly in recent decades.

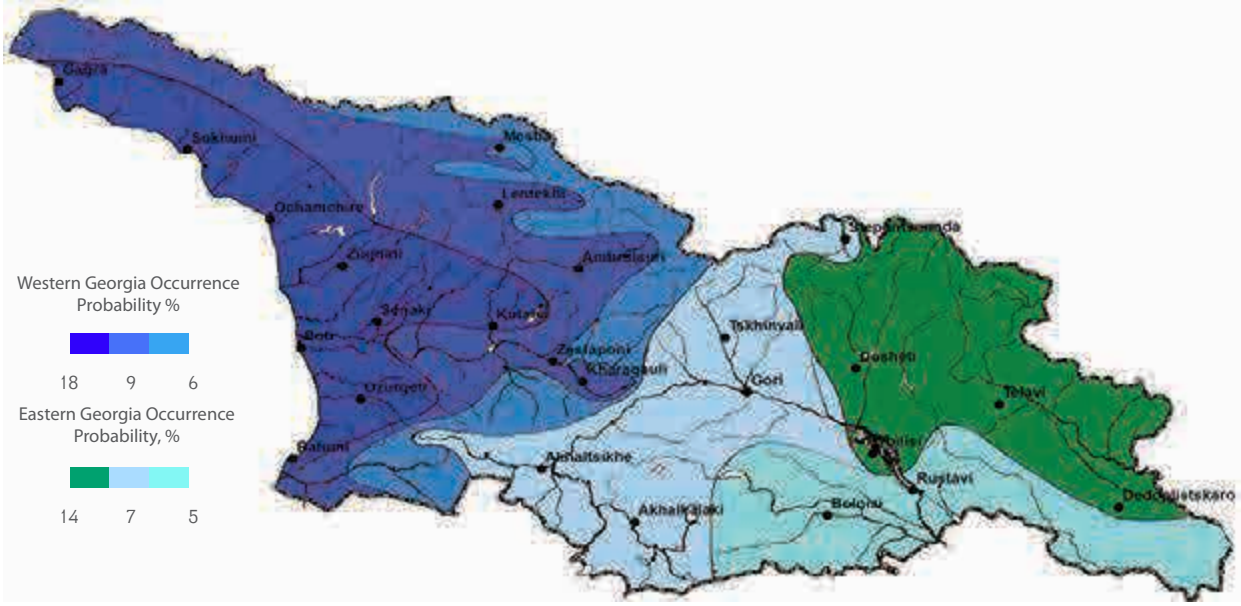
- Up until 1995 floods occurred on average 3 to 5 times per year and varied between 2 to 20 times per year after 1995. In 2007-2009, it reached a range of between 7 to 20 occurrences per year (See Figure 9.4). During the last 3 years floods and flash floods claimed life of 7 people and caused damage assessed at 110 million GEL.
- In the recent past, the drought cycle for Georgia has changed from 15-20 years to 6 years (See Figure 9.5). Over the period 1995 to 2009, droughts inflicted on agriculture a reported economic loss of 400 million GEL in the agricultural sector.
- Since 1970, the increase in frequency and intensity of avalanches has been observed. Large slides were recorded during the winter period in 1970- 1971, 1975-1976, 1986-1987, 1991-1992, 1996- 1997, and 2004-2005. The areas of Svaneti, Mountain Adjara, Tusheti, Kazbegi, and Dusheti districts were significantly damaged and 176 human causalities were recorded. Over the period from 1970 to 1987, more than twenty thousand people were displaced from their homes. In 2007-2009, twenty avalanche events took place, claiming 3 lives.
- The most intensive hail falls were observed in 1983, 1987, 1993, and 1997 (See Figure 9.7). According to incomplete data, damage caused by the hail falls during the last 14 years is estimated as 150 million

Map 9.1 Landslide risk zones in Georgia

Landslides can occur in almost all locations in Georgia, from the coast up to high mountain regions. Approximately 1.5 million hectares of Georgia is at risk of landslides.

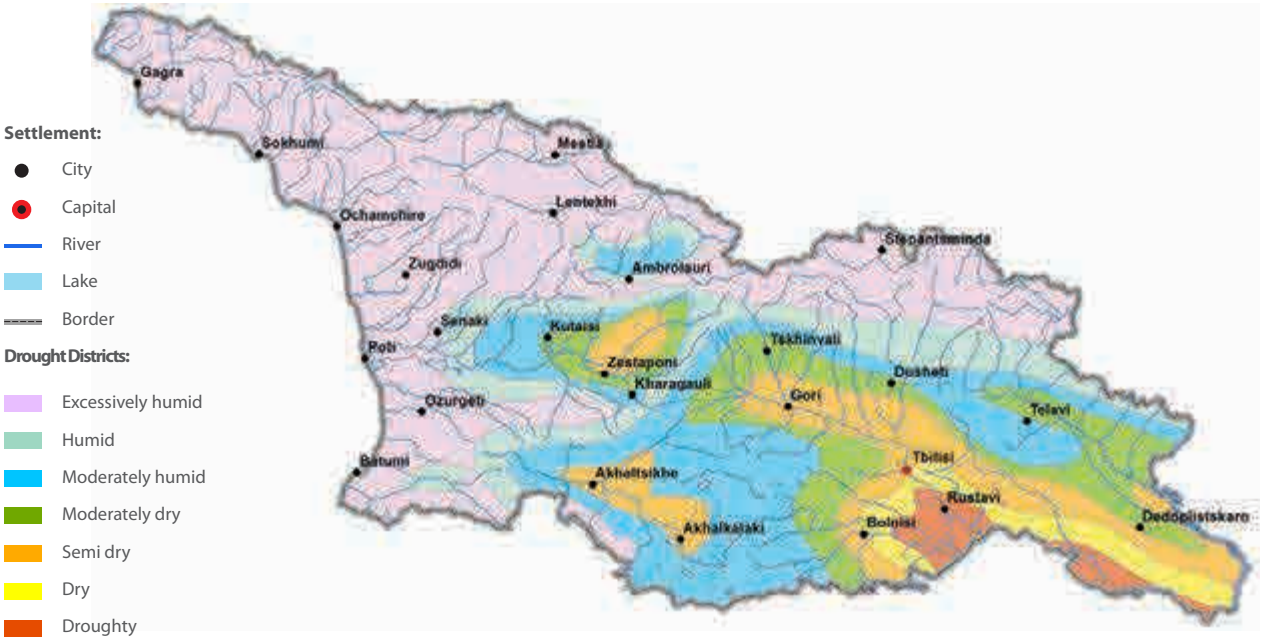
Map 9.2 Mudflow risk zones in Georgia

Mudflows are common place for approximately 3,000 erosive water courses in Georgia. An estimated 2 million hectares of the territory of Georgia is at risk of mudslides. The most intensive and frequent mudslides are observed in the Caucasus ridge areas of which are underlain by clay shale, Tsiv-Gombori and Saguramo-Ialno ridges and Adjara-Trialeti mountain system.



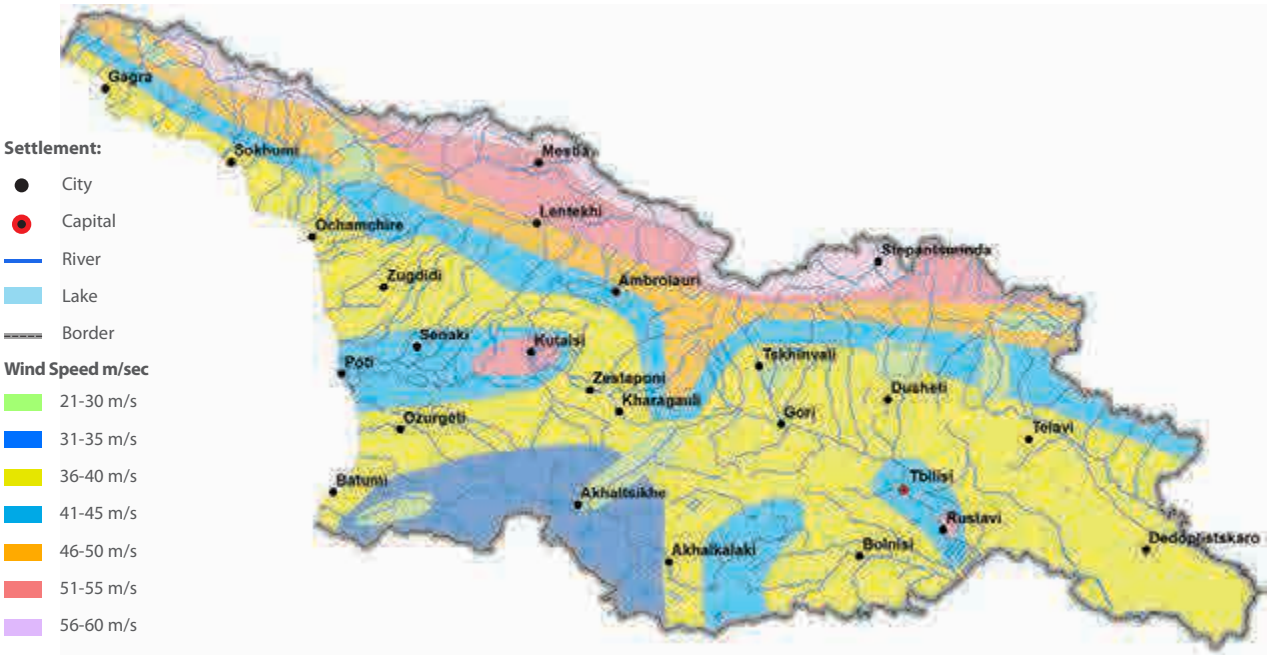
Map 9.3 Areas at Risk of Flooding in Georgia

Almost all rivers in Georgia are prone to sudden increases of water levels which can give rise to flooding. The rivers of Imereti, Samegrelo, Guria, Mtskheta-Mtianeti, as well as the rivers of Mtkvari basin (including Alazani) are at most risk of flooding.



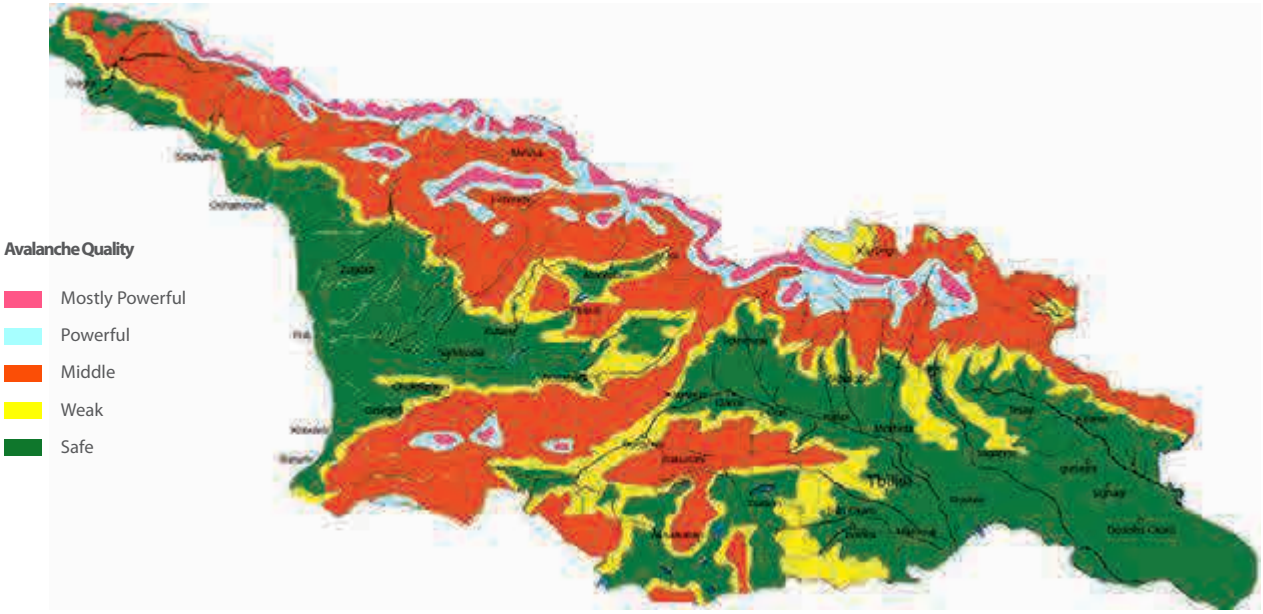
Map 9.4 Regions Prone to Drought in Georgia

Droughts are observed across almost all of Georgia. Drought conditions are frequent and pronounced in the Shida Kartli and Qvemo Kartli regions, in Kakheti, and Zemo Imereti.



Map 9.5 Areas with High Wind Speeds in Georgia

Frequent strong winds are observed in the Caucasus ridge zones, Kolkheti lowlands, Zemo Imereti, Shida Kartli, Tbilisi, Gare Kakheti, and Samtskhe-Javakheti regions.



Map 9.6 Risk of avalanches in Georgia

Over half the territory of Georgia is at risk of snow avalanches. Avalanches are especially intensive in the mid and high mountain zones. The zones most at risk are the western and central segments of the Caucasus and Guria-Adjara mountains.

Map 9.7 Areas with intensive hail fall in Georgia

Hail falls are observed throughout all of Georgia. The intensity and frequency of the hail falls are higher in East Georgia.

GEL. Over the period 2007 to 2009, twenty seven hail falls were observed with economic loss (inflicting economic loss) of 20 million GEL.

- In 1995-2006, the recurrence of strong winds varied between 1 to 4 times per year. From 2007 to 2009, the frequency of strong winds increased to 6-12 times per year (See Figure 9.6). Over this period the economic damage caused by strong winds was estimated (based on incomplete data) at approximately 12 million GEL, with nine human casualties.
- In 1982, coastal erosion occurred along 220 km of the total 320 km of the Georgian Black Sea coastal line. The alarming rate of coastal erosion was arrested to some degree by applying artificial beach-forming methods, increasing the solid sedimentation process. Between 1982 and 1990, coastal erosion was confined to approximately 8 km and the total area of newly created beaches reached 150 hectares. Since 1992, the 'artificial creation' of the coastal line was ceased and consequently the coastal erosion process has resumed in vulnerable areas that were previously protected. Today this process has intensified. Areas of high amenity are being significantly impacted; occasionally, expensive lands used for tourism-recreational purposes are beying destroyed; landslides are repeatedly occurring in numerous districts, particularly in Mussera, Akhali Athoni, Eshera, Gonio, and Tsikhisdziri.

Landslides and mudflows are the most extensive and dangerous natural disasters in Georgia. Furthermore, the landslide hazard keeps increasing by geometrical progression on an annual basis.

- By 2009, approximately 53,000 sites damaged by landslide-gravitational processes, or under the risk of such damaged, have been identified. Around 2, 000 settlements and 25-30% of road and pipeline networks are located within this high-risk zone.
- It is estimated that on an annual basis mudflows cause damage of approximately 100 million USD. However, economic damage in the case of extreme mudflow events might exceed hundreds of millions of USD. For instance, the economic damage caused by mudflows in mountains of Adjara over the 1982 to 1998 period was assessed at approximately 500 million USD. Over the period 1987 to 1991, economic damage caused by mudflows at a national level exceeded one billion USD, while damage caused by mudflows during 1995 to 2008 surpassed 330 million USD, claiming lives of 43 people. There were numerous glacial mudflows in the basin of the river Tergi. The most tragic of them occurred in 2002, when the glacial mudflow passed from the mountain Mkinvartsveri through the river Karmadoni canyon, killing 130 people. In 2007, Devdoraki gorge glacial mudslide demolished 500 meters of the central highway of Georgia in Dariali range.

Untill the last decades of the twentieth century, landslide and mudslide processes characterized by certain cyclic character, were linked to particular geological-climatic conditions occurring once in 2-5 years. Starting from the 90's, these processes became more activated, occuring almost every year and covering more and more territories, settled areas and engineering facilities (See table 9.1 and 9.2).

IV/9. 3. MAIN CHALLENGES

It is important to ensure that effective management measures are put in place in order to prevent and mitigate the possible negative consequences of natural disasters. The key activities here are monitoring, preparedness and timely warning-informing the public.

In order to reduce the negative consequences of natural disasters, it is very important in the first place to determine the location, type, and scale of the expected phenomenon, as well as the estimated impact of such an event on the population and infrastructure. Based on this information, in order to minimise the impact of natural disasters, it becomes possible to prepare action plans that include measures to be undertaken at regional, municipal and local levels. Some of these measures include complex infrastructural works (such as hydro-engineered bank fortification works or construction of artificial beaches), which must be implemented well in advance. Further, the other part includes provisions for disaster response measures.

Making the public fully aware of the risks associated with natural disasters and what can be done to minimize these risks is essential, as well as the provision of timely information to the population when such event is forecast. It is of crucial importance to inform people on simple preventive or protective measures that can be easily implemented by municipalities, communities or residents themselves.

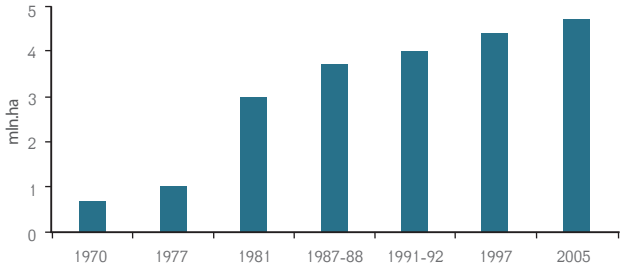


Figure 9.1 Area of Georgia affected by and under risk of damage from geological disasters.

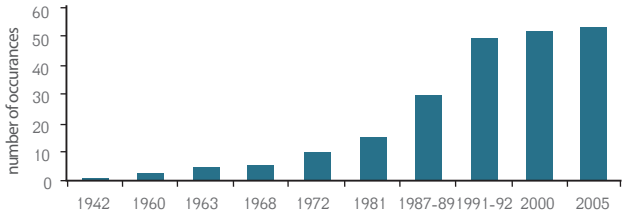


Figure 9.2 Number of landslides recorded by year

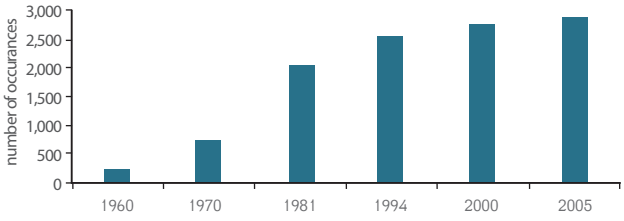


Figure 9.3 Number of mudflows recorded by year

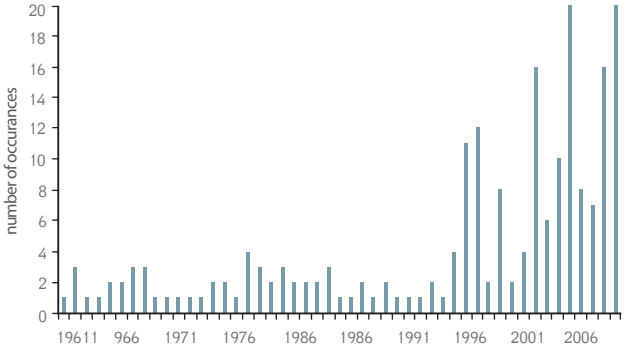


Figure 9.4 Frequency of flooding observed in Georgia between 1961 and 2009

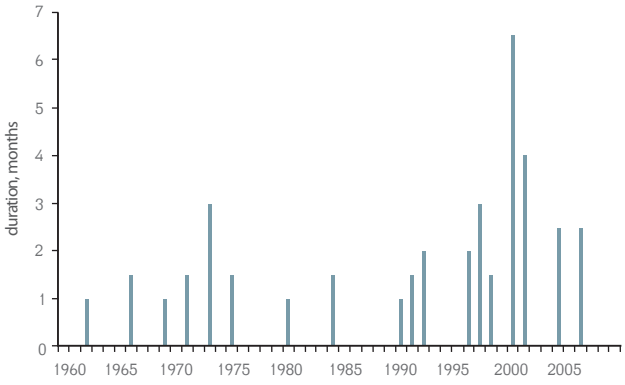


Figure 9.5 Duration of drought periods in Georgia between1960 and 2009

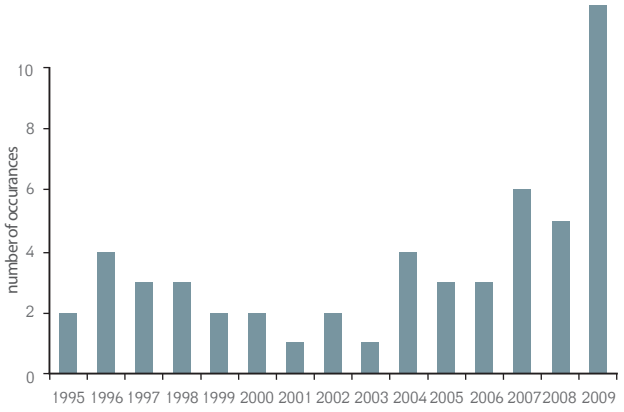


Figure 9.6 Occurrence of strong winds in Georgia between1995 and 2009

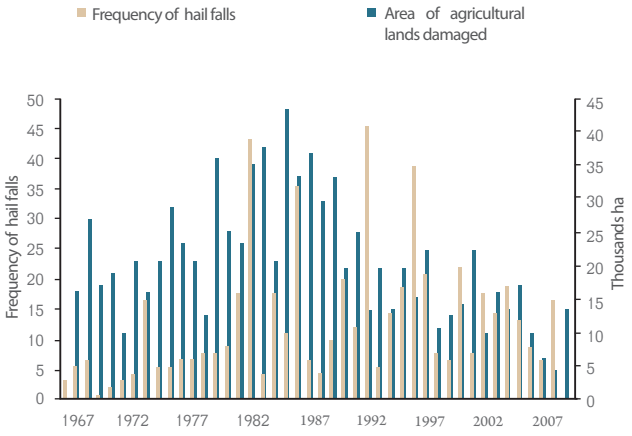


Figure 9.7 Frequency of hail falls and areas of agricultural lands damaged between 1967 and 2009

Therefore, establishing of an effective early warning system is essential. An appropriate network of hydro-meteorological and geo-monitoring, the associated data management and forecasting capabilities are fundamental to adequately assess the risks of natural hazards and forecast their occurrence. In recent years, certain measures in this direction have been undertaken. The hydro-meteorological observation network was extended to some degree, hydrologic forecasting was improved, the geological processes all over the country were catalogued and the risk factors, associated with their occurrences, defined. However, a further extension and upgrade of the hydro-meteorological network is still required together with more comprehensive studies of geological processes and hazards (especially in the mountainous regions).

There are regular hydro-engineered bank fortification works undertaken to protect people from floods and mudflows. In 2009, for example, almost 9 million GEL was spent on provision of such measures and 30 dangerous shore sites were strengthened through construction/rehabilitation of ground dams, stone or concrete dikes. The climatic and geologic conditions of the country require that such activities are continued in the future on a regular basis.

Years	Landslide			Mudslide				Threatened units		
	Manifestation (activated and newly developed)	Approximate direct damage, mln . GEL	Casualties	Mudslide frequency	Approximate direct damage, mln . GEL	Casualties	Total damage, mln. GEL	Damaged agricultural land, ha.	Number of settlements	Living houses
1995	670	132	6	250	96	12	228	179	274	195
1996	610	80.3	3	165	27	5	107.3	232.3	403	626
1997	871	102	2	335	44	7	146	336.5	458	227
1998	543	67	5	173	20	6	87	229.6	370	159
1999	56	12	1	27	4.5	-	16.5	137.8	157	314
2000	65	13	1	23	3.0	-	16	162.2	240	207
2001	75	15	-	26	4.0	-	19	127.5	191	127
2002	69	13.8	1	23	2.5	2	16.3	147.9	203	193
2003	71	14.5	3	28	4.0	-	18.5	106.5	90	207
2004	949	147	4	258	28	2	175	16,289.2	755	6,042
2005	603	96	-	155	9.0	4	105	7,589.6	473	3,682
2006	356	70.5	1	63	9.0	-	79.5	3,172.5	531	2,066
2007	136	20.5	-	104	11.5	-	32	1,389.1	269	707
2008	311	48	-	126	15	8	63	1,387.7	392	1,198
2009	323	63.5	1	193	16.5	3	80	8,232.3	521	2,696
total	5,708	895.1	28	1,949	294	49	1,189.1	397,219.7	5,327	18,646

Table 9.2 Intensity of landslides and mudflows identified in urban areas of Georgia during regional geological monitoring between 1995 and 2009 and the estimated resulting damage

years	Activated and newly developed landslides	Developed mudflows
1980-1986	2,684	1,521
1987-1988	2,581	824
1989-1991	2,823	594
1992-1994	1,203	674
total	9,291	3,613

Table 9.1 Landslides and mudflows detected in urban areas of Georgia through the regional geological monitoring between 1980 and1994

years	Floods		Drought		Storms		Avalanches		Hail falls		Damage total mln GEL
	Number of occurances	damage mln GEL/number of dead	duration (months)	damage mln GEL	Number of occurances	damage mln GEL/number of dead	number of potential occurances	damage mln GEL/number of dead	Number of occurances	damage mln GEL	
1995	4	3/1	-	-	2	0.5	8	3/2	7	13	20/3
1996	11	29/1	1.5	17	4	4/5	6	4/3	11	17	70/9
1997	12	38	2	26	3	1	10	4	14	35	104
1998	2	2/1	1	6	3	72/5	9	4/2	12	8.5	92/8
1999	8	31/1	-	-	2	3	12	4/1	9	6.9	45/2
2000	2	2	6	300	2	1.0	7	2/1	7	5.8	311/1
2001	4	4	2.5	21	1	0.1	6	3/1	8	10.4	39/1
2002	16	78.7	-	-	2	0.6	8	1.5	8	6.8	88
2003	6	4/2	-	-	1	0.1	8	2/2	7	6.0	12/4
2004	10	21/1	-	-	4	0.8	10	5/1	11	12.5	39/2
2005	20	80/4	-	-	3	0.4	14	5/3	19	6.9	92/7
2006	8	15/1	1.5	5.0	3	0.3	12	2.5	11	6.2	29/1
2007	7	40/1	-	-	6	1/1	10	3.0/1	7	5.0	49/3
2008	16	38/1	-	-	5	2.9	4	1.9	5	2.9	46/3
2009	20	30/5	1.5	6	12	8/8	6	3/2	15	9.5	56/15
total	146	415/19	16	381.0	53	96.3/19	130	47.5/19	151	152.1	1,092/57

Table 9.3 Extreme hydro-meteorological phenomena identified in Georgia between1995 and 2009 and the estimated damage caused

IV/10

MINERAL RESOURCES

Georgia is rich in mineral resources. Uncontrolled and unregulated extraction of mineral resources can impact the environment. This is particularly the case for the metal mining industry in areas of long-term impact, such as Chiatura, Kazreti, Lukhuni and Tsana.

IV/10. 1. INTRODUCTION

Georgia's mineral resources are a very important asset for the country's economy. However, the mining and extraction of mineral resources can have an impact on the environment. As such, it is important that a proper regulatory system is in place to ensure that these activities are carried out in an environmentally sound manner.

State Regulation

In Georgia, all mineral resources are the property of the state. Any activity connected to the exploitation of mineral resources is subject to licensing. A licence for the exploitation of mineral resources must be obtained at the public auction. The term of the licence depends on the type of mineral resource and on the actual demand for it. In addition to a mining licence, the licensee also obtains a temporary right on the land use necessary for the processing operations. After finalizing its activities, the company is obliged to rehabilitate the site - recultivate the land and return it to the state.

IV/10. 2. MINERAL RESOURCES RESERVES

Georgia is located at the edge of the Eurasian and Afro-Arabian plates which determine its special geological features. The territory is quite diverse in its structural and geological development, which gives rise to a diversity of mineral wealth. The intensity of the geological processes as well as the area and scale of their development processes have determined the deposit size and often its quality. Large scale mineral deposits are not found in Georgia, the deposits are mainly of small and medium size.

Thus, the Mineral Resources Fund represents the register of information of all deposits and mines located within the country, for which the state has approved extraction of mineral resources. This Fund is a part of resource base, which could be included into market relations due to its economic and industrial characteristics.

As such, the Fund represents an estimate of the economic value of the mineral resources currently identified within the state. It is currently comprised of 552 deposits.

The mining and processing of metals is potentially the most environmentally harmful mineral extraction industry undertaken in Georgia. The mining and processing of other kinds of solid mineral resources are comparatively inert and as such their extraction and processing is less harmful to the environment (Table 10.1; Figure 10.1).

The following deposits are particularly significant for Georgia; Chiatura manganese and Madneuli (Bolnisi district) poly-metal within the metal sector; and within the non metal sector, zeolitic deposits (in Dzegvi, Tedzami, Akhaltsikhe, and others) and construction and decorative stones.

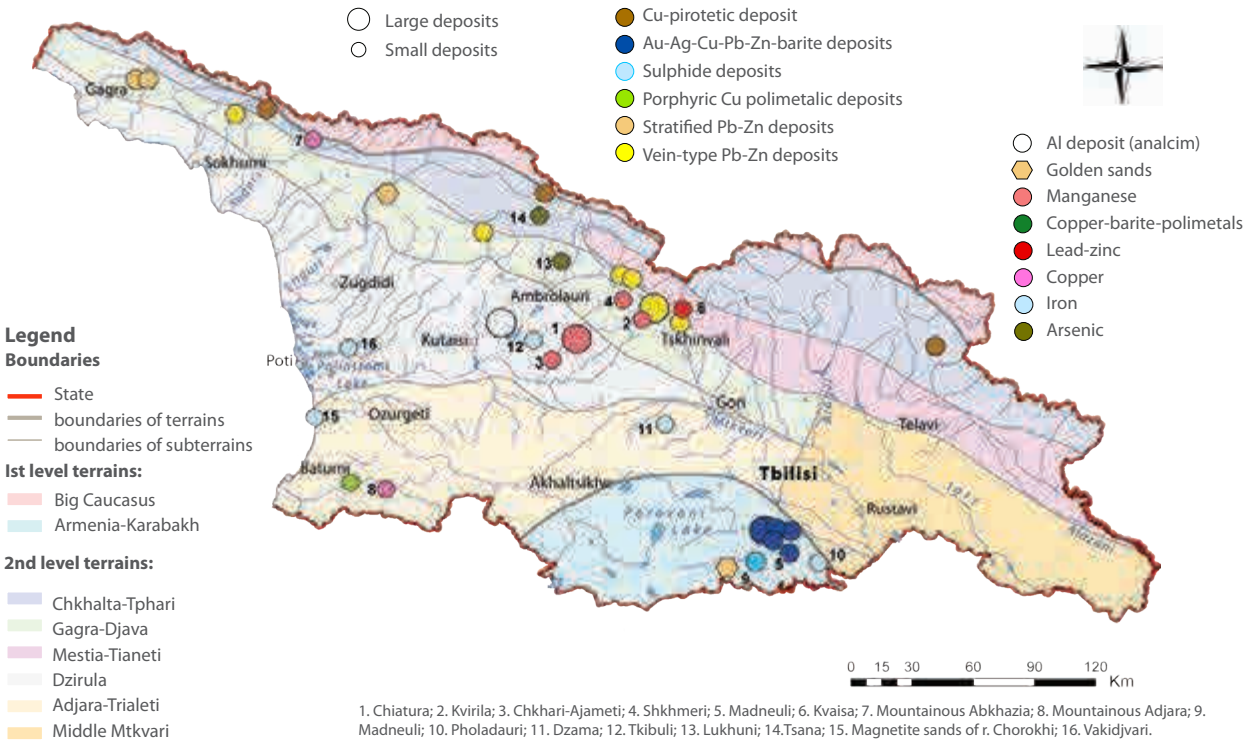
Mineral Resource	Supply Approved
Metals (ferrous, non-ferrous, precious, rare)	419,965,000 t
Solid fuel resources	
Coal	373,934,000 t
Peat	47,644,000 t
Facing stones	
Gabbros	7,224,000 m^3
Gabbros-diorite	5,972,000 m^3
Syenite	660,000 m^3
Granite	5,400,000 m^3
Tuff-breccias	14,938,000 m^3
Dacite	2,289,000 m^3
Teschenite	6,165,000 m^3
Diabase	10,741,000 m^3
Basalt	45,052,000 m^3
Dolerite	19,579,000 m^3
Marble	4,259,000 m^3
Marble-like limestone	78,026,000 m^3
Chemical industry raw materials	
Barytes	4,731,000 t
Acid-resistant andesite	12,717,000 t
Mirabilite	1,493,000 m^3
Bentonite	6,418,000 t
Mineral pigment	437,000 t
Talc	2,774,000 t
Calcite	27,211,000 t
Diatomite	7,995,000 m^3
Building materials	
Detritus	459,221,000 m^3
Sand-gravel	658,487,000 m^3
Brick clays	135,207,000 m^3

Mineral Resource	Supply Approved
Building materials	
Chalk	3,962,000 m^3
Limestone for lime	292,173,000 t
Gypsum	20,342,000 t
Cement clays	64,070,000 m^3
Cement limestone	392,014,000 t
Sheetrock	14,917,000 m^3
Slate tiles	11,796,000 m^3
Light stuffs	220,323,000 m^3
Wall rocks	4,898,000 m^3
Silica sand	168,804,000 m^3
Subsidiary raw material for metallurgy	
Dolomite	44,904,000 t
Fire-clay	91,636,000 m^3
Molding (forming) send	2,300,000 m^3
Spongolite	1,957,000 m^3
Fluxing limestones	1,700,000 t
Supply of industrial materials	
Teeming basalt	9,892,000 m^3
Lithographic stones	120,000 m^3
Semi-precious stones	920 t
Raw materials for agriculture	
Peat	41,880,000 t
Zeolite	30,381,000 t
Clay gypsum	3,460,000 t
Raw materials for ceramic industry	
Ceramic clay	2,504,000 m^3
Trachyte	945,000 m^3
Loamy gypsum	2,232,000 t

Table 10.1 Deposits Registered in the Mineral Resources Fund

Ferrous Metals

Georgia does not belong to any important world basins of ferrous-containing ores. However, there are number of areas where iron ores may be found. Four quite significant deposits of ferrous metals have been identified in Poladauri, Dzama, Tkibuli-Shaori, and Supsa-Natanebi (Figure 10.1, Map 10.2). In addition, there are significant reserves of titan magnetite sands located in the estuaries of the rivers Supsa and Natanebi. The ferrous deposits are not currently being exploited, although studies are underway and it is anticipated that mining operations will begin in the near future.



1. Chiatura; 2. Kvirila; 3. Chkhari-Ajameti; 4. Shkhmeri; 5. Madneuli; 6. Kvaisa; 7. Mountainous Abkhazia; 8. Mountainous Adjara; 9. Madneuli; 10. Pholadauri; 11. Dzama; 12. Tkibuli; 13. Lukhuni; 14.Tsana; 15. Magnetite sands of r. Chorokhi; 16. Vakidjvari.

Map 10.1 Distribution of metals in Georgia

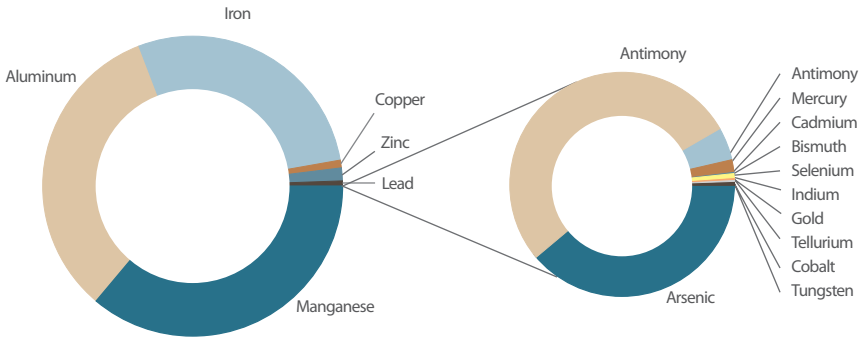


Figure 10.1 Reserves of metals and rare elements in Georgia

Municipality	Deposit location	Deposit volume (thousand tonnes)	Operational Status
Chiatura	Chiatura	201,921	Operating
Terjola	Chkhari-Ajameti	5,000	Operating
Zestafoni	Riv. Kvirila depression (Rodinauli district)	15,460	Closed
Oni	Shkmeri	1,576	Closed

Table 10.2 Manganese deposits, reserves and exploitation.

Georgia has been one of the biggest producers of manganese in the world since the end of the nineteenth century (Table 10.2; Map 10.2). Manganese extraction continues today, and according to the licence conditions issued for exploitation of the Chiatura manganese deposit, approximately 1.6 million tonnes of this metal should have been extracted between 2008 and 2011. An estimated 40 thousand tonnes per year will be extracted thereafter, with the licence allowing a minimum extraction of 200 thousand tonnes in total. The licence for exploitation of the Chkhari-Ajameti deposit was issued for a 27 year period with a total extraction quantity of 20,000 tonnes.

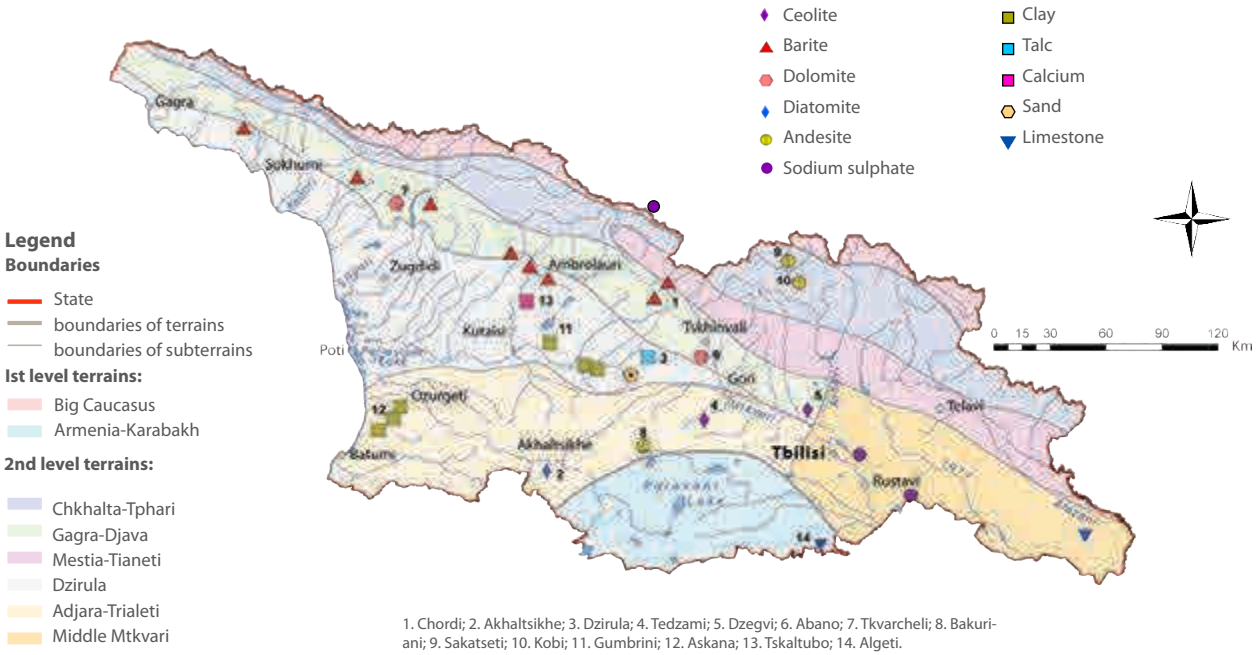
Precious Metals

Precious metals are found as small deposits in the Caucasian main ridge and include arsenic, mercury, tungsten, and molybdenum. Gold-arsenic, arsenic and gold-antimony deposits in Georgia are of significant economic importance. The extraction works for arsenic deposits have temporarily ceased even though the licence for extraction works at the Lukhuni deposit was issued for 25 years and allows for the extraction of 9, 534 tonnes of arsenic.

Intensive extraction of metals (including gold and silver) is on-going at Bolnisi gold-cooper-barite-polymetal deposits, where the complex processing licence is issued for 20 years and allows an annual extraction of 0.4 to 1 million tonnes of ore. At the moment, new deposits are being evaluated at this mining location to assess the reserves available for future extraction.

Municipality	Deposit location	Quantity (Thousand tonnes)	Operational Status
Ambrolauri	Lukhuni	8.7	Ceased
Lentekhi	Tsana	30.225	Ceased
Lentekhi	Chorokhi	1.85	Closed

Table 10.3 Arsenic and associated metals



1. Chordi; 2. Akhaltsikhe; 3. Dzirula; 4. Tedzami; 5. Dzegvi; 6. Abano; 7. Tkvarcheli; 8. Bakuriani; 9. Sakatseti; 10. Kobi; 11. Gumbrini; 12. Askana; 13. Tskaltubo; 14. Algeti.

Map 10.2 Distribution of non-metal mineral resources in Georgia

IV/10. 3. IMPACT OF EXTRACTION OF MINERAL RESOURCES ON THE ENVIRONMENT

The pollution of air, water and soil, as well as deforestation and landslide activation are major environmental concerns related to the extraction of mineral resources. The scale of these impacts varies depending on the minerals being extracted and the technologies used. The anticipated lifetime of a mining operation is mainly dependant on the supply of mineral reserves available at the mine site and the viability of their extraction. The rate at which such reserves may be extracted is also determined by the mining licence which defines annual extraction amounts. The terms for mining licences are set according to the types of mineral wealth and range from 2-5 to 20-45 years. In general, the exploration and extraction of metals and solid fuel resources requires much more time than that for construction materials for example, as a result the terms for such licences tend to be longer.

Among the mining enterprises currently operating in Georgia, one of the significant sources of environmental pollution is the extraction of manganese. For example in January 2009, the concentration of manganese in the Kvirila River at the city of Chiatura was 3.9 mg/l, while the maximum allowed concentration is 0.1 mg/l. The area downstream of the extraction facility, including the river and adjacent lands, has been found to be contaminated. The situation is aggravated by the fact that background manganese levels are high in the river as it naturally erodes manganese-containing rocks while flowing through the area.

Activities connected to poly-metal ore extraction in Bolnisi are also very harmful to the environment. The ore is extracted by open cast mining. The open pit has already been excavated to a depth of 300 metres below ground level. Mining activities such as rock breaking and blasting, in addition to traffic associated with moving the ore, give rise to significant air pollution. Dust clouds travel long distances from the mine, particularly the small dust particles. Additionally, heavy metals are washed out by rainfall, resulting in the contamination of soil and ground waters.

In addition to the ore mining, the ore processing operations also have a negative impact on the environment, an example of which is the pollution of the river Kazretula. This river has been polluted for many years by the activities of mining and processing operations. The primary pollutants are heavy metals. Mashavera River is partly polluted too, but has self treatment capacities, because of which, exceedance of maximum allowable concentrations is very rarely recorded, mostly when the ore processing plant was not operational.

The area in which waste from the mining process was stored (the tailing ponds) is contaminated with metal wastes including copper, zinc and iron sulphates. In the absence of substantial remediation measures this area cannot be used for agricultural or other purposes, and will remain a contaminated site.

Mines that have temporarily ceased operation can also have a significant impact on the environment if they are not decommissioned in an appropriate manner. Infiltration of rainwater through exposed partially processed surfaces leads to leaching of contaminants into the water, giving rise to elevated levels of metals and other compounds in the adjacent surface and ground waters.

There are concerns regarding the arsenic extraction works at Lukhuni (realgar-auropigment deposit) and Tsana (arsenopirit deposit). Although these works have temporarily ceased, during their operation pollution from improper extraction and processing operations posed a significant risk to people's health and the environment. High purity arsenic for semiconductor systems and 16 other arsenic containing compounds were produced in the Racha (vil. Uravi) and Svaneti (vil. Tsana) regions of Georgia up until the 1990's. The purification process involved the burning of arsenic concentrates in special furnaces, the emissions from which contained high concentrations of arsenic sulphides, so called "white arsenic". These emissions impacted an area of more than 20 km around those furnaces. These facilities have now ceased operation, however recent scientific studies [1] found that the content of arsenic in the soils around the factory were 20 to 30 times those of background levels. Increased level of oncological diseases have been observed among people and domestic animals in the surrounding areas. It is widely held by the residents of Racha that this pollution of the river Madnis-Gele (river Lukhuni) valley has resulted in decrease of number of bees and swallows in the region.

In addition to the pollution caused by emissions from the facility, there are considerable amounts of hazardous wastes stored at these facilities, which were generated during their many years of operation. There is an urgent need for proper decommission of these facilities and hazardous waste disposal, including contaminated soil, in an appropriate and responsible way.

The current environmental situation of the deposits and mines within the territories temporarily outside of Georgian Government control is largely unknown. The main facilities of concern include; Qvaisi Lead-Zinc deposit in South Ossetia, Tkvarcheli coal deposit and Mercury deposits in Akhei and Avadkhara, within Abkhazia.

The extraction and processing of ceramic, semi-precious, inert and construction materials are less harmful to the environment. However when improperly managed, these processes can give rise to significant environmental pollution. The main environmental risks associated with such facilities include the runoff of sediments and contaminated waters into rivers, noise and vibration, particularly associated with blasting at quarries, and dust from the processing and associated transport activities. All of these environmental impacts must be controlled by appropriate legislation and the implementation of an adequate permitting and monitoring process.

IV/10. 4. MAIN CHALLENGES

The extraction and processing of mineral resources is a key sector of the Georgian economy, and is essential for economic development of the country. However, these processes can have a significant impact on the environment and are considered one of the most potentially dangerous activities for the environment in Georgia. Undertaking such works without proper regard for the environment can lead to serious contamination of soil, water (surface and ground), and air. Such environmental contamination can have health implications for people living close to these activities.

While assessing the environmental impacts of the mining sector, it is important to note that the extraction and processing methods can vary considerably from ore to ore and depending on the environment from which the ore is extracted. The environmental hazards associated with each of these processes can also vary significantly.

The monitoring network for mining and processing facilities dealing with hazardous materials such as heavy metals should be improved. The monitoring programme should not be restricted only to measuring environmental parameters in the close vicinity of the facility but should also include monitoring of these parameters at remote locations from the site in order to take into account the dispersion of pollutants by air and water and to determine the overall impact of the site activities.

Many sites are contaminated as a result of activities which occurred during the Soviet period. Programs for the remediation of these sites have to be developed as the current companies who undertake the mining processes are not responsible for historic pollution. It is necessary to develop relevant remediation programs, which should be financed through cooperation between the state and the current mining companies. In this regard, the initiatives of some enterprises are promising. For example, since November 2006, the mining company JSC Madneuli, operating at the Bolnisi deposit, established a department with responsibility for Health and Safety and Environmental Protection. The main focus of this department is related to the remediation of historic contamination at the site. The company is cooperating with the Ministry of Environmental Protection in planning and undertaking the remediation strategies.

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V

NATURE PROTECTION

V/11

BIODIVERSITY

Georgia has a diverse ecosystem with a wide array of flora and fauna.

The protected areas system is the principal mean for protection and preservation of biodiversity in Georgia. Currently 7.1% of the territory of Georgia is covered by protected areas of different categories. It is planned to further extend the system of protected areas.

Absence of biodiversity monitoring influences to some extent the effectiveness of planning and implementation of protective measures. A National Monitoring System is currently being developed. National indicators for this system have already been developed and methods of data collection are currently being selected. A resource-centre accessible via internet has already been created , where biodiversity monitoring data will be available.

V/11. 1. INTRODUCTION

Georgia, as part of the Caucasus eco-region, represents one of 34 biodiversity "hotspots" identified by Conservation International as areas distinguished by their special biodiversity which at the same time are seriously under threat. The Caucasus eco-region is also identified as having global significance by WWF due to the diverse number of endemic species, and the specific evolutionary processes and unique historical floral and faunal development of this area.

State Regulation

The main instrument for protection and conservation of biodiversity in Georgia is the development of a protected areas system. By contrast to the earlier approach, which envisaged the establishment of some separate and strictly protected reserves, the Law of Georgia on Protected Areas (1996) provides the legal basis for development of a system of protected areas of different regimes. The use of natural resources is either limited or prohibited in these areas, depending on the regime.

In addition, the legislation provides protection of endangered species. In particular, the President of Georgia approved the Red List of Georgia in 2006, which lists endangered species of flora and fauna. According to legislation, the use of these species for economic purposes is prohibited. Additionally, it is prohibited to undertake any activity that can cause a decrease of the number of any species listed in the Red List, or degrade the state of their natural habitat. The use of these species is only allowed by exemption, such as use for scientific purpose, for rehabilitation, survival, or cure.

The taking of other species from the wild is also strictly regulated in Georgia (see Chapter 12).

To avoid or mitigate the impacts on biodiversity caused by commercial activities such as industry, construction, agriculture, etc, the following mechanisms are in place in Georgia:

- Environmental Impact Permits are required for activities which can have a significant impact on the environment. In order to obtain a permit, an assessment of impact of the planned activities on environment (including the live environment) is undertaken. Based on these assessments, the appropriate measures to avoid or mitigate the expected impact of the activity can be developed.
- The Environmental Inspectorate undertakes inspections to evaluate compliance with conditions of environmental permits and licenses and the rules introduced for nature use. In addition, the Inspectorate investigates illegal unauthorised activities that can impact biodiversity.
- The System of liability for damage caused to the biodiversity.

In addition, the legislation provides protection against introduction of alien species. It is prohibited to introduce alien fauna species. Phyto-sanitary and veterinary controls are in place to prevent the introduction of alien species crossing state borders. Special regulations are in place to govern the discharging of ballast waters in Georgian territorial waters in order to prevent the introduction of undesirable living organisms.

Biodiversity means the diversity of forms of living organisms. Life on Earth significantly depends on this diversity. Biodiversity is determined at three levels; diversity of specimens within each species, diversity of species, and the number of different ecosystems/biomes on the Earth.

A Protected Area means any part of land or sea, where some human activities are prohibited for the purposes of protecting biodiversity, ecosystems, or cultural monuments. There are different levels of restriction depending on the category of the protected areas. For instance, it is prohibited to enter a reserve (except in special cases). By contrast to the reserves, it is allowed, and indeed desirable, to visit National Parks where special routs have been developed for these purposes. On territories designated for multi-purpose use, the restrictions are fewer. In these areas the use of certain amounts of natural resources are permitted.

The establishment of a unified network (system) of protected areas, consisting of protected areas of different categories, is the best way for economic development, while protecting and maintaining biodiversity. To maintain ecological unity it is essential to provide 'corridors' between protected areas. This type of protected areas network provides a safe environment for the fauna and flora species and restricts human activities to a minimal level.

V/11. 2. THE CURRENT SITUATION

Species

Georgian flora is one of the richest among countries with moderate climates. 4,130 vascular plants, 812 mosses, over 800 lichens and up to 7,000 fungi species are found in Georgia. Over 2,600 taxa of algae are described in Georgian inland waters. However, these data do not fully reflect the actual diversity of algae, lichen, and fungi species of Georgia.

One of the indicators of high biological diversity of Georgia is the high number of endemic species. 900 species (21% of total number) are endemic. Up to 600 species (14.2% of total number of species) are Caucasian endemic, while around 300 species (9% of total number of species) are Georgian endemics. There are 16 endemic genera in Georgian and Caucasian flora: Alboviodoxa, Woronowia, Chymsydia, Trigonocaryum, Symphyoloma, Pseudobetckea, Charesia, Mandenovai, Sredinskaya, Grossheimia, Cladocheta, Pseudovesicaria, Gadellia, Agasyllis, Paederotella, and Kemulariella.

About 2,000 species of Georgian flora have a direct economic value, utilized as timber, firewood, food (fruit, hazel nut), forage and animal food or used in medicine, painting and volatile oil extraction.

Georgia is a part of the West Asian centre of cultivated plants, which is considered to be the origin for barley, wheat, legume, vine, and many fruit species. There are many local species, variations and wild relatives of these cultivated species in Georgia (especially of wheat, legume, and vine).

In terms of the faunal components, 16,054 fauna species have been described in Georgia, among which 758 species are chordates. Amongst the Caucasian endemics there are 19 mammals, (Caucasian and Eastern Caucasian turs (Capra caucasica and C. cylindricornis), Caucasian birch mouse (Sicista caucasica), Kluchor's birch mouse (S. kluchorica), Kazbegi birch mouse (S. kazbegica)),three bird species (Caucasian grouse (Tetraom lokosiewiczi), Caucasian snowcock (Tetraogallus caucasicus) and Caucasian chiffchaff (Phylloscopus-lorenzii)), 15 reptiles, and three amphibians. The Georgian endemics are represented by only one species, the Adjarian lizard (Darevskiamixta). Amongst the invertebrates the most numerous group is the insect class (11,471 species).

The Georgian Red List includes 123 fauna species and 56 timber plant species. Forty four species of Georgian chordates are globally endangered and are listed in the IUCN Red List as Vulnerable, or higher categories. Table 11.1 shows the species distributed in Georgia, as well as the numbers of endangered species according to taxonomic groups.

The Red List of Georgia represents the list of endangered species of flora and fauna. The history of the list begins in 1982, when the original Red Book of Georgia was prepared, listing threatened species under three categories: almost extinct (or present in inaccessible areas), endangered, and rare species. There were 65 fauna and 161 flora species listed in total.

In 2003, the Law on the Red List and Red Book of Georgia was adopted. In accordance with this law, the status of endangered species must be assessed in accordance with the IUCN criteria. In 2005-2006, the Commission on Endangered Species, newly established under the Academy of Sciences of Georgia, conducted an appropriate assessment according to the IUCN criteria and compiled the new Red list, which was adopted by order #303 of the President of Georgia on May 2, 2006.

Despite measures undertaken by the State, loss of biodiversity continues. Figure 11.1 illustrates problems connected with fauna species, showing alterations in total amounts of endangered vertebrates beginning from the 1980's until 2006. The state of large mammals is especially grave. Gazelle and the southern population of Wild Goat (Trialeti range) became extinct in Georgia in the twentieth century. Leopard and Stripped Hyena can only be found as individual specimen. The number of Red Deer has drastically decreased, there are only three small populations remaining. In 1990-2005, the number of East Caucasian Tur (Capra cylindricornis) decreased by 20%, while the number of West Caucasian Tur, by 50%. The population of Brown Bear has also decreased significantly. Fish populations are also decreasing; the population of sturgeon in Georgian waters have decreased by a minimum of 37 times.

Alien species of flora and fauna introduced to the country accidentally or for different reasons, continues to be a problem. From the 1930's, different fish and fur species as well as many hunting species, have been deliberately introduced to Georgia for economic purposes. Some attempts were unsuccessful, such as the Fallow-deer and some fur species, while the others were quite successful. Some introduced species were invasive and as a result, spread widely. There are five species which were introduced and spread widely in Georgia; the Raccon Dog (Nyctereutes procyonoides), Common Raccon (Procyon lotor), Nutria (Myocastor coypus), Muskrat (Ondatra zibeticus), and Eurasian Red Squirrel (Sciurus vulgaris). The number of Common Raccon and Muskrat are quite high and have a negative impact on local species. Rainbow trout, European vendace, white-fish, mirror carp, silver carp, grass carp, and northern white-fish have also spread widely, and are now regarded as a commercial species. It should be mentioned, that Common Carp, introduced in 70`s, had a significant negative impact on the local fish fauna of inland waters.

Taxonomic group	Number of Species	Number of species included in IUCN Red List as vulnerable or higher category	Number of species included in the Red List of Georgia			
			Extinct at national level	Extremely endangered species	Endangered species	vulnerable species
Plants						
Algae	2,605					
Mushrooms	7,000					
Lichens	800					
Mosses	812					
Vascular Plants	4,130		-	2	18	36
Animals						
Invertebrates	15,761			2	8	32
Fishes	188	10	-	1	6	7
Amphibians	13	1	-	-	1	1
Reptiles	54	11	-	1	2	8
Birds	390	14		2	9	24
Mammals	111	8	4	5	6	18

Table 11.1 Numbers of Plant and Animal Species and Endangered Species by Taxonomic Groups

Some plant pests that have been introduced to the country have significant negative impact on native plants and forest plant species. The pests, which represent the most significant risk include the Bark beetles, Fall Webworm, Colorado potato beetle, Pale Tussock Moth Caterpillars, and Ips typographic etc.

There is relatively little data available on the number of non-native flora in Georgia. There are presumed to be up to 450 non-native plant species, of which around 80 species are cultural plants, and 368 accidental[1] and invasive species[2]. Invasive species can cause irreversible change to some ecosystems, including unique ones, and represent a serious threat to native local biodiversity. They can also represent a serious threat to agricultural lands and to human health.

The introduction of plant species is generally more successful in semi-natural areas that are strongly influenced by human activities or in wetland areas, while natural

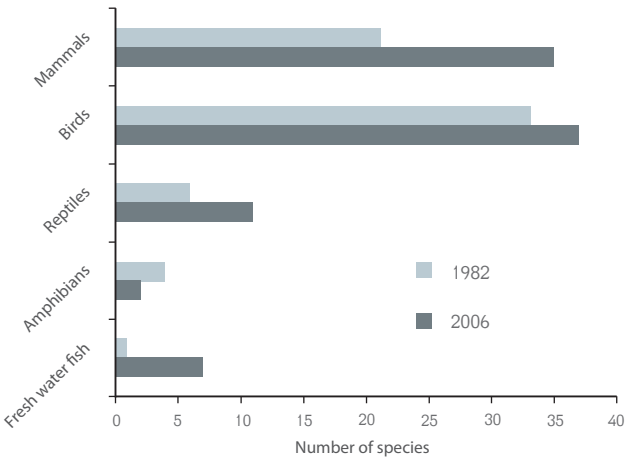


Figure 11.1 Alterations in numbers of endangered vertebrates in Georgia

[1]Accidental non-native plants cannot create a self-renewable population. Its sustainability depends on reintruduction.

[2]Invasive non-native plants can create a self-renewable sustainable populations at new places.

forests and herbaceous communities are quite resistant to the introduction of alien plant species.

Ecosystems and Habitats

Georgia's complex landscape and variations in climatic conditions between the various provinces, contributes to the overall level of diversity found in the country. The main ecosystems are: forests, fresh-water and wetlands, marine and coastal, high-mountain, semi-desert and steppes. Deciduous and coniferous forests rich with endemic and rare species cover more than a third of the country are a true treasure of the state.

The Kolkheti refugium, limestone areas of the Western Caucasus and high mountainous vegetation complexes are especially notable for their species diversity and the high numbers of species unique to this area.

Some of the ecosystems of Georgia have global environmental value. For instance, there are 31 sites of special importance for bird species, 17 sites of special interest for biodiversity, which are included in the Emerald Network. The wetland forests of Kolkheti lowland located at the sea coastal line, as well as the unique peatbogs and alder forests, are included in the Ramsar List of Wetlands of International Importance.

Forest Ecosystems

Forest ecosystems are extremely significant for the conservation of biodiversity in Georgia as they cover about 40% of the territory. Furthermore, 97% of forests are natural, as opposed to plantation, and are represented primarily by mountainous forests (98%) important for the provision of ecosystem services including water regulation, soil protection and climate stabilization. They are also important habitats for many endemic and endangered plants and animals. Virtually intact forest stands, with high conservation value, have been preserved in Georgia and forest ecosystems are found in almost all regions of the country.

The main types of forests are broadleaf, coniferous, subalpine thin and crook stem, arid thin and floodplain forests. Broadleaf forests occupy 81% of forest cover while coniferous forests cover around 19%.

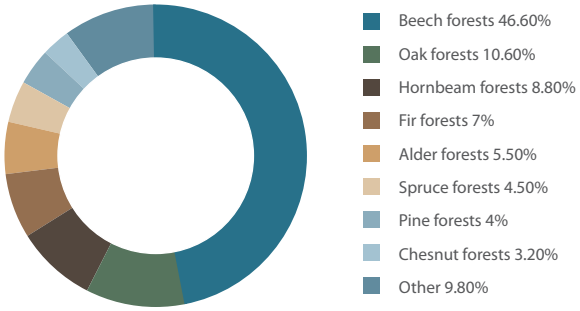


Figure 11.2 Species composition of forests

As of 2010, around 10% of forests are within protected areas and special protection is afforded to riparian forests and sub-alpine forests outside of protected areas.

The main threat for most of Georgia's forest ecosystems is unsustainable timber logging, damage inflicted by forest parasites, and forest fires. Inventory (i.e. using satellite imagery and GIS-based analysis) has not yet been carried out and so a real picture of the current national forested cover or changes and trends in the general health of forests is not available.

In Georgia, like many European countries, economic development primarily impacts riparian forests, which are one of the most significant components of Georgian biodiversity, and represent biological corridors and refuges for many species. Today, riparian forests exist mainly as separate fragments.

Fresh Water Ecosystems

Fresh water ecosystems include lakes, rivers, wetlands, and artificial water reservoirs and represent typical components of the Georgian landscapes.

The unique peat bogs located at Kolkheti lowlands and Paliastomi Lake are protected by Kolkheti National Park and Kobuleti Protected Area and Managed Reserve with its unique coastal peatbogs. These peatbogs are especially important for their unique floral composition, and abundance of endemic and relict species.

The wetland ecosystems of the Kolkheti lowlands are also an important habitat for migratory birds. Up to 300 species of birds have been registered there. The territory is a significant habitat for endangered species included in the Red List of Georgia, as well as globally endangered species, such as the great white pelican, Dalmatian pelican, white stork, black stork, lesser white-fronted goose, ruddy shelduck, white-headed duck, imperial eagle, saker falcon, etc. During spring and autumn, the migration of hundreds of birds of prey (27 species) are registered near Batumi. Javakheti plateau lakes, such as Khanchali, Madatapha, Bugdasheni (South Georgia) are also very important habitats for many migratory bird species.

More than 80 species of freshwater fish are present in Georgia. The conservation status of most fresh water fish fauna species are not determined.

Freshwater ecosystems are impacted by human activities through a variety of unregulated economic activities that adversely affect water levels. Water pollution, illegal fishing, damming and the introduction of alien invasive species represent the main threats for freshwater fish fauna. Poaching and the artificial modification of freshwater and wetland ecosystems also represent significant impacts on migratory birds.

Table 11.2 Red List species in Georgia and the reasons for inclusion them in the Red List

Animals

Mammals

Eurasian beaver	Castor fiber	Extinct in XIX cc
Eurasian lynx	Lynx lynx	Small, fragmented population
Brown bear	Ursus arctos	
Leopard	Panthera pardus	Very small population, rare subspecies
Tiger	Panthera tigris	Extinct in XX cc
Hyena	Hyaena hyaena	Very small population
Nehring's blind mole rat	Nannospalax nehringi	Small, fragmented habitat
Turkish Hamster	Mesocricetus brandti	
Promethe' s vole	Prometheomys schaposchnikovi	
Tristram's Jird	Meriones tristrami	
Harvest mouse	Micromys minutus	

Mediterranean Horseshoe Bat	Rhinolophus euryale	Globally vulnarable
Mehely's Horseshoe Bat	Rhinolophus mehelyi	
Bechstein's Bat	Myotis bechsteinii	
Barbastelle bat	Barbastella barbastellus	
Harbour Porpoise	Phocoena phocoena	
West Caucasian tur	Capra caucasica	
East Caucasian tur	Capra cylindricornis	
Caucasian Birch Mouse	Sicista caucasica	Very small habitat
Kluchor Birch Mouse	Sicista kluchorica	
Kazbeg Birch Mouse	Sicista kazbegica	
Jungle cat	Felis chaus	Reduction of habitat
Eurasian River Otter	Lutra lutra	
Marbled polecat	Vormela peregusna	

Caucasian squirrel	Sciurus anomalus	Under pressure of allien species
Grey Hamster	Cricetulus migratorius	Reduction of population density
Red-backed vole	Clethrionomys glareolus ponticus	Small, dot-like habitat
Mediterranean Monk Seal	Monachus monachus	Extinct in Georgian coastal waters
Bottlenose Dolphin	Tursiops truncatus	Sharp decrease of number in Black Sea
Red Deer	Cervus elaphus	Exists only at two geographic locations
Goitered gazelle	Gazella subgutturosa	Extinct in the end of XX cc
Wild goat	Capra aegagrus	Almost all population in one geographic location
Chamois	Rupicapra rupicapra	Significant reduction in recent years

Reptiles and amphibians

Dahl's Rock Lizard	Darevskia dahli	Small, fragmented habitat
Ajarian Lizard	Darevskia mixta	
Javelin sand boa	Eryx jaculus	
Collared Eirenis	Eirenis collaris	
Montpellier Snake	Malpolon monspessulanus	
Greek Tortoise	Testudo graeca	Considered globally vulnarable
Clark's Lizard	Darevskia clarkorum	

Snake-eyed Lizard	Ophisops elegans	dot-like habitat
Asian Snake-eyed Skink	Ablepharus pannonicus	
Dinnik's viper	Vipera dinniki	Globally vulnarable
Caucasus viper	Vipera kaznakovi	
Caucasian salamander	Mertensiella caucasica	
Eastern Spadefoot	Pelobates syriacus	Decreasing in Georgia

Birds

Red-necked Grebe	Podiceps grisegaena	Small population
Great White Pelican	Pelecanus onocrotalus	
White Stork	Ciconia ciconia	
Black Stork	Ciconia nigra	
Ruddy Shelduck	Tadorna ferruginea	
White-tailed Eagle	Haliaeetus albicilla	
Levant Sparrowhawk	Accipiter brevipes	
Long-legged Buzzard	Buteo rufinus	
Golden Eagle	Aquila chrysaetus	
Egyptian Vulture	Neophron percnopterus	
Bearded Vulture	Gypaetus barbatus	
Griffon Vulture	Gyps fulvus	
Lanner Falcon	Falco biarmicus	
Boreal Owl	Aegolius funereus	
Caspian Snowcock	Tetraogallus caspius	

Dalmatian Pelican	Pelecanus crispus	Globally vulnarable, small population
Lesser White-fronted Goose	Anser erythropus	
Marbled Duck	Marmaronetta angustirostris	Globally vulnarable
White-headed Duck	Oxyura leucocephala	
Eastern Imperial Eagle	Aquila heliaca	
Greater Spotted Eagle	Aquila clanga	
Velvet Scoter	Melanitta fusca	Very small population
Cinereous Vulture	Aegypius monachus	
Red-footed Falcon	Falco vespertinus	
Barn Owl	Tyto alba	
Common Crane	Grus grus	
Little Bustard	Tetrax tetrax	Vulnarable in Europe
Stone Curlew	Burhinus oedicnemus	

Güldenstädt's Redstart	Phoenicurus erythrogastrus	Small, fragmented habitat
Great Rosefinch	Carpodacus rubicilla	
Radde's Accentor	Prunella ocularis	
Saker Falcon	Falco cherrug	Vulnarable globally, very small population
Lesser Kestrel	Falco naumanni	Decreasing globally and locally
Caucasian Grouse	Tetrao mlokosiewiczi	Small habitat and decreasing population
Bearded Parrotbill	Panurus biarmicus	Reduction of population density

Fish

Cartilaginous fish		
Beluga	Huso huso	Globally vulnarable
Atlantic Sturgeon	Acipenser sturio	
Ship Sturgeon	Acipenser nudiventris	
Starry Sturgeon	Acipenser stellatus	
Russian Sturgeon	Acipenser guldenstaedti	
Persian sturgeon	Acipenser persicus	

Bony fish		
Brown trout	Salmo fario	Substantial reduction recently
Kutum	Rutilus frisii	Small, fragmented habitat
Kolkhic Khramulya	Varicorhinus sieboldi	
Golden loach	Sabanejewia aurata	
Monkey goby	Neogobius fluviatilis	

Subspecies (Bony fish)		
Shad	Alosa caspia paleostomi	Dot like habitat (spotted habitat)
Black sea salmon	Salmo fario labrax	Substantial reduction recently
Asp	Aspius aspius taeniatus	Small, fragmented habitat
Angora loach	Nemachilus angorae alasanicus	

Arthropoda

Arachnids		
Fen raft spider	Dolomedes plantarius	Globally vulnarable species

Crustaceans		
Colchic crayfish	Astacus colchicus	Small, fragmented habitat
Pylzow's crayfish	Pontastacus pylzowi	very small habitat

Insects

Death's-head sphinx moth	Manduca atropos	Very small unstable population
Komarov's sphinx moth	Rethera komarovi	
Oleander sphinx moth	Deilephila nerii	
Dwarf sphinx moth	Pterogon gorgoniades	
Syrian silkworm	Pachypasa otus	
Scarlet tiger moth	Callimorpha dominula	
Gloomy woolly bear	Axiopoena maura	
Gruner's Orange Tip	Antocharis gruneri	
Eastern Orange Tip	Anthocharis damone	
Hewistoni's mountain ringlet	Erebia hewistonii	
Iranian brassy ringlet	Erebia iranica	
Romanoff's tomares	Tomares romanovi	
Meleager's Blue	Polyommates daphnis	
Smirnov's Looper moth	Apocolotois smirnovi	
Big steppe humble bee	Bombus fragrans	
Stone humble bee	Bombus eriophorus	
Wulfeni humble bee	Bombus alpigenus	
Persian humble bee	Bombus persicus	
Violet carpenter bee	Xylocopa violacea	
Omophron limbatum	Omophron limbatum	

Schamyl's Ghost Moth	Phassus shamil	Species with randomly narrow habitat
Lederer's brahmin moth	Brahmaea ledereri	Registered in the beginning of XX cc
Small Night Peacock Butterfly	Eudia pavonia	Small, fragmented habitat
Rose Peacock Butterfly	Perisomena coecigena	
Balkan yellow Silkworm	Lemonia balcanica	
Nordmann's Appolo	Parnassius nordmanni	
Banded Agrion	Calopteryx mingrelica	
Appolo	Parnassius apollo	Globally vulnarable species
Caucasian Swallowtail butterfly	Allancastria caucasica	
Rosalia Longicorn	Rosalia alpina	
Caucasian golden-ring	Cordulegaster mzymtae	
Dark pincertail	Onychogomphus assimilis	
Ash burnet	Zygaena fraxini	Dot-like habitat
Kurnakov's Ground beetles	Inotrechus kurnakovi	Is known from only one spot in the world
Injaeva's Ground beetles	Inotrechus injaevae	

Annelid Worms		
Caucasian Earthworm	Eisenia transcaucasica	Small, fragmented habitat
Iagodekhi Earthworm	Eisenia lagodechiensis	
Pharyngeal Earthworm	Dendrobaena faucium	
Kintrishi Earthworm	Alollobophora kintrishiana	Dot-like habitat

Gastropods		
Beech Snail	Helix buchi	Small, fragmented habitat

Plants

Angiosperm

Glasswort	Anabasis aphylla	Extremely small habitat
Georgian Almond	Amygdalus georgica	
Greek Strawberry Tree	Arbutus andrachne	
Sommier's wetch	Astragalus sommieri	
Tana wetch	Astragalus tanae	
Albov's Daphne	Daphne albowiana	
Silky Daphne	Daphne pseudosericea	
Tree Heath	Erica arborea	
Eversmannia subspinosa	Eversmannia subspinosa	
Russian Salttree	Halimodendron halodendron	
Schober's Nitrebush	Nitraria schoberi	
Demetri's Pear	Pyrus demetrii	
Ketskhoveli's Pear	Pyrus ketzkhovelii	
Sakhokia's Pear	Pyrus sachokiana	
Kikodze's willow	Salix kikodseae	
Armenian Rowan	Sorbus hajastana	
Kariagin's Thyme	Thymus karjaginii	
European Hop Hornbeam	Ostrya carpinifolia	Drastic decrease of number and habitat
Colkhic box	Buxus colchica	Trend of decrease of number and habitat
Sweet Chectnut	Castanea sativa	
Populus euphratica	Populus euphratica	Spotted habitat and small number
Sambucus tigranii	Sambucus tigranii	

Georgian Maple	Acer ibericum	Fragmented habitat
Medvedev's Birch	Betula medwedewii	
Samegrelo Birch	Betula megrelica	
Radde's Birch	Betula raddeana	
Southern Hackberry	Celtis australis	
Glabrous Hackberry	Celtis glabrata	
Cherry microcarpous	Cerasus microcarpa	
Pink Rock-Rose	Cistus creticus	
Colchic Hazel	Corylus colchica	
Pontian Hawthorn	Crataegus pontica	
Transcaucasian Daphne	Daphne transcaucasica	
Epigaea	Epigaea gaultherioides	
Abkhazian Broom	Genista abchasica	
English Walnut	Juglans regia	
Grecian laurel	Laurus nobilis	
Osmanthus	Osmanthus decorus	
Pistachio tree	Pistacia mutica	
Wing-Nut	Pterocarya pterocarpa	
Colkhic Oak	Quercus hartwissiana	
Imeretian Oak	Quercus imeretina	
High-mountainous Oak	Quercus macranthera	
Pedunculate Oak	Quercus pedunculiflora	
Popntian Oak	Quercus pontica	
Smirnov's Rhododendron	Rhododendron smirnowii	
Rhododendron ungernii	Rhododendron ungernii	
Gareji Sagebrush	Salvia garedji	
Colkhic Bladdernut	Staphylea colchica	
Wytch Elm	Ulmus glabra	
Smoothleaf Elm	Ulmus minor	
Water Elm	Zelkova carpinifolia	

Gymnospermous		
Stinking Juniper	Juniperus foetidissima	Small fragmented habitat
Indian Juniper	Juniperus polycarpos	
Pitsunda Pine	Pinus pityusa	
Common yew	Taxus baccata	

High Mountain Ecosystems

High mountains are traditionally defined as those areas higher than 2,000 m above sea level and include sub-alpine, sub-nival and nival ecosystems. The main habitats of the high mountains are shrub, sub-alpine tall grass meadows, alpine meadows, alpine moles and a variety of rock and scree habitats. High mountain flora is very diverse primarily due to the location of the Caucasus on the boarder of Europe and Asia, and by diverse climatic conditions, complex topography, and other factors.

Alpine meadows are mainly used as pastures and, as a result, the vegetation conditions have deteriorated somewhat with an alteration in species composition and a reduction in overall productivity. The upper soil layer is damaged by erosive processes such as landslides and avalanches. The intensive collecting of medicinal plants is considered as one of the threats to these ecosystems.

High mountain ecosystems in Georgia can be found in the protected areas of Tusheti, Lagodekhi, Kazbegi and Borjomi-Kharagauli.

Arid and Semi-Arid Ecosystems

Arid and semi-arid ecosystems are mainly found in the south-eastern part of Georgia, at the border with Azerbaijan and Armenia. These ecosystems are characterised by desert and semi-desert vegetation, steppes, arid light woodlands, Shibliak, phryganoid vegetation, rock xerophytes, halophyte communities, and tugai forests along the River Iori.

Steppes are mainly used for winter grazing purposes. The phytocenosis structure of the steppes has suffered significant damage and, in some areas, overgrazing, has led to a reduction in herb species diversity. The arid thin forests widely present in the past, are now only observed in their original form in the Vashlovani State Reserve. The artificial regulation of flow in the River Lori and deforestation have resulted in a decrease of the unique floodplain tugai type forests along the river.

Vashlovani National Park (24,610 ha) was established in 2003 to protect and conserve rare arid and semi-arid ecosystems in Georgia. In doing so the area of the original Vashlovani Reserve (10,143 ha) was more than doubled.

Black Sea

Among the 184 species living within the Black sea, 110 are present within Georgian waters. There are three dolphin species resident in the Black Sea (Common dolphin –Delphinus delphis, bottlenose dolphin –Tursiops truncatus, harbour porpoise – Phocoena phocoena) two of which, the harbour porpoise and the bottlenose dolphin, are included in the Red List of Georgia. The harbour porpoise is also listed by IUCN as a globally vulnerable species. All three species are protected under the Bonn Convention on Migratory Species (CMS).

The coastal waters of the Black Sea and its associated river estuaries, especially the Rioni estuary, are significant habitats for sturgeon. Six species of sturgeon are observed in the area (Acipensesturio, A. stellatus, A. gueldenstaedti, A. nudiventris, A. persicus, Husohuso) and all of them are included in the Red List of Georgia, whilst A. sturio is listed by the IUCN as globally endangered. The reasons for decreasing of number of sturgeon are: construction of hydro-power stations on spawning rivers, the extraction of gravel from riverbeds, and the increasing level of water pollution.

The most valuable natural habitats of the Black Sea and Georgian coastline are included in Kolkheti National Park and are under special protection regimes. Kolkheti National Park comprises 15,742 ha of marine protected area, strict and managed protection zones, and is a significant habitat for dolphins and sturgeons.

Protected Areas

As of 2010, protected areas in Georgia are divided into five different categories as described in Table 11.3.

Since 2005, the following new protected areas have been established in Georgia:

- Mtirala National Park – 15,806 ha;
- Tbilisi National Park - 22,425 ha, which now includes the Saguramo State Reserve (5,359 ha);
- Imereti Caves Protected Areas, comprising 11 Natural Monuments with 9 Karst Caves (precise areas are not known).

National category	IUCN category	Number	Area	Share in total territory
National reserve	I	14	141,534.11 ha	2 %
National park	II	8	258,437.1 ha	3.7%
Natural monument	III	14	314.8 ha	
Managed reserve	IV	12	61,158 ha	0.88%
Protected landscape	V	2	34,510 ha	0.5%
Total			495,954.01 ha	7.11 %

Table 11.3 Protected areas categories in Georgia

The International Union for Conservation of Nature (IUCN) was established to protect and conserve the natural diversity of the Earth biosphere. The World Commission on Protected Areas (WCPA) is housed within the IUCN, and conducts worldwide programs on biodiversity protection aimed at the extension and better management of the protected areas.

In 1994, the IUCN developed a unified classification system of protected areas which is now in use worldwide. According to this classification system, protected areas are divided in 6 following categories:

1. Strictly Protected Area (nature reserve, or wildlife area). This type of protected areas is created for the protection of ecosystems or species of special importance. They are conserved in natural conditions and hence, human intervention is restricted at the maximum level.
2. National Park. This is large natural or nearly natural area, the aim of which is to maintain the viability of large ecosystems. National Parks also serve to promote greater understanding of nature and biodiversity, to promote education and research. National Parks can be used for recreation and tourism purposes.
3. Natural Monument. As a rule, this is small area, which protects a certain natural component: for example, an especially beautiful rock, a karst cave, or even an old tree. These areas can be tourist attractions in their own rite.
4. Habitat/Species Management Area. This is a comparatively small area, for conservation or rehabilitation of certain species or habitats. The protection regime depends here on specific needs of the protected element and, consequently, the level of restriction on human activity in these areas can vary form one management area to the next.
5. Protected Landscape. This is an area where a landscape of a certain ecological, biological, or cultural values has been created due to human activities. The protection approach here is to maintain the traditional interaction between man and environment.
6. Protected Area with Sustainable Management of Resources. This is an area where natural conditions are maintained and where resources can be used in a sustainable way. Protection of these areas is aimed at maintaining the traditional, balanced interaction between man and environment.

With the adoption of the Law of Georgia on the Status of Protected Areas in 2007 the status of several existing protected areas changed (Ajameti, Kazbegi and Algeti Nature Reserves converted to the relevant Managed Reserves) and the sizes of several others (Ktsia-Tabatskuri, Nedzvi, and Tetrobi Reserves) defined.

Table 11.3 presents the list of protected areas.

A number of additional protected areas are to be establish in Javakheti Plateau, Pshav-Khevsureti, Central Caucasus (Racha and Svaneti), and in Machakhela gorge. The extension of Kazbegi and Algeti National Parks, Mariamjvari Reserve and Ktsia-Tabatskuri Managed Reserve are also planned.

It is envisaged that up to 40 areas will be evaluated for designation as Natural Monuments as part of the on-going project on the conservation of natural monuments.

Protected areas are managed in accordance with special management plans, which define the main strategic direction of development of the protected area and the programs and activities to be undertaken in order to achieve these goals. Such plans are already developed for Batsara and Babaneuri Reserves, Kolkheti National Park, Kobuleti Reserve and Managed Reserve. Other protected areas are managed by a set of interim regulatory rules while specific management plans are being developed.

Fires caused by the 2008 August Russian Military Agression in Georgia significantly damaged large areas of Southern Georgia. Proceeding from the created circumstances (military actions, cimpliicated relief and other circumstances, which made fire fighting measures very difficult), the fire spread very quickly along the right bank of Gujarula River and enclosed the significant territories covered with forest.

The fire also affected Borjomi-Kharagauli Protected Area (Reserve and Natural Park and Nezvi Managed Reserve). In the national park, the fire source was recorded in four places, an area constituting around 150 ha. The fire damaged the forest and plane ecosystems and mainly damaged coniferous forests. In addition, the fire damaged the eco-educational touristic path of the national park and its adjacent forest.

National Biodiversity Strategy and Action Plan

The Government of Georgia approved the National Biodiversity Strategy and Action Plan (NBSAP) in February 19, 2005 by the Decree #27. The NBSAP details a ten year strategy for biodiversity protection and sustainable re-

source use, as well as specific activities for the first five year period. It is envisaged that an action plan for the next five years will be developed, taking into account the current situation and the progress made by that time.

The following issues are distinguished within the NBSAP with due regard to the state of the country's biodiversity and the issues and problems that threaten it: development of protected areas; protection and monitoring of species and habitats; agro-biodiversity; sustainable hunting and fishing; sustainable forestry; and bio-safety. The NBSAP defines 140 activities to be undertaken in order to achieve the stated goals. NGOs and scientific institutions will play a role in the implementation of the NBSAP, in addition to government bodies. The ministry of Environment of Georgia will coordinate activities.

Results achieved by implementation of NBSAP, are listed below:

- A protected areas system is being developed;
- The new version of Red List of Georgia has been prepared in accordance with the IUCN criteria and categories;
- The conservation management plans for several endangered species and species groups have been prepared and the implementation has started;
- The establishment of a National Biodiversity Monitoring System has been initiated;
- Ex situ and on-farm conservation of endemic, endangered and cultivated flora species of Georgia has been conducted;
- Legal and institutional environment for the sustainable management of biological resources has been improved;
- Biodiversity Resource Centre of Georgia (www.chm.moe.gov.ge) has been established.

#	Protected area	Area (ha)	Establishment date
	Reserves	141,534	
1	Lagodekhi	22,295	1912
2	Tusheti	10,858	1980
3	Babaneuri	862	1960
4	Batsara	2,985	1935
5	Vashlovani	10,143	1935
6	Liakhvi[3]	6,388	1977
7	Mariamjvari	1,040	1935
8	Sataplia	354	1935
9	Borjomi	14,820	1929
10	Bichvinta-Mjusera[3]	3,645	1966
	Bichvinta	165	1926
	Lidzava	1,296	1960
	Mjusera	2,184	1946
11	Ritsa[3]	16,289	1946
12	Pskhu-Gumista[3]	40,819	1978
	Pskhu	27,334	1978
	Gumista	13,400	1978
	Skurcha	85	1946
13	Kintrishi	10,703	1959
14	Kobuleti	331	1998
	total	**141,534.11**	
	National Parks	258,437	
1	Borjom-Kharagauli	61,234	1995
2	Kolkheti	45,447[4]	1998
3	Tusheti	71,482	2003

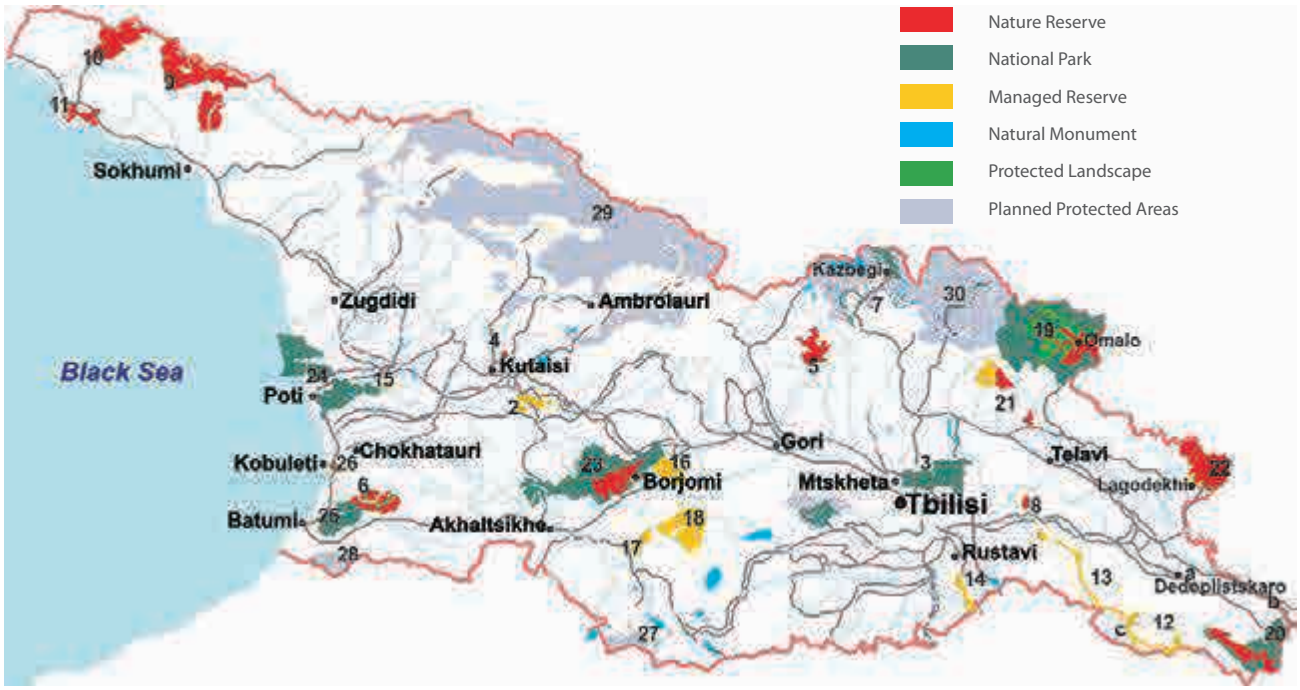
[3] Located in the area where the state control is not provided de facto

[4] Of which 29,704ha is terrestrial and 15,743ha - marine

[5] Areas of natural Monuments (except three) are not defined yet

4	Vashlovani	24,610	2003
5	Mtirala	15,806	2006
6	Tbilisi	24,327	1946
7	Algeti	6,822	1965
8	Kazbegi	8,707	1976
	total	**258,437.1**	
	Natural Monuments[5]	315	
1	AlaznisPlain	204	2003
2	Takhti-Tefa	9	2003
3	ArwivisKheoba	100	2003
4	KumisTavi Cave		2007
5	TetriCave		2007
6	KhomulisCave		2007
7	TsutskhvatiCave		2007
8	NavenakheviCave		2007
9	NagareviCave		2007
10	JasonCave		2007
11	SakajiisCave		2007
12	Tskaltsitela Gorge		2007
13	Okaces Canyon		2007
14	OkacesWaterfall		2007
	total	**314.8**	
	Managed Reserves	61,158	
1	Gardabani	3,484	1957
2	Korugi	2,068	1965
3	Iori	1,336	1965
4	Chachuna	5,200	1965
5	Katsoburi	295	1964
6	Ktsia-Tabatskuri	22,000	1995
7	Nedzvi	8,992	1995
8	Tetrobi	3,100	1995
9	Kobuleti	439	1998
10	Ilto	6,971	2003
11	Lagodekhi	2,156	2003
12	Ajameti	5,117	1946
	Protected Landscapes	34,510	
1	Tusheti Protected Landscape	31,320	2003
2	Kintrishi Protected Landscape	3,190	2007
	total	**34,510**	
	Multi purpose areas		
	Akhmeta		2003
	Lagodekhi		2003
	Vashlovani		2003
	Kolkheti		1999
	Kobuleti		1999

Table 11.4 Protected Areas of Georgia by 2010



1 Algeti National Park
2 Ajameti Managed Reserve
3 Tbilisi National Park
4 Imereti Caves Protected Areas
5 Liakhvi Nature Reserve
6 KintriSi Nature Reserve
7 Kazbegi National park
8 Mriamjvari Nature Reserve &
Korugi Managed Reserve
9 Psxu-gumista Nature Reserve
10 Ritsa Nature Reserve
11 Bichvinta-miusera Nature Reserve
12 Chachuna Managed Reserve
13 Iori Managed Reserve
14 Gardabani Managed Reserve
15 Katsoburi Managed Reserve
16 Nedzvi Managed Reserve
17 Tetrobi Managed Reserve
18 Ktsia-tabatskuri Managed Reserve
19 Tusheti protected Areas
Tusheti Nature reserve
Tusheti National Park
Tusheti Protected Landscape
20 Vashlovani Protected Areas
Vashlovani Nature Reserve
Vashlovani National Park
ა) Artsivis Kheoba Natural Monument
ბ) Alaznis Chala Natural Monument
გ) Takhti-Tepha Natur
21 Batsara-Babaneuri Protected Areas
Batsara Nature Reserve
Babaneuri Nature Reserve
Ilto Managed Reserve
22 Lagodekhi Protected Areas
Lagodekhi Nature Reserve
Lagodekhi Managed Reserve
23 Borjomi-Kharagauli National Park
& Borjomi Nature Reserve
24 Kolkheti National Park
25 Mtirala National Park
26 Kobuleti Protected Areas
27 Javakheti Planned Protected Areas
28 Machakhela Planned Protected Areas
29 Central Caucasus Planned Protected

Map 11.1 Protected Areas of Georgia

One of the key parts of biodiversity protection is plant conservation through creation of seed banks. More than 600 endangered and endemic flora species (17%) are already preserved in the seed banks within Georgia and Great Britain (as part of the Kew Botanical Garden Millennium Seed Bank project).

The seed bank was created based on 3,057 samples of the field plants and vegetables stored at the Georgian Agricultural Institute where and 1,519 samples of fruit and vine species stored at the Institute of Gardening, Viticulture, and Wine-making.

On farm conservation of endangered traditional Georgian agricultural species is now underway. The Biological Farm Association, 'Elkana', recently undertook initiatives on farms in the Samtskhe-Javakheti for the preservation and cultivation of tradition of five species of grain (wheat, barley, rye, millet, and gomi (Italian millet)), five species of legumes, and one species of "Industrial" flax. 22 local apple species have been collected for preservation, and saplings form these species have been distributed to farms in the Samtskhe-Javakheti region.

V/11. 3. MAIN CHALLENGES

The main threats to Georgian biodiversity of are the degradation and loss of habitats and the unsustainable use of biological resources; as a result, many species of flora and fauna have become endangered. Poaching is considered to be the main reason for the decreasing population of large mammals. Large mammal populations are so distressed that only special conservation measures can improve their status. Programmes for the rehabilitation of the gazelle population in Vashlovani National Park and the wild goat population in the Borjomi-Kharagauli National Park are under way. Conservation management plans have also been prepared for the following species and species groups: Tur, leopard, bats, brown bear, Caucasian black grouse, some waterfowls, imperial eagle, lesser kestrel, sturgeon species, and Caucasian salamander.

Wild goats (Capra aegagrus) were inhabitants of the Borjomi Gorge area from ancient times. There are now just nine specimen that have been reintroduced from Armenia. At this point the herd is housed in specially constructed paddocks and is breading successfully.

The forest ecosystem is in particular need of protection. The felling of trees for timber and firewood remains one of the key threats to biodiversity. Firewood is still the main source of energy in many small towns and villages. Notwithstanding the measures undertaken for the rehabilitation of Chiauri and Iori flood-plains, extensive measures are still required for the rehabilitation of Alazani and Iori flood-plain forests.

More attention must be paid to the problem of invasive species. Research is required to better understand the influence of the invasive species on local species. Preventative measures such as improved border controls must be established, in addition to control measures (mechanical, chemical, biological) to restrict the expansion of invasive species and to minimize their impact.

Gazelle (Gazella subgutturosa) were once very common in the Shiraki Valley. This species became totally extinct in the 1960's due to overgrazing and uncontrolled hunting. A rehabilitation programme for the gazelle population in Vashlovani National Park is currently underway. In particular, 10 adult specimens have been introduced from Turkey. Initially these animals are being kept in a specially constructed compound within the park. The herd is already breading successfully.

Due to lack of modern and effective tools for data collection, storage and analysis, the identification of the actual changes in species and habitat conditions has become quite difficult. This in its turn has made the assessment of the current state and trends of biodiversity significantly more complicated. As a result, there is a poor information base on which to make decisions for biodiversity conservation.

Modern and effective mechanisms for data collection, processing and analysis are necessary for defining the changes in species and habitats status. In addition for the assessing the scale of the possible hazards impact on biodiversity. Today there is not enough information and clear basis for effective decision making in the field of biodiversity conservation.

To improve the assessment of biodiversity status in Georgia, the establishment of biodiversity monitoring national system is underway in cooperation with GIZ. The selection of biodiversity monitoring national indicators has been accomplished. At present, the methods of data collecting and analyzing according to separate indicators are being developed. After the methodological part is completed, it is planned to collect and analyse the data in accordance with separate indicators (more details are available on the website: www.biomonitoring.ge).

The state of biodiversity in Georgia is also being impacted by global climate change. In the process of preparation of the Second National Notification to the Convention, the most vulnerable ecosystems have been identified as: coastal, arid, semi-arid, and high mountain zones.

Georgia ratified the Cartagena Protocol to the Convention on Biodiversity in 2008. Accordingly, the tools for national enforcement of the Protocol commitments are to be developed.

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V/12

FISHERY AND HUNTING

The use of biological resources is strictly regulated in Georgia. The rules for fishing and hunting are defined. Where these rules are breached there are a range of administrative, civil and criminal penalties. Hunting is strictly controlled; there are defined areas, species and hunting seasons.

It is necessary to develop an appropriate monitoring system to evaluate the effectiveness of measures put in place to achieve sustainable management of fishing and hunting.

V/12. 1. HUNTING

Sport and amateur hunting are the only types of hunting allowed in Georgia. Any person who has the right to hold and use hunting firearms, has the right to hunt. A hunter must pay an annual fee of 10 GEL to hunt migratory birds. A hunter must keep records while hunting, including a licence confirming his right to keep and use the gun.

Hunting is allowed only within hunting farms (except hunting migratory birds). Only hunting of those animals listed in the Hunting List (Tables 12.1 and 12.2) are allowed.

Nutria	Myocastor coypus
Hare	Lepus europaeus
Badger	Martes meles
Pine Marten	Martes Martes
Stone Marten	Martes foina
Wolf	Canis lupus
Golden Jackal	Canis aureus
Fox	Vulpes vulpes
Raccon Dog	Nyctereutes procyonoides
Wild Cat	Felis silvestris
Wild Boar	Sus scrofa
Roe	Capreolus capreolus
Common Raccon	Procyon lotor

Table 12.1 Mammals allowed for hunting in Georgia

Latin name	English name	Dates	Daily limits
Anser anser	Gray Lag Goose	01 November – 01 March	Total daily limit – 8
Anas strepera	Gadwall	01 November – 01 March	
Anas crecca	Common Teal	01 November – 01 March	
Anas platyrhynchos	Mallard	01 November – 01 March	
Anas querquedula	Garganey	01 November – 01 March	
Anas clypeata	Northern Shoveler	01 November – 01. March	
Fulica atra	Northern Shoveler	01 November – 01 March	
Scolopax rusticola	Eurasian Woodcock	15 October – 15 December	7
Gallinago gallinago	Common Snipe	From the third Saturday of August – until February, 15.	5
Coturnix coturnix	Common Quail		20
Columba palumbus	Common Wood-Pigeon		10
Columba livia	Rock Dove		10
Columba oenas	Stock Dove		10
Streptopelia turtur	Eurasian Turtle-Dove		10

Table 12.2 Birds allowed for hunting in Georgia

Hunting of species shown in Table 12.2 is allowed throughout Georgia, except in protected areas and within 500 meters around them, as well as within the administrative limits of cities. Hunting dates and daily limits per hunter are defined for each species[6]. The hunting of Chuckar (Alectoris graeca) and Phaesant (Phaesianus colchicus) is allowed within hunting farms.

In all cases it is prohibited to exceed hunting quotas for animals, to damage their nests, dens, or habitats, or to use inhuman hunting methods (for instance, hunting of large animals with small-calibre weapon, or small shot).

It is illegal to hunt animals not listed in Tables 12.1 and 12.2, or to hunt in violation of the rules mentioned above, for example hunting in Reserves or National Parks, using inappropriate weapons or methods, exceeding the established limits, etc.

Poaching is generally punished by fines and confiscation of weapons, although in special cases criminal charges can be brought against poachers. In addition, compensation is payable to the State based on number of animals wounded or killed, and the damage caused to the environment. For the poaching of one bird the

[6] Order #512 of the Minister of Environment and Natural Resources of Georgia (07.12.2005) on 'Approval of the Rules, Dates, Guns and Methods of Taking from the wild According to Species'

amount of compensation levied for damage caused to the environment ranges from 10 to 300 GEL, while in case of poaching of a large mammal damages range from 10 to 15,000 GEL.

In circumstances where a wild animal poses a threat which is likely to lead to the death or injury of a person, or damage to property, killing of the animal is allowed at the moment of attack. People can also apply to their local authority, who will undertake appropriate measures in accordance with the Ministry of Environment. In such cases, the animal which has been killed must be disposed of by burial or incineration. The carcass or any of its parts cannot be used for any purpose.

Hunting farms have been established in within State Forests by private persons who have obtained the appropriate licences (See details in Chapter 20). The owners of hunting farms are obliged to comply with a number of requirements defined by the licences. For example, they are responsible for the protection and restocking of the endangered species hunted in their area and for conducting an annual inventory of the wild species within their territory.

As of 2010, there are 15 operational hunting farms with total area of 73,655 ha. Most have not yet conducted the obligatory inventory on their territories and as such, did not receive approved hunting quotas. For the 2009-2010 hunting season, quotas were approved for only 5 hunting farms.

A basic survey of the hunting sector has been undertaken based on the initiative of the Ministry of Environment Protection of Georgia. Based on the findings of this study, the main needs and strategic directions for the sector have been defined.

Species	Damage per capita (GEL)
Deer	15,000
Caucasian tur	13,000
Wild goat	10,000
Gazelle	10,000
Bear	10,000
Chamois	6,000
Roe deer	5,000
Leopard	5,000
Caucasian lynx	1,000
Stripped hyena	1,000
Wild boar	1,000
Otter, Mink, Marble polecat	500
Wolf	300
Fox	250

Table 12.3 Damage caused to the environment calculated for some mammal species

Species	2007-2008	2008-2009	2009-2010
Wolf (Canis lupus)		3	39
Hare (Lepus europaeus)	81	81	249
Fox (Vulpes vulpes)	3	30	184
Jackal (Canis aureus)	22	72	221
Badger (Martes meles)	2	4	65
Pheasant (Phasianus colchicus)	20	80	94
Chuckar (Alectoris gracea)	106	119	60
Wild boar (Sus scrofa)	60	125	157
Common Raccon (Procyon lotor)	Unlimited amount		Subject to total removal
Marten (Martes martes)			84
Roe deer (Lapreolus lapreolus)			12

Table 12.4 Numbers of specimens of allowed for hunting species

V/12. 2. FISHERY

There are three kinds of fishery allowed in the Georgian marine territorial waters and inland waters: commercial, sport, and amateur. Licences or permits are not required for fishing within 300 meters of the coast or for sport and amateur fishing. There are however some obligatory requirements to be fulfilled. In particular:

- Taking of marine mammals, salmon and sturgeon species, and fresh water crayfish is prohibited. It is also prohibited to fish trout species during the period 1st October to 1st January, and plaice-turbot between 15th February and 1st July. If these species have been by-caught accidentally, they should be immediately released into their natural habitat.
- It is prohibited to fish within the vicinity of; dams and bridges (within 500 m from dams and 50 m from bridges); power stations; farming and melioration channels; and in fish ladders associated with dams.
- It is prohibited to use more than 8 mm hooks, or more than double, or triple hooks in sturgeon or salmon rivers.
- It is prohibited to use any kind of explosive or poisoning substances, electric shock devices, fire-guns, or pneumatic guns.
- It is prohibited to use methods of chasing or startling, use of nets, damming and filtering water bodies, the use of any kind of dredging or bottom trawling, drift-nets without bottom attachment, underwater hunting with harpoon-like guns, and use of aqualungs, or other autonomous breathing equipment.
- It is prohibited to leave working sport-amateur fishing equipment in water bodies unsupervised.

Commercial fishing, except fishing within the 300 m coastal zone, is only allowed with proper licences.

At present, the following fish species are commercially fished in the Black Sea (anchovy, whiting, spiny dogfish, three mullet species, mackerel, and shad). Anchovy are the most commercially important with annual catches of approximately 30,000 – 40,000 tonnes. Annual quantities of the other fish species landed are much smaller. Long-term (10-year) fishing licenses were issued in 2006.

Salmon and sturgeon rivers of Georgia include: Psou, Khashupsa, Bzipi, Mchishta (Shavtskala), Khipsta (Tetrtskala), Aapsta (Baklanovka), Gumista, Kelasuri, Kodori, Mokvi, Galidzga, Okumi, Eristskali, Enguri, Khobi, Supsa, Natanebi, Kintrishi, Chakvistkali, Chorokhi, Acharistskali and their tributaries.

Sport and amateur fishing includes fishing with all kinds and systems such as fishing-rods, spinning, casting nets, traps, and also underwater hunting and the collection of hydrocoles.

The following are not considered to be sport or armature fishing:

- the use of an aqualung, or any other autonomous breathing equipment,
- using of more than 3 hooks (in separate cases 6-12 hooks are allowed),
- use of nets size of more than 1.2 m in width and mesh size is less than 2 sm.
- The use of more than 1 net per person.

Species/catching amount by years (kg)	2006-2007	2007-2008	2008-2009	2009-2010
	17,446,796	25,972,831	31,338,338	39,857,275
Anchovy	40,967.5	19,798	17,030.5	6,843
Whiting	53,229.5	10,018	29,5330.1	100,617
Mackerel	2,368.3	41	140	26
Spiny dogfish	48	68	101.9	
lufari	25	17	671	252
Shad	57	1.7	60.7	
Goby	1,320	25	7,437	
Sprat		44	282.5	1,524
Flathead mullet	132	316	216.8	8,159
Golden mullet	138	197	110	
Thin-lipped mullet	24	55	34.4	
Pickarel	3,778.5	55.1	757.5	
Red mullet	36.6			
Garfish		19	5	
Common stingray			10.6	
Black Sea Turbot			2	
Stargazer			1.5	
Swingletail				

Table 12.5 Catches by species and years in the Black Sea

Long-term licenses[7] for fish farms were issued in 2005 on the Dalis Mta, Shaori, and Jinvali water reservoirs. In 2009-2010, the fish fauna of 25 lakes and artificial reservoirs (Sioni, Tkibuli, Lipi, Kaishauri, Uziro, Gremiskhevi, Algeti, Akhmazi, Zresi, Suldi, Samsari, Pantiani, Beshtasheni, Paravani, Kartsakhi, Bugdasheni, Sagamo, Japana, Ujarma) were surveyed. Based on the findings of these surveys, special conditions were included in fishing licences for inland water bodies. These conditions should ensure the sustainable use of local fish resources and the rebuilding of fish stocks. By October 2010, fishing licences were issued for Nadarbazevi, Jandara, Santa and Tabatskuri lakes and Tsalka reservoir. The licensing procedure is currently underway for other water bodies.

V/12. 3. MAIN CHALLENGES

The most acute problem in the fields of fishery and hunting is poaching (i.e. illegal fishing and hunting).

One of the main drivers for illegal hunting is considered to be the uneven distribution of hunting farms around the country, and the under development of hunting farms that are in existence.

Development of the biological monitoring system will significantly facilitate the planning of appropriate measures, necessary to achieve sustainable management within these fields.

[7] Since July, 2005 these licences have been replaced by the fishery licences

VI

WASTES AND OTHER ENVIRONMENTAL ISSUES

VI/13

WASTES

The annual volume of domestic waste produced per capita in Georgia is approximately half that of the European average. However, waste volumes produced per capita are increasing in line with improvements in peoples' living standards. At the moment, municipal waste collection schemes do not cover all settlements in Georgia, but the situation is improving.

Up to one hundred landfills are operational in Georgia, among which only five (two municipal and three private) meet the required environmental standards. The remainder represent a considerable source of environmental pollution and as such, their replacement with modern landfills is urgently required. In addition, a National Strategy is required to reduce the amount of waste going to landfill, in particular the removal of recyclable and biodegradable waste streams should be targeted. This will require a significant investment in infrastructure within the country for the segregation, separation, reuse and treatment of such wastes.

There are still quite large quantities of industrial wastes remaining at the sites of former Soviet industries. One of these sites located in Racha-Svaneti is of significant concern, as it contains more than 100,000 tonnes of arsenic containing waste.

The neutralization, collection, and transportation of medical wastes are only properly organised in Batumi and Kobuleti. There are ten small incinerators in the country for burning medical, biological, and veterinary waste. The treatment capacity of these incinerators to process the total amount of these wastes at a national level needs to be assessed.

VI/13. 1. INTRODUCTION

Waste is a significant source of environmental pollution. In Georgia, wastes are disposed at landfills where waste is compacted and covered by soil, or some other inert material. Most of the landfills are not properly designed and practically all of them violate the operational requirements: the disposed wastes are not regularly and timely compressed, covered and spilled with moisture to avoid self-ignition of wastes. As a result, smouldering combustion of wastes occurs, resulting in emissions of very hazardous pollutants, dioxins and furans, into the atmosphere. These persistent organic pollutants are resistant to environmental degradation and are transported by atmospheric streams at long distances. Rainwater entering the landfill results in the production of highly toxic liquid leachates, which cause serious pollution when it enters rivers or ground water.

Waste, without proper treatment, is a very hazardous source of pollution for the environment, the treatment of which is quite an expensive process.

State Regulation

The regulation of waste in Georgia is governed by several different pieces of legislation.

The importing of hazardous and radioactive wastes into the country is prohibited by the Law of Georgia on "Import and Transit of Waste within the Territory of Georgia". Importing non-hazardous waste substances is allowed only in case of re-export or processing. The law defines an extensive list of wastes allowed for import for the above purposes.

The export of waste from Georgia is regulated directly by the Basel Convention on the "Control of Transboundary Movements of Hazardous Wastes and Their Disposal", to which Georgia acceded in 1999. According this Convention, the export of hazardous waste is only allowed by obtaining the consent of the government of the importing country. To obtain such 'consent', Georgia must send an official notification in a predefined format to the country to which the waste is to be exported.

The existing legislation, the Law of Georgia on the "Environment Protection" requires that preference be given to the use of recyclable materials and technologies for minimization of waste, when undertaking any kind of activities.

For the treatment, neutralization, and disposal of waste in Georgia, an Environmental Impact Permit is required. To obtain the Environmental Impact Permit, the interested party must conduct an Environmental Impact Assessment for the proposed activity, engage in a process of public participation and, submit the application to the Ministry of Environment Protection of Georgia for ecological expertise. The treatment, use, and disposal of wastes must be conducted in accordance with the environmental, sanitarian-hygienic and epidemiologic standards and rules. There are two such standards: 'Sanitary standards and rules for solid domestic waste landfills'[1] and 'Sanitary rules for collecting, storing, and treatment of wastes from medical-prophylactic organizations'.[2]

The disposal of any waste by dumping into the sea or in any other water body is prohibited in Georgia.

Despite the fact that Georgian legislation does not define waste types, in practice they are divided based on their origin as household, industrial and medical wastes. Sometimes construction waste is also considered as a separate category of waste. Municipal authorities are responsible for the planning and implementation of activities for the collection, treatment, and disposal of household waste. The producers of other types of waste are responsible for their management and disposal.

VI/13. 2. EXISTING SITUATION

a) Production of Waste

Household Waste

There is no comprehensive record of the amount of household solid wastes collected in Georgia, and as such, information on exact amount produced is not available. The amount is being calculated based on approximate values, including the population number and waste accumulation factors as assessed by experts. According to data for 2007, the annual production of the solid household waste in Georgia was 3.42 million cubic metres (approximately 800,000 tonnes[3]). The production of household solid waste in different regions is shown in Figure 13.1.

[1] Approved by Order No 36/n of 2003 of the Minister of Labor, Health and Social Protection
[2] Approved by Order No 300/n of 2001 of the Minister of Labor, Health and Social Protection

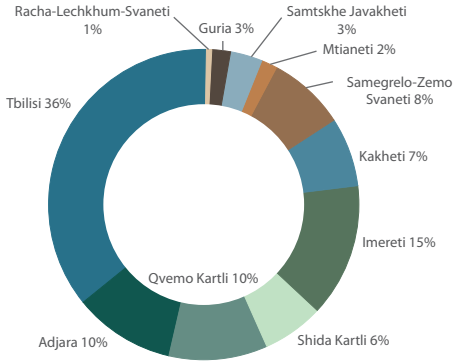

Figure 13.1 Annual production of household waste in Georgia by region

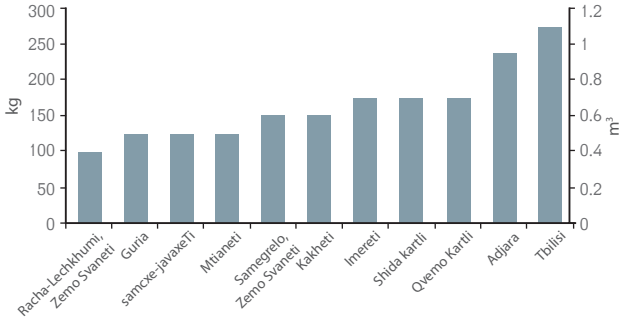

Figure 13.3 . Annual per capita production of household waste in regions of Georgia. Assessment, 2007

According to an assessment undertaken in 2003[1], organic substances constitute a third, by weight, of solid household waste collected in Tbilisi (see Figure 13.2). Recyclable materials (paper, glass, plastics, metals) constitute 18% of the waste. It should be noted however, that the plastic fraction of the waste is increasing annually.

Since 2007, the collection and recording of waste in Tbilisi has significantly improved. Data on annual generation of municipal wastes in Tbilisi are shown in the Figure 13.4.

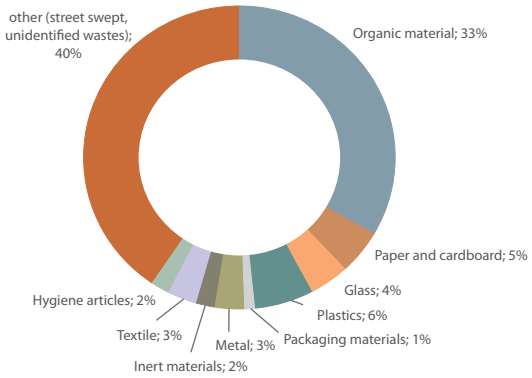

Figure 13.2 Composition of household wastes in Tbilisi. 2007 (source: Tbilisi Waste Management Concept 2006, GTZ, Infrastruktur&Umvelt

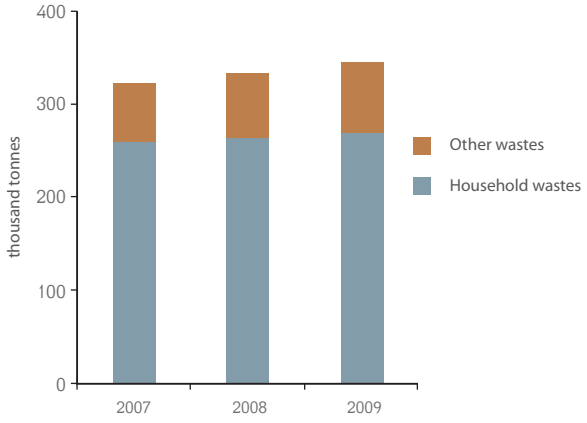

Figure 13.4 . Annual generation of municipal waste in Tbilisi, 2007 -2009

It is estimated that the annual production of household waste in the different regions of Georgia varies between 100 – 280 kg per capita. The highest level is in the capital, as shown in the Figure 13.3. For comparison, the average annual production of municipal waste in EU countries was 522 kg per capita in 2007.

Industrial Waste

The generation of industrial waste in Georgia is not recorded at the moment, and the amount of industrial waste produced annually is not available. According to assessment data prepared in 2006 [1], a minimum of 100,000 tonnes of industrial waste is produced annually in Tbilisi alone, of which over 6,000 tonnes are hazardous wastes (Figure 13.5).

[1]Mean concentration of domestic wastes is assumed 250 kg/m^3

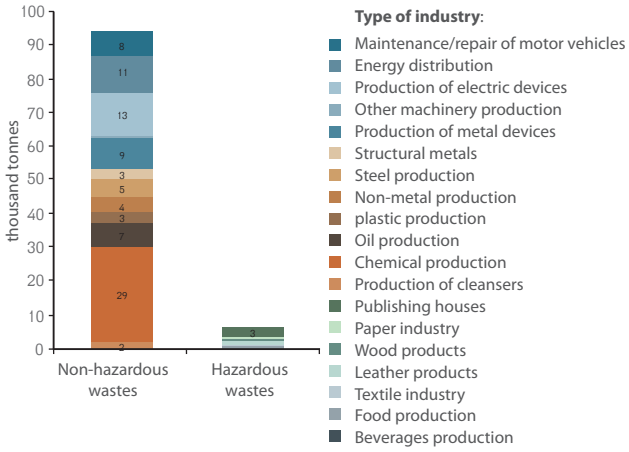

Figure 13.5. An assessment of annual production of industrial waste in Tbilisi, 2006. Source: Tbilisi Waste Management Concept, 2006, GTZ, Infrastruktur&Umvelt.

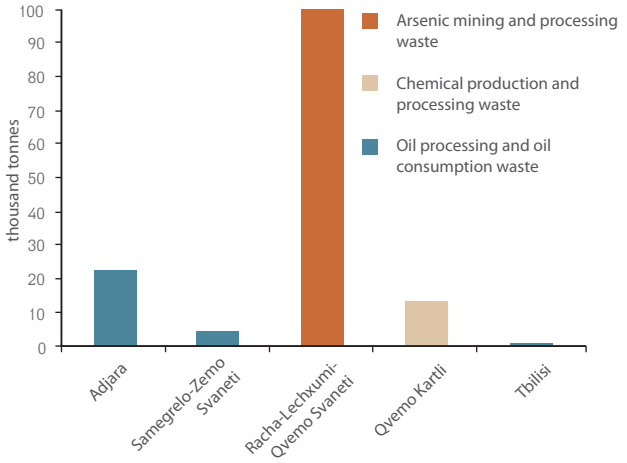

Figure 13.6. Hazardous waste from different industries accumulated in different regions. Inventory data, 2007

There are no landfills for industrial waste in the country. As such, industrial wastes are disposed of at municipal waste landfills, or more often, stored at the site of the facility producing the waste.

During the Soviet era, when the industrial sector operated at full capacity, the mining industry (including coal mining and processing), ferrous and non-ferrous metallurgy and oil extraction/processing were the most significant waste generating sectors. As a consequence, large volumes of industrial waste have been accumulated in the cities of Rustavi, Kutaisi, Zestaphoni, Bolnisi, etc., where these activities were undertaken. The wastes generated by these industries (ore, untreated rocks, gobs, etc.) were generally stored at the factory site or on lands adjacent to the factory. The wastes were stored at sites without taking into account any environmental considerations.

During 2007, information was collected from 450 large and medium size enterprises concerning the amounts of accumulated wastes at their sites. This information showed that the total amount of this type of waste was estimated at over 12 million tonnes, of which 140,000 tonnes were considered hazardous waste (Figure 13.6).

The majority of the accumulated industrial waste was produced by the mining sector. Hazardous, arsenic containing waste, accumulated in the Lentekhi and Ambrolauri districts, are of particular note. It is estimated that there are more than 100,000 tonnes of this waste.

Medical Waste

The generation and disposal of medical wastes in Georgia is poorly recorded at present. Hence, only estimates of the quantities of these wastes, derived from expert assessment of recording data (see [2] and [3]), are available. According to different assessments, the annual production of medical waste (from hospitals, polyclinics, drugstores) is around 5,000 to10,000 tonnes. Of this, 1.2 to 1.8 thousand tonnes are considered hazardous and consist of: infectious wastes (materials polluted with different infectious pathogens or exudates), sharps (injection needles, glass pieces, etc.), medical and diagnostic waste materials, expired medicines, disinfection waste and pathologo-anatomical wastes (Figure 13.8).

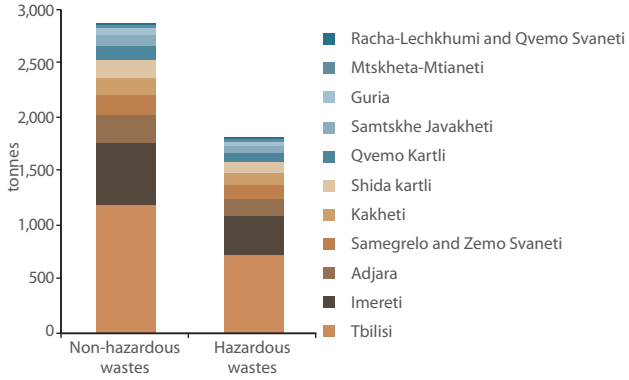

Figure 13.7. Annual production of medical waste in Georgia. Assessment, 2009. Source: [3]

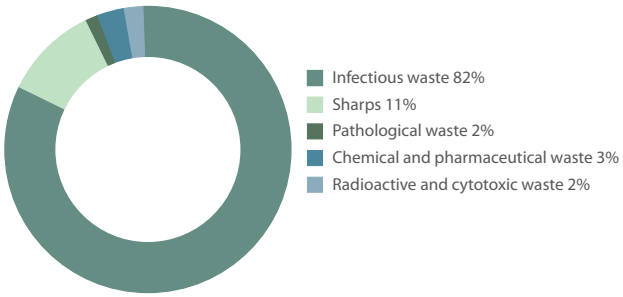

Figure 13.8. Composition of hazardous medical wastes. 2009. Source [3]

Waste Processing

Waste segregation is not carried out in Georgia to any significant level at the moment, although some centres have been established for the collection of recyclables such as metal, paper, plastic, and glass. These materials are collected from different sources such as waste bins and landfills and are delivered to the recycling centre where people are paid a small amount for the material. Scrap metal is mainly exported, while other materials (paper, plastic, glass, etc.) may be used as raw material for recycling, though in very small amounts. People also use wood bark waste as heating material.

The list of wastes for which processing permits are issued in Georgia is given in Table 13.1. The table shows that there are some plants in Georgia processing both non-hazardous and hazardous wastes. In particular, there are plants carrying out recovery/treatment of waste oils; plants processing lead scrap from old and damaged batteries; plants producing hydrocarbons from used belts and elastomers, etc. The capacity of these plants is very low.

Waste	Location of plant	End product of waste processing
Plastic products	Tbilisi	Milled and briquetted plastic waste
	Kutaisi	Tile
Domestic waste	Rustavi	Segregated and briquetted waste, compost
Old motor vehicle batteries	Tbilisi (2 permits) Rustavi Gardabani district (2 permits), village Agtakala, village Lilo	Lead bars
Used belts and elastomeric materials	Tbilisi Khobi district, village Ojikhevi Kaspi district, village Metekhi	Mazut
Waste oils	Tbilisi	Recovered technical oils

Table 13.1. Permits issued for waste processing in Georgia (as of 2009)

Waste Treatment and Disposal

Landfills

There are 69 'official' municipal landfills operating in Georgia today. Only six of them have Environmental Impact Permits: Dedoplistskaro (till 2013), Tbilisi, Ureki-Natanebi (in private posession of Ltd Atu), Ozurgeti vil. Meria (in private posession of Ltd Atu), near Rustavi (territory of Gardabani Municipality, in posession of BP), Khobi vil. Pirveli Maisi (Ltd Makronebi-XXI). The remainder are technically illegal. As a rule, the structure and operation of these landfills do not meet the required standards, they do not have the relevant approved construction projects nor the required Environmental Impact Permits.

- Some of the landfills are located at or close to riverbanks. During rain and floods waste is washed into the rivers;
- The landfills do not have a lining system to contain polluting liquids, which arise as part of the degradation process, and prevent them from entering into groundwater.
- The waste disposed of at the landfills is not regularly compacted and is not covered by a barrier soil layer.
- Landfills do not have proper system of collection and removal of combustible landfill gasses or irrigation of the landfill surface. As a consequence, waste can self-ignite resulting at a fire on the landfill, which can be extremely difficult to control. This is particularly disturbing for residents living within the vicinity of such landfills.
- Monitoring of the landfill area (water, air, soil) is not conducted;

- Landfills are not properly fenced and protected, allowing farm animals such as cattle and sheep to have free access to the landfills. which creates risks of spreading the microorganisms that can cause disease.

There are 28 known 'unofficial' landfills in Georgia, although the actual number of unauthorised landfills is likely to be far greater. The total area of the known landfills is between 289 and 300 ha. Their distribution by Region is given in Figure 13.9.

Waste is disposed of in municipal landfills without any prior separation. Industrial, construction, medical, biological and other kinds of waste are disposed together with household waste.

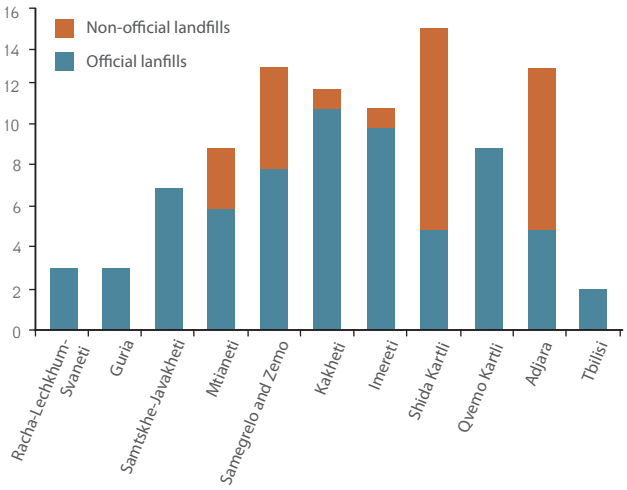

Figure 13.9. Number of domestic waste landfills in the regions of Georgia

There are currently no hazardous waste landfills operating in Georgia. The old hazardous waste storage facility near Rustavi, at Iagluja Mountain, was closed in 1985, and is currently in a very poor state of repair. According to some assessments, it contains up to 3,000 tonnes of hazardous chemical substances, including chlororganic pesticides. Between 2007 and 2009, approximately 230 tonnes of obsolete pesticides were collected in different regions of Georgia and were placed in temporary storage in the central storage facility near the village of Badiauri. In 2010, these wastes were transferred to the Iagluja waste storage facility. About 600 tonnes of pesticide-contaminated soil is also stored at the Iagluja waste storage facility.

Incineration

There are about 11 small incinerators operating in Georgia, used for the incineration of medical wastes. The collection, processing and transportation of hazardous medical waste for incineration, is only organised at a municipality level in Batumi, Kobuleti and Tbilisi. Several companies deal with medical waste collection and treatment, though not all medical facilities are served. It should however be noted that there is an ongoing project funded by the Government of Netherlands, aimed at improving current practices of management of infectious wastes in medical facilities.

VI/13. 3. WASTE MANAGEMENT INFRASTRUCTURE

Municipalities are responsible for the collection and transportation of household waste. However, a regular waste collection service is only available in some of the central settlements. According to the most recent data from 2009, only 30% of the population are provided with a regular waste collection service in Shida Kartli and Mtskheta-Mtianeti. The same situation is also evident in other regions, with the exception of large towns. However, the situation is improving every year.

Domestic waste in Georgia is collected by the following methods:

Bunkers – many multi-storey buildings are provided with a waste collection bunker from which the wastes are loaded into special waste transporters. This is not a mechanized process and hence, it is quite inefficient. Cleaning and disinfection of bunkers is rarely undertaken and as such these represent potential sources of contamination and infection, and breeding grounds for insects and rodents. In Tbilisi, most of the bunkers have been closed and replaced by containers.

Containers – are provided in the streets. The volume of the containers is between 0.8 to 1 cubic meter. Waste is loaded into the waste transporters once or twice per day.

Bell system – is used in those areas, where the container system is not in operation. The waste collecting happens at different frequency, mostly two or three times a week. This system is not effective.

After cleaning the streets, gardens, parks, or beaches, the waste is collected in bunkers, or just gathered at an adjacent area. This waste is often burnt.

Location of incinerators	Type of waste to be burnt	Organization granted an Environmental Impact Permit
Tbilisi, Alekseevka	Medicinal waste	LEPL[1] L. Sakvarelidze National Centre of Diseases Control and Public Health Protection
Tbilisi , Vashlidjvari	Waste of the Veterinary Clinic	Ltd Environmental Technology
Tbilisi	Wastes of Institutes of Bacteriophage , Microbiology and Virology	Ltd Environmental Technology
Tbilisi	Medicines, pesticides, oil waste	Ltd Kimiani (Territory of the Institute of Physical and Organic Chemistry)
Tbilisi	Medical waste	JSC Gudushauri Madical Center
Batumi	Medical wastes of the diagnostic laboratory of the Batumi Plague and Especially Dangerous Infection Prevention Centre	LEPL L. Sakvarelidze National Centre of Diseases Control and Public Health Protection
Batumi	Medicinal waste	Municipal enterprise San- dasuptaveba
Kutaisi	Medicinal (epidemiological) waste	Imereti Regional Centre of health Protection
Kutaisi	Waste of the Veterinary Clinic	Kutaisi regional Veterinary Clinic
Akhaltsikhe	Waste of the Veterinary Clinic	LEPL Akhaltsikhe Veterinary Clinic

Table 13.2. Incinerators of Georgia

Modern closed compactor waste collection trucks are used for waste collection in large cities and towns such as Tbilisi, Batumi, Kutaisi, Gori, Rustavi, etc., while open body trucks, or tractors with trailers are still used in the regions, especially in villages. The collection and transportation of waste in open trucks is ineffective and leads to littering of roadways on the transport route.

There is no waste collection service operating in most villages, and people carry the waste out of the settled area and throw it into rivers or ravines.

In general, municipal companies undertake the collection, transportation, and disposal of waste, in addition to services such as street cleaning, etc. These activities are financed by fees paid by householders and by industrial and commercial organisations operating within the municipality. The scale of charges for individuals vary throughout the country between 0.40 to 1.2 GEL per month, while the fees for commercial entities depend on type and scale of their activities and on the area occupied. Usually not all individuals pay the required fees.

VI/13. 4. MAIN CHALLENGES

Waste generation figures per capita are not very high in Georgia by comparison to the EU average; however, increased levels of waste production are expected in line with economic development.

The main issue is the provision of properly constructed and managed landfills and other waste management infrastructure, such as transfer stations and recycling centres. All but few landfills do not meet environmental requirements, thus causing pollution of air, ground water, and surface water bodies. These landfills must be phased out, along with the planning and construction of new landfills.

It should be noted that the construction of three modern municipal landfills is planned for 2010-2012: in Rustavi, Adjara and Borjomi. When completed, the old unauthorised landfills in this area will be closed.

[1]Legal Entity of Public Law

Type of activity	Measurement units	Fee rate per measurement unit per month, GEL
Natural persons	Per head	1.2
Museums, libraries, archives*	1 m^2 of total area	0.027
Offices, agencies, professional and state organizations, banks, credit agencies and commercial companies*	1 m^2 of total area	0.1
Movie theatres and theatres	One chair	0.41
Geriatric homes, orphanages*	One place	0.16
Schools, institutes, colleges, kindergartens, educational institutions (fees for infrastructure area are not paid)	One pupil	0.25
Hotels*	One bed	2.15
Hospitals*	One bed	1.45
Polyclinics, diagnostic centres, dental clinics*	1 m^2 of total area	0.2
Stadiums, open areas of sport organizations and manages (except training and competition grounds)	1 m^2 of open area	0.025
	1 m^2 of closed area	0.1
Food product shops (trading area)	1 m^2 of working area	0.95
Industrial product shops (trading area)	1 m^2 of working area	0.31
Agricultural markets, open and closed flower shops	1 m^2 of total area	0.37
Mixed trade fairs	1 m^2 of total area	0.26
Parking grounds and storages (except long-term storages)	1 m^2 of open area	0.025
	1 m^2 of closed area	0.1
Petrol stations	1 m^2 of total area	0.1
Trading and demo buildings for car selling	1 m^2 of total open area	0.05
	1 m^2 of total closed area	0.1
Garages, technical services	1 m^2 of total open area	0.025
	1 m^2 of total closed area	0.17
Baths, saunas	1 m^2 of total area	0.22
Barber shops and beauty parlours	1 m^2 of total area	0.43
Small business, personal service facilities	1 m^2 of total area	0.31
Restaurants, pizzerias, canteens, cafes, bars	One seat	3
Banquette halls for ritual services	One seat	1.2
Bakeries	1 m^2 of working area	0.32
Discotheques, night clubs, casinos, totalizators, game and entertainment centres	1 m^2 of total area	0.45
Station houses, airports, motor vehicle and metro stations	1 m^2 of open area	0.01
	1 m^2 of closed area	0.1
Open recreational areas, squares, gardens, attractions	1 m^2 of total area	0.01
Military troops and penitential systems*	One place	0.75
Open areas of enterprises, where the production process is carried out	1 m^2 of total area	0.01
Manufacturing enterprise buildings (except industrial waste)	1 m^2 of total area	0.05

Table 13.3. Cleaning fees in Tbilisi

* fees for infrastructure area are not paid

New landfills are also required in other municipalities and regions. The construction of fewer large regional landfills is preferable. Large regional landfills should be connected to towns and villages outside of their direct catchment area by a series of waste transfer stations. Consideration needs to be given to waste management in mountaneous districts.

Particular attention should also be paid to stemming the trend of increasing waste generation within the country. Continued public information and education initiatives are required to encourage people to change the way in which they live, and to become more sustainable. Producers should be encouraged to use less or easily degradable packaging materials on products and to produce less waste during the production process by using more efficient processes.

Significant investment is also needed to promote the segregation, collection and use of reusable and recyclable materials from the waste stream. This will require establishing 'bring centres' or dedicated collection systems for recyclables and biological fraction suitable for composting. It also requires people to adopt the practice of segregating waste in their homes into recyclables and refuse. The waste recycling/processing capacity of the country must also be increased.

The management of hazardous wastes, especially the medical, veterinary, and special biological wastes, is also in need of improvement. These wastes represent high-risks, given their potential as sources of infectious diseases. It is necessary to provide a system requiring strict recording, collection, and proper disposal of these wastes. Appropriate waste management systems for pesticide contaminated packaging materials must also be put in place, which will include their separate collection and treatment.

The necessary funding and resources are being identified for processing large quantities of industrial waste, especially hazardous waste generated during the Soviet period and stored at industrial sites, also requires urgent attention. The most pressing problem is considered to be the proper management of arsenic containing waste, large quantities, (100,000 tonnes) of which are stored in the Racha-Svaneti region.

Hazardous wastes from agriculture such as old or obsolete pesticides are also a significant problem, especially those stored at the old storage site at Iagluja Mountain. This site is in a very poor state and is considered a significant source of pollution within the region. A comprehensive survey is planned to identify the most hazardous wastes stored within the facility to arrange for their safe removal and disposal.

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VI/14

CHEMICALS

Two major groups of chemicals are especially hazardous to the environment and human health: persistent organic pollutants and ozone depleting substances. These substances are not produced in Georgia and their import and export is regulated. However, there is still a risk of contamination of the environment in Georgia with these substances, mainly due to the way in which these substances were used in the past.

There is an amount of obsolete pesticides still left in the country, some of which still needs to be identified and collected. The majority of these substances are temporarily stored in the old, outdated depository at the Iagluja Mountain.

The use of ozone depleting substances has decreased over the last 10 years as a result of the use of alternative substances. At the moment Georgia only consumes ozone depleting substances defined by the Montreal Protocol as temporary allowed substances. A plan for phasing out these substances is currently in preparation.

VI/14. 1. INTRODUCTION

In the latter half of the twentieth century these chemicals were commonly used in agriculture (pesticides) as well as in industrial and consumer electronic equipment (electric transformers, capacitors, air conditioners, refrigerators, washing machines, etc). Some man-made chemicals are especially dangerous for the environment. These include persistent organic pollutants (POPs) and ozone depleting substances (ODSs).

State Regulation

Georgia is party to several international treaties regulating the use of chemical substances dangerous for the environment. These treaties are:

1. The Vienna Convention on the "Protection of the Ozone Layer" (1985) and the Montreal Protocol on "Substances That Deplete the Ozone Layer". In accordance with these treaties, Georgia is obliged to phase out the production of a number of substances believed to be responsible for ozone depletion (Table 14.1).

2. The Stockholm Convention on "Persistent Organic Pollutants". Georgia joined the Convention in 2006. The Convention regulates 12 persistent organic substances of which nine are pesticides (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene), the second group represents industrial chemicals (polychlorinated biphenyls) and the third group is by-products (dioxins and furans), which are generated during different industrial processes. The convention obliges the countries to neutralize-liquidate persistant organic pollutants occuring as wastes, to reduce to the maximum extend the use of POPs in production with the final aim of phasing them out. Also, reduction of by-products emmissions into the environment with their final ceasure (see Table 14.2).

3. The 1998 Rotterdam Convention on the "Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides", which regulates the international trade of 47 hazardous chemicals. In brief, the prior notification and consent of the receiving country is required prior to international shipments of the listed substances.

At the national level, substances regulated by the above mentioned Conventions are listed in the special List of "Materials of Limited Marketing", that means that production, or international and internal shipments of these substances are subject to special permitting.

Substances that deplete the Earths' ozone layer (Ozone Depleting Substances – ODSs) represent several groups of chlorine, bromine and fluorine containing synthetic substances. These are stable gaseous substances, which can be transported over long distances, reach the higher layers of atmosphere and interact with ozone layer molecules causing a decrease in ozone concentrations in upper layers of atmosphere.

Ozone depleting substances are used in refrigerators and air conditioners as cooling agents, as well as the propellants used in fire extinguishers and aerosols, or in production of foam plastics and foam-rubbers. They are used also as fungicides and as solvents. Initiatives are underway to replace them with the alternative less harmful substances and technologies in order to protection the earth's ozone layer.

Substance group	Year (12 months)	Requirement
I group of Annex A Chlorofluorocarbons (CFC-11, CFC-12, CFC-113, CFC-114, CFC-115)	Baseline (average annual consumption in 1995-1997): 22.5 t	
	Starting July 1, 1996	Consumption and production freeze at the baseline level
	Starting January 1, 2005	Reduction by 50%
	Starting January 1, 2007	Reduction by 85%
	Starting January 1, 2010	100% phase out (exceptional uses can be allowed)
II group of Annex A Halons (halon -1211, halon-1301, halon-2402)	Baseline (average annual consumption in 1995-1997) 7.3 t	
	Starting January 1, 2002	Use and production freezing at the basic level
	Starting January 1, 2005	Reduction by 50%
	Starting January 1, 2010	100% phase out (exceptional uses can be allowed)
I group of Annex B Chlorofluorocarbons (CFC-13, CFC-111, CFC-112, CFC-211, CFC-212, CFC-213, CFC-214, CFC-215, CFC-216, CFC-217)	Baseline (average annual consumption in 1998-2000): 0 t	
	Starting January 1, 2003	Reduction by 20%
	Starting January 1, 2007	Reduction by 85%
	Starting January 1, 2010	100% phase out (exceptional uses can be allowed)

II group of Annex B: Carbon tetrachloride	Baseline level (average use in 1998-2000): 0 t	
	Starting January 1, 2005	Reduction by 85%
	Starting January 1, 2010	100% phase out (exceptional uses can be allowed)
III group of Annex B Methyl chloroform (1,1,1 trichloroethane)	Baseline level (average annual consumption in 1998-2000): 0 t	
	Starting January 1, 2003	Consumption and production freeze at the basic level
	Starting January 1, 2005	Reduction by 30%
	Starting January 1, 2010	Reduction by 70%
	Starting January 1, 2015	100% phase out (exceptional uses can be allowed)
I group of Annex C: Chlorofluorocarbohydrates (consumption) HCFCs	Baseline level (average annual consumption in 2009-2010): 0 t	
	Starting January, 2013	Consumption and production freeze at the basic level
	Starting January 1, 2015	Reduction by 10%
	Starting January 1, 2020	Reduction by 35%
	Starting January 1, 2025	Reduction by 67.5%
	Starting January 1, 2030	100% phase out (the consumption can be allowed for serving 2.5% of existing refrigerators)
II group of Annex C: Bromfluorocarbohydrates (HBFCs)	Starting January 1, 1996	100% phase out (exceptional uses can be allowed)
III group of Annex C: Bromchloromethane	Starting January 1, 2002	100% phase out (exceptional uses can be allowed)
Annex E: Methyl bromide (brommethane)	Baseline level (average annual consumption in 1995-1998): 22.74 t	
	2002	Consumption and production freeze at the baseline level (exept the use for quarantine and preshipment treatment processes)
	2005	Reduction by 20%
	2015	100% phase out (exceptional uses can be allowed)

Table 14.1 Obligations of Georgia according to the Montreal Protocol on Substances That Deplete the Ozone Layer

Persistent Organic Pollutants

(POPs) are organic substances characterized by their high toxicity, resistance to degradation and propensity for bio-accumulation (ability of accumulating in biological organisms, or ecosystems).

These substances can be transported long distances by air and water, or by migratory species of animals, e.g. the pesticide DDT was found in Antarctica and continues to damage the ecosystems. They are are very slow to degrade and maintain their toxicity for many years.

Name of Substance	Designation of substance	Requirement of the Convention	
		Production and use	Import/Export
Endrin	Pesticide	Total ban on production, import/export and use	Import and export is allowed only for disposal in environmentally acceptable way, or for the use in the purposes preliminary permitted and registered.
Toxaphene	Pesticide		
Aldrin	Pesticide	Complete ban on production; Import of existing stock for use in the purposes defined by the Convention and only on the base of registration at the Convention Secretariat	
Dieldrin	Pesticide		
Heptachlor	Pesticide		
Chlordane	Pesticide	Production, import and use only for use in the purposes defined by the Convention and only on the basis of registration at the Convention Secretariat	
Mirex	Pesticide		
DDT	Pesticide		
Hexachlorobenzene	Pesticide,Industrial chemical	Production, import and use only for use in the purposes defined by the Convention and only on the basis of registration at the Convention Secretariat ; Minimization of unintended emissions	
Polychlorinated biphenyls (PCB)	Industrial chemical (in oils)	Complete ban on production Phase out of the PCB containing devices by 2025. Ban on the export and import of such devices. Removal of these substances from the devices and neutralization by 2008; Minimization of emissions and leakages	
Polychlorinated dibenzo-p-dioxins (PCDD) Polychlorinated dibenzo-furans (PCDF)	No use (combustion by-product)	Minimization of emissions	

Table 14.2 Obligations of Georgia according to the Stockholm Convention on the Persistent Organic Pollutants

Polychlorinated biphenyls – are a group of 209 chlorine containing organic substances. These are synthetic substances used for different industrial purposes, including dielectric liquids for electric transformers and capacitors, thermo isolation liquids, also as dye additives.

Polychlorinated biphenyls are toxic substances. They cause cancer and disorders of endocrine, immune, and reproductive systems.

These substances bio accumulate, which means that their concentration can increase higher up the food chain.

There are additional requirements regulating pesticides in Georgia. In particular, only pesticides registered by the Food Safety, Veterinary, and Plant Protection Service of Georgia can be produced, imported, or exported. There are currently 168 active substances and up to 350 pesticide preparations registered by this Service. Mostly those are the pesticides registered in USA or EU and listed either in the Appendix I of the EU Directive 91/414/EEC, or in the USEPA List of the Registered Active Substances. The Food Safety, Veterinary, and Plant Protection Service regularly monitors pesticides' sold in Georgia in order to detect illegal sale of unregistered pesticides.

VI/14. 2. CURRENT STATE

As compared with the Soviet Period, the use of pesticides in agriculture has decreased by 5-6 times. This can be explained by the lack of resources available to farmers and the fact that the newer pesticides are more economic in use (smaller amounts are needed to achieve the same effect) and are more environmentally friendly. Chlorine containing organic pesticides, mercury containing pesticides, tiazole group pesticides are no longer used in Georgia. The use of phosphorous organic insecticides has also been significantly reduced. Half of the chemical pesticides are the copper-bearing fungicides.

some of which were completely ruined and robbed (the construction materials were stolen). In many cases the residue pesticides were mixed and dumped in the open air without any packing. They were exposed to the elements and were being continually washed into the soil.

During 2006-2009, most of the obsolete pesticides found in these storages sites (Soviet Kolkhozes) have been collected. Over 230 tonnes have been packed in suitable containers and removed for storage at the Iagluja Mountain depository. 600 tonnes of soil polluted with pesticides has been also collected at the former Kolkhozes areas and moved to the Iagluja depository. There are currently only small portions of obsolete pesticides left at different locations within Georgia which have to be collected and safely stored.

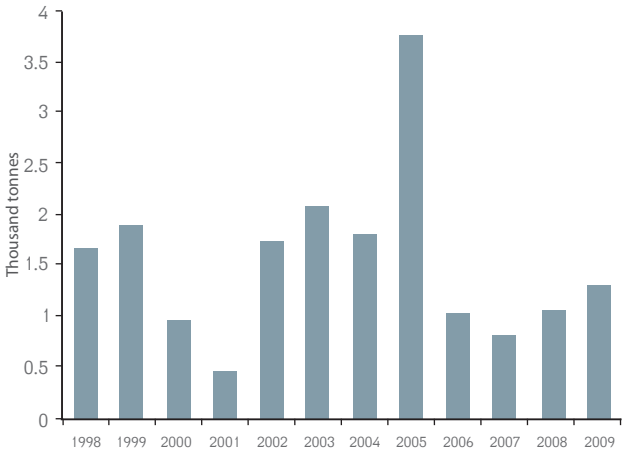

Figure 14.1 Import of pesticides in Georgia by years

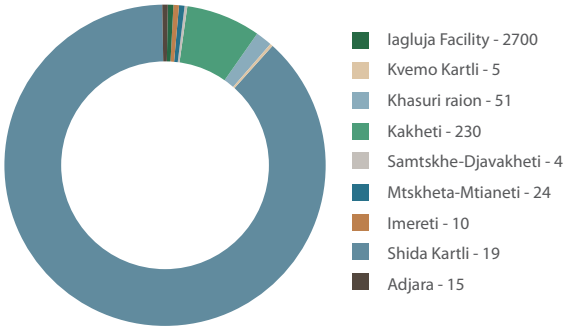

Figure 14.2 Amounts (in tonnes) of the obsolete pesticides identified in Georgia, 2005

Persistent Organic Pollutants

Pesticides are not manufactured in Georgia. The import of those pesticides specified by the Rotterdam and Stockholm Conventions is prohibited at a national level. There are no reported incidents of illegal import or sale of these substances. However, there is a large stockpile of expired pesticides which were in use in the Soviet period.

An inventory of obsolete pesticides held in the country was conducted in between 2004 and 2006 with the support of UNDP. Over 3,000 tonnes of obsolete pesticides have been identified, the majority of which (up to 2,700 t) are located in the depository of chemical substances at the Iagluja Mountain, and approximately 360 tonnes, in other storage facilities (former Kolkhozes) in different parts of the country. Over 200 of these storage facilities have been studied, and pesticides have been found at 46 of them (Figure 14.2). When the inventory was conducted, most of the storage facilities were damaged,

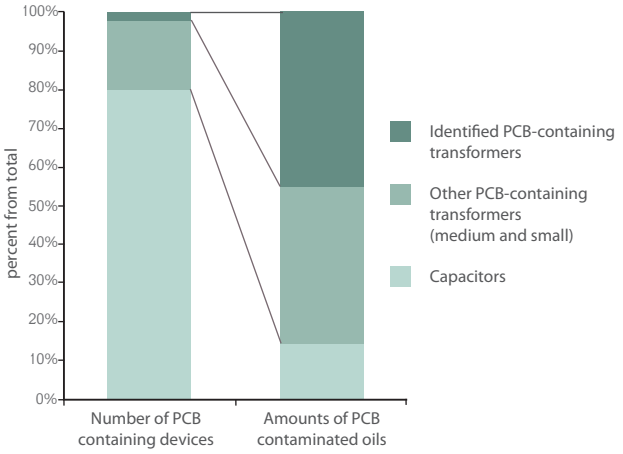

Figure 14.3 Numbers of electric devices containing oils contaminated with polychlorinated biphenyls and the amounts of these oils.

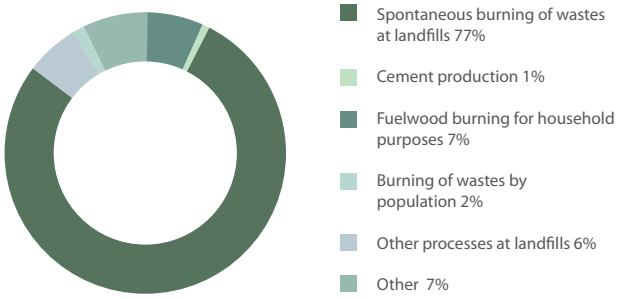

Figure 14.4 Sources of dioxin and furan emissions in Georgia. Assessment, 2004. Source [1]

Persistent organic pollutants (polichlorinated biphenils) are found in Georgia in electrical energy distribution equipment, such as transformers, capacitors, currency-switches etc. There are approximately 1400 or more tonnes of oils polluted with polychlorinated biphenyls being in use in Georgia. In order to prevent pollution of the environment, those oils are to be collected and treated using environmentally safe technologies. (Figure 14.3).

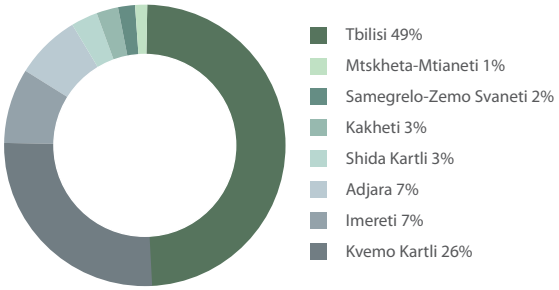

Figure 14.5 Emissions of dioxins and furans in Georgia by regions. Assessment, 2004 Source [1]

Dioxins and furans are a group of highly toxic organic substances, which represent combustion by-products. Dioxins are generated by certain combustion processes such as the incineration of waste, the combustion of solid and liquid fuel in industrial (electric energy generation) and domestic appliances (ovens and fire places), as well as in the open burning of waste. These are gaseous, stable substances, which can get into the food chain and have ability to accumulate in living tissues. These substances cause cancer and disorders of immune, endocrine and reproductive systems.

An inventory of dioxins and furans was conducted in Georgia in 2004. The assessments showed that the main source of generation of dioxins and furans in Georgia are landfills.

Uncontrolled combustion which occurs at landfills mainly as a result of spontaneous ignition (Figure 14.4) is considered to be the main source. The total emission of dioxins at the country scale is 100 g equivalent annually[1], which is considered quite high, taking into account the country scale, population number, and climatic conditions.

Ozone Depleting Substances

Ozone depleting substances are not produced in Georgia and can only be obtained by import. Table 14.1 shows consumption of ozone depleting substances in Georgia between 1995 and 1998. These years are the so called 'basic years' for Georgia (the phasing out schedules are prepared based on the data for these years). As it is shown in Figure 14.6, the consumption of ozone depleting substances is decreasing in accordance with the schedule defined by the Montreal Protocol.

Reduction of the consumption of ozone depleting substances in Georgia was achieved as a result of a number of simultaneous measures. Firstly, more stringent regulations were developed (as previously mentioned, ozone depleting substances in Georgia are subject to limited sale); capacity building program for customs (trainings for customs officers and provision of the appropriate equipment) also made

[1]Toxic equivalence factor (TEF) expresses the toxicity of dioxins, furans in terms of the most toxic form of dioxin, 2,3,7,8-TCDD (Tetrachlorodibenzo-p-dioxin)

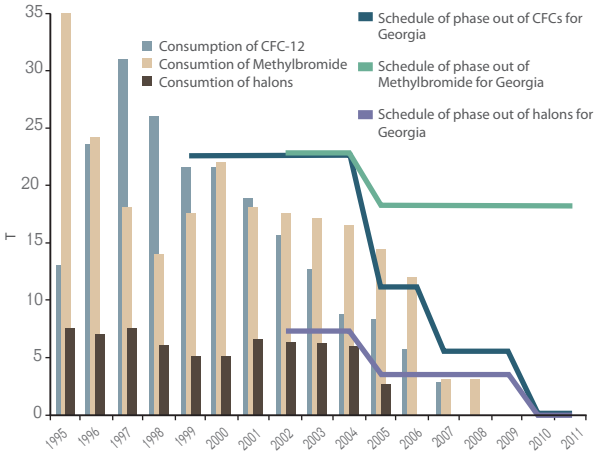

Figure 14.6 Use of ozone depleting substances in Georgia and the related obligations according to the Montreal Protocol

the accurate registration of imported/exported ozone depleting substances possible.

However, the introduction of alternative substances and technologies (demonstration projects, trainings) were the most effective measures in achieving the set goal of phasing out the hazardous ozone depleting substances. Relevant NGOs ('Association of Georgian Refrigeration Technicians' and 'Association Civil Society in Villages') have been provided with capacity building, enabling them to provide support in this field. For instance, the centre for collecting and recycling of ozone depleting refrigerants was established by the NGO 'Association of Georgian Refrigeration Technicians', which can provide the relevant services for existing refrigerators and air conditioners without importing new batches of the required substances. The "Association Civil Society in Villages' learned and introduced the technologies for managing greenhouses, which avoids the use of methyl bromide for regular treatment of soils.

At the moment, only one group of ozone depleting substances are in use in Georgia, chlorofluoro-carbohydrates (I group of the Annex C of the Montreal Protocol, Table 14.1). The temporary use of these substances is allowed by the Montreal Protocol, as these substances are less harmful to the ozone layer. Georgia plans to start phasing out these substances in 2013.

VI/14. 3. MAIN CHALLENGES

Pesticides belonging to the category of persistent organic pollutants are not used in Georgia today. However, there is a large stock of the obsolete pesticides which remain from the Soviet period, currently stored at the out-dated Iagluja Mountain depository.

There are a number of unregistered small facilities in Georgia storing old pesticides. It is necessary to collect these pesticides and take appropriate measures to ensure the safety of environment.

Georgia must phase out polychlorinated biphenyls by 2025, in accordance with the Stockholm Convention. Georgia is also obliged to minimize emissions of dioxins and furans on a country scale, the main source of which is the burning of waste at the landfills.

For implementation of the requirements of the Convention a draft National Implementation Program has been developed. The Program covers the issues of development of national regulations, capacity building, public awareness, destruction of pesticides and polichlorinated buphenils, reduction of emissions of dioxin-furans, development of monitoring system, etc.

Regarding ozone depleting substances, only chlorofluorocarbohydrates are in use today in Georgia and this is due to be regulated in 2013. An assessment of ozone depleting substances at a country scale is underway at the moment, in addition to the planning and preparation of the measures aimed at phasing out their use.

References

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2. Chemical profile of Georgia, 2009, UNITAR, Georgian Centre for Strategic Research and Development, http://www2.unitar.org/cwm/publications/cw/np/np_pdf/Georgia_National_Profile_2009_Georgian.pdf


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VI/15

IONIZING RADIATION

Both natural and man-made sources of ionizing radiation can be found in Georgia.

Background levels of radiation in the environment do not exceed acceptable limits. The Chernobyl accident resulted in contamination of some areas of the country with radioactive substances, however at present there is no threat to human health and the environment.

Man-made sources of ionizing radiation are regulated by legislation. No radiation sources are currently produced in Georgia. The sources in use today are mostly imported from abroad, with a small share of the sources remaining since the Soviet period. Georgia has developed the appropriate infrastructure for the control of nuclear and radioactive materials and has enhanced its institutional and technical capacity to combat illicit trafficking.

Particular attention has been paid to the detection and neutralization of radioactive sources of which control has been lost during the collapse of the Soviet Union. Attention is also being focussed on the development of a proper radioactive waste management system.

VI/15. 1. INTRODUCTION

The term "ionizing radiation" is defined in the Law of Georgia on Nuclear and Radiation Safety (1999) as radiation generated as a result of nuclear transformation, or of a deceleration of charged particles in a substance, which produces charged ions when interacting with a physical or biological body.

High doses of ionizing radiation are dangerous to living organisms, as the intensive ionization causes damage to living tissues and destroys their functions. This can result in organ failure, genetic changes, and even death. Radiation safety standards have been developed to avoid these harmful effects.

There are naturally occurring sources of radiation in the environment which result in so-called "background" levels of radiation to which we are all exposed. Ionizing radiation is used in many sectors - e.g. energy, medicine, industry, science, defence. These use man-made sources of ionizing radiation.

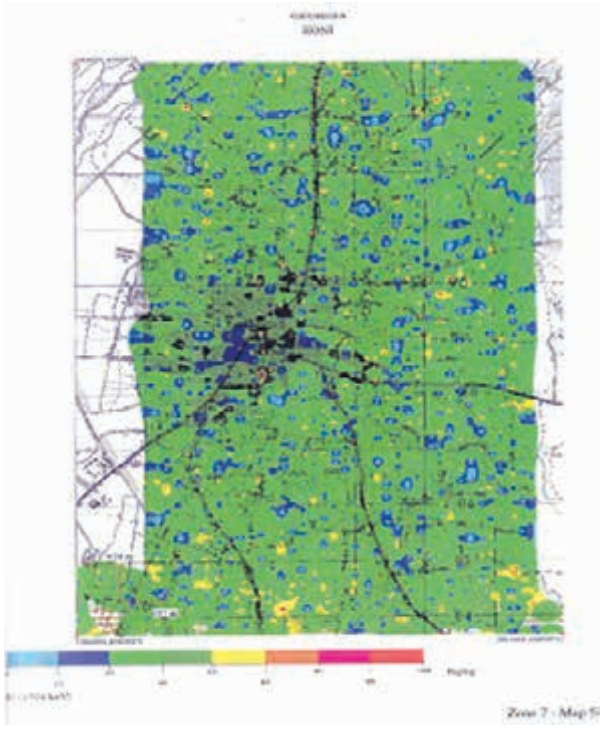
Natural Sources of Ionizing Radiation

Radioactive isotopes disseminated in the Earth's crust (uranium-235, uranium-238, thorium-232, potassium-40 etc.) are natural sources of ionizing radiation and have been in existence since the earth's formation. These isotopes have long half-lives and as a consequence their decay occurs over a long period, during which they emit isotopes of other substances which can be radioactive. Of particular note in this regard is radon-222. In addition, natural sources of ionizing radiation such as carbon-14, can be created by cosmic rays, but in lower quantities.

In 2000, an aero-gamma-survey of radiation on some of the territories of Georgia was undertaken by specialists of Nuclear and Radiation Safety Service and Atomic Energy Safety Commissariat of France under the auspices of the International Atomic Energy Agency. Measurements were undertaken in the Lanchkhuti, Ozurgeti, Abasha, Martvili, Senaki, Khobi, Chkhorotsku, Tsalenjikha, Zugdidi, Khoni, Vani, Zestafoni, Kharagauli districts,

Ionizing radiation possesses high energy. It can detach electrons from an atom, or break a chemical bond and generate electrically charged ions. Examples of ionizing radiation are x-rays and gamma-rays. Other types of radiation with less energy which cannot generate ions are called a non-ionizing radiation. Radio-waves, microwaves, and visible light are examples of non-ionizing radiation.

and in the city of Poti. The survey did not detect any areas of excessively high radiation levels from naturally occurring radioactive nuclides. The content of natural sources of ionizing radiation in soil fluctuated within expected limits. Natural background levels of ionizing radiation are slightly elevated in some areas due to the natural characteristics of the soil, but the levels remain within permissible limits. An example of this is the area of mountain Chegola located between Khoni and Martvili, which has a uranium deposit (of non-industrial significance) in the depths of the mountain. The increased activity of Uranium-238 has been observed, raising the background level of natural radiation to 25-26 micro roentgen per hour, while the background radiation in the surrounding area is around 8-10 micro roentgen per hour (up to 60 micro roentgen/hr is considered normal).

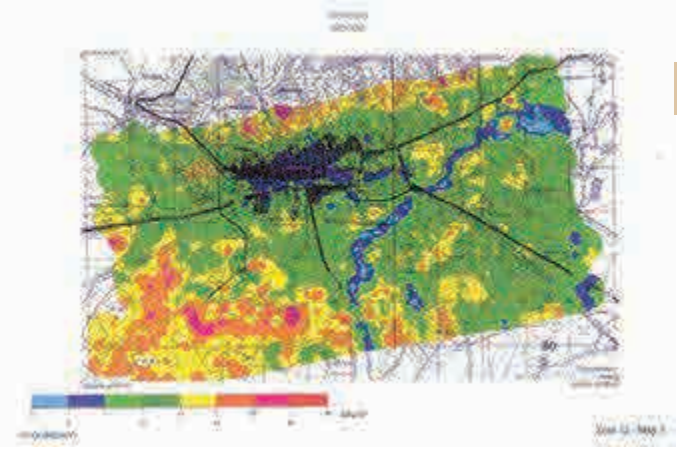


Map 15.1 Typical picture of natural Uranium-235 concentrations (near the town of Khoni). Specific activity data obtained through gamma-aero-survey in 2000.

Anthropogenic Sources of Ionizing Radiation

Many radioactive isotopes are produced as a result of human activities, either for immediate needs, or as a by-product of certain technological processes (tritium, iodine-129, iodine-131, caesium-137, strontium-90, technetium-99, plutonium-239, etc.). Some of these do not exist as natural isotopes. In addition, ionizing radiation generators are also used, which do not contain radioactive sources, for example x-ray devices. Uncontrolled ionizing radiation coming from man-made sources and generators can be very dangerous to human health and the environment.

Some areas contaminated with man-made radionuclides such as caesium-137 and strontium-90 were detected in a number of regions of West Georgia after the 1986 Chernobyl accident. Soil does not naturally contain these isotopes. For instance, if soil contains caesium-137 with a specific activity higher than 1,000 Bq/kg, it is officially considered to be contaminated. The survey conducted in 2000 found elevated concentrations of such contaminants in some areas which were traced to the Chernobyl accident. However the concentrations are very minor and in all cases the emission dose rates are within the permissible limits.



Map 15.2 Chernobyl footprint: concentration of cesium-137 in soil (near the town of Senaki). Specific activity data obtained through gamma-aero-survey conducted in 2000.

VI/15. 2. RADIATION MONITORING IN GEORGIA AND ITS RESULTS

The National Environmental Agency, a legal entity of public law under the Ministry of Environment Protection of Georgia, conducts monitoring on natural radiation background levels. The background levels have been found to be normal in all areas monitored (Table 15.1).

Place/year	Mean annual values of gamma-radiation doses in ambient air (micro-roentgen/hour)				
	2005	2006	2007	2008	2009
Akhalkalaki	13	14	13	14	14
Akhaltsikhe	13	14	16	17	17
Batumi	13	14	14	13	13
Gori	13	14	14	14	14
Pasanauri	11	11	12	12	12
Dedoplistskaro	11	11	11	10	10
Tbilisi	13	13	13	13	14
Telavi	11	11	11	12	12
Paravani	15	16	16	15	16
Sachkhere	12	13	11	11	12
Poti	9	12	12	12	12
Kutaisi	13	12	12	12	12
Tsalka	12	13	13	14	15
Zestafoni	10	11	11	12	12
Lagodekhi	-	12	12	12	10

Table 15.1 Mean annual values of gamma-radiation doses in ambient air for 2005-2009 (micro-roentgen/hour)

Ionizing radiation sources are not produced in Georgia. A small amount of the sources in use today remain from the Soviet period. Sources needed for various purposes are imported. Some spent sources are being exported back to the foreign producers for further handling. Import and export of ionizing radiation sources is subject to permitting. The Nuclear and Radiation Safety Service maintains a register of data on import, export, transit and transportation of radioactive sources within the country.

In January 2010, the following were registered in Georgia: 640 organizations engaged in radiation related activities, 1,145 generators of ionizing radiation, 1,537 so-called "sealed"[1] and 762 "unsealed" sources with activity varying from 1 millicurie up to 35,000 curie. 326 disused sources were stored in a special centralized temporary repository under state supervision. The unsealed sources are, as a rule, of low activity, and are used for scientific purposes.

The handling and storage of sources which are in use are regulated by National legislation. Disused sources are given the status of radioactive waste and stored in a temporary repository. Nuclear fissionable material must be stored under strict control. The Nuclear and Radiation Safety Service of the Ministry of Environment and Natural Resources of Georgia conducts regular monitoring of this material. The temporary repository of radioactive substances came into operation in 2007 and provided safe storage of radioactive wastes. The long-term policy for radioactive waste management is under development.

A scientific-research nuclear reactor was operated in Georgia from the 1960's until the 1990's. It is now closed, and with the support of the International Atomic Energy Agency, is in the process of being decommissioned. The former site for the disposal of radioactive wastes, which was operated during the Soviet period, is located to the east of Tbilisi and has been closed since the 1990's. The background levels of radiation are within the permissible levels at both of these facilities.

[1]Sealed source – radioactive source disposed in a capsule for an unlimited time, or mixed with non-radioactive material in a manner that prevents accidental leakage or separation.

VI/15. 3. MAIN CHALLENGES

Detection, removal and safe storage of uncontrolled and disused radioactive sources remaining since the Soviet period is still in progress. Management of these sources during the period of collapse of the former Soviet Union appears to have been very poor, with many being lost or discarded in an inappropriate manner (especially by military facilities of the former Soviet Union and later the Russian Federation). Up to 300 of these sources have now been located and neutralised, 45 of which were found between 2007 and 2009. Work on the location and containment of these sources continues.

To prevent and restrict illegal use and transit of nuclear and radioactive substances, the use of portal detectors at check points on the Georgian border commenced in 2008-2009. As such, the level of control on the transit of nuclear and radioactive substances is considered adequate.

The capacity to deal with emergency response to radiological accidents has been developed to some extent in Georgia however future improvements are required.

It is planned to introduce monitoring of population exposure within priority sectors. So far some initiatives have been undertaken, primarily in the field of medicine. Further work is needed in this sector in the near future using partnership opportunities.

VII

ENVIRONMENTAL IMPACT OF ECONOMIC SECTORS

VII/16

AGRICULTURE AND FORESTRY

Two thirds of Georgia's land area is used for either forestry or agriculture. In 2009, 47.3% of the Georgian population lived in the countryside.

Agriculture was traditionally the main stay of the Georgian economy and from an employment perspective it still remains as such, although its contribution to GDP has substantially decreased, from 50% in 1990 to only 10% in 2009. In line with this, the environmental impact of agriculture decreased substantially. For example, the use of high volumes of pesticides and fertilizers in the second half of the twentieth century resulted in the pollution of both surface and groundwater with nitrates and pesticides. The use of the agrochemicals has decreased substantially over the past 20 years, resulting in reduced levels of pollution of natural waters from the agricultural sector.

One of Georgia's most valuable natural resources are its forests. Apart from their economic value, forests provide soil and water protection functions. Forests also play a major role in the provision of resources for the population, in particular firewood used for heating homes and meeting needs for timber. Forests are also of immense importance as a source of secondary wood materials and non-timber resources for local residents.

The economic crisis of 1990's resulted in intensive (often illegal) exploitation of Georgian forests and thus degradation of a substantial part of the Georgian Forest Fund. The balance between the rate of deforestation and the forests natural growth/replacement capacity was broken. However, no proper inventory of forests has been undertaken for the last 20 years, so detailed information on their condition does not exist.

Control over illegal logging improved considerably after the creation of Environmental Inspectorate in 2005. The forest fires caused by the Russian aggression of 2008 substantially damaged South Georgian forests. The war conditions and difficult landscape of the region did not allow timely extinguishing of fires, which resulted in expansion of the fires through the large area of forests on the right bank of the Gudjaretstskali river, covering area of approximately 950 hectares. 250 ha of forest (app. 150 cubic meters of timber) were completely destroyed. 700 ha of forests were 70% destroyed (app. 140 cubic meters of timber). As a result of the fires, the vegetation of the area lost its ecological function and the economic value.

VII/16. 1. INTRODUCTION

Two thirds of Georgia's land area is used for either forestry or agriculture. In 2009, 47.3 percent of the Georgian population lived in the countryside.

Agriculture was traditionally the mainstay of the Georgian economy and from an employment perspective it still remains as such, although its contribution to GDP substantially decreased from 50% in 1990 to only 10% in 2009. In recent years, significant changes in markets for Georgian agricultural produce, in particular the closure of the Russian market, have posed significant problems for the sector.

One of Georgia's most valuable natural resources are its forests. Apart from their economic value forests provide soil and water protection functions; support the maintenance of hydroenergic potentials of the rivers, improve climate conditions and create favourable conditions for the sustainable development of the country. Forests also play a major role in the provision of resources for the population, in particular firewood used for heating homes. However, the role of the forest is as important in the provision of secondary materials (brushwood, dry trees) and non-timber resources (mushrooms, berries, etc) for the local population.

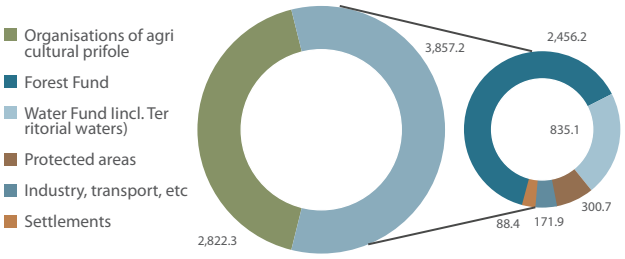


Figure 16.1 Land distribution in Georgia in accordance with the owner's profile. Thousand hectares

The total area of agricultural land in the country is more than 3 million hectares, or 43.5% of the country's territory. Fifteen per cent of the territory of the country is arable land and perennial crops, 28% - pastures and hay fields (see Figure 16.3). At present the cultivated land of the country is almost completely privatised. About one million hectares of land has been transferred to private ownership, 80% of which is agricultural land (see Figure 16.2). Of the 6.6 million hectares in state ownership, only one third is agricultural land (mainly pastures and hay fields).

In 2008, 796,000 agricultural farms utilized 914,000 hectares of land, from which 838,000 ha was agricultural land (717,000 ha private, and 191000 ha rented from the state). Only part of this land area was cultivated. Thus,

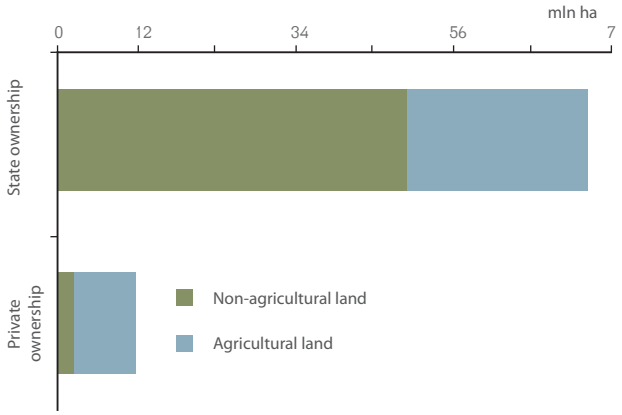


Figure 16.2 State and privately owned land in accordance with the type of use. Mln. ha.

according to the 2004 agricultural survey data, the area of the perennial plantings has reduced by 2,454,000 ha compared to 1988, the area of arable land - by 364,000 ha. According to the 2008 data, only 329,000 ha of arable lands (41%) was cultivated.

A decrease in the intensity of agriculture has also resulted in a decrease of its impact on the environment. During the last 20 years, the use of fertilizers and pesticides fell sharply and as a result the general impact on the environment and biodiversity has reduced considerably. In the 1980s' about 600,000 tons of mineral fertilizers were used, while in the mid 1990's this had reduced to only about 12,000 tons of fertilizers. Nowadays there is an increase in use of fertilizers with the latest figures showing the use of 52,700 tons in 2008 (Figures 16.6 and 16.7), however the level of the use is still insignificant in comparison with that of the 1980s.

The use of pesticides has also been drastically reduced. In 2008, the area of annual and perennial plants treated with pesticides totalled 182.2 ha (13.4% of the land area occupied with crops and perennial plants, see Figures 16.9 and 16.10).

VII/16. 2. AGRICULTURE

Natural climatic conditions in Georgia are favourable for agriculture, particularly in terms of tillage and animal husbandry. However, the majority of the Georgia land area is not suitable for agricultural purposes due to its terrain.

The political and economic situation of the last 20 years has had a substantial effect on the agriculture sector. As of 2007-2009, the incomes within the agricultural sector are low and this has impeded growth within the sector.

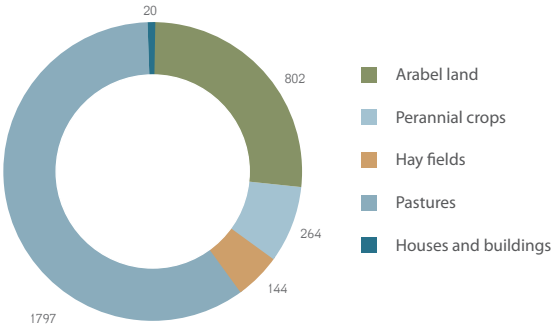


Figure 16.3 Agricultural lands in Georgia. Thousand hectares.

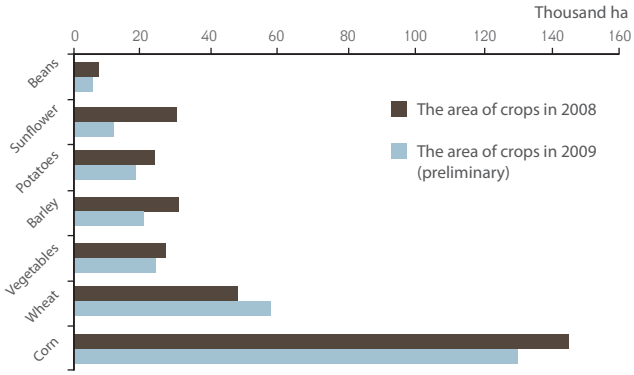


Figure 16.5 Area used for the principal annual crops in 2008 and 2009.

Traditional crops include vine, wheat, corn, fruit trees, citruses and tea. Traditional areas of livestock include sheep and cattle breeding; bee keeping is also well developed.

The size of the national herd has decreased considerably since the 1990's. The number of sheep and goats have approximately halved, while the number of cattle increased.

Despite the decline in livestock numbers, the condition of pastures has not improved. One of the reasons lies in the fact that the pressure on Georgian pastures increased instead of decreasing as traditional pastures located beyond the Georgian borders, e.g. North Caucasus winter pastures, became unavailable for use.

High concentrations of nitrogen of ammonia and in some cases, organic substances in surface waters to some extend arise from pollution by untreated municipal wastewaters and from diffused pollution from agricultural sources (see Chapter 4). Agricultural pollution poses a potential risk to supplies of drinking water for cities and villages, particularly where well and spring waters are used, such as in western Georgia in particular.

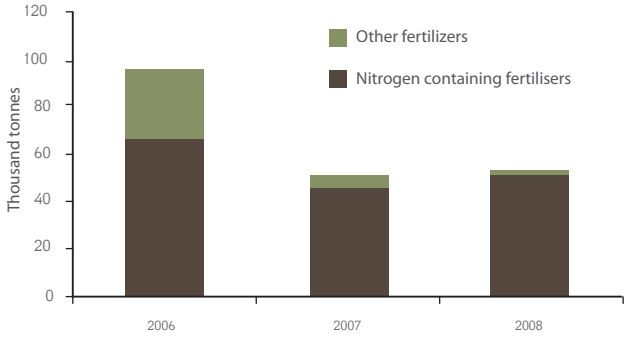


Figure 16.6 Use of mineral fertilizers in agriculture[1]

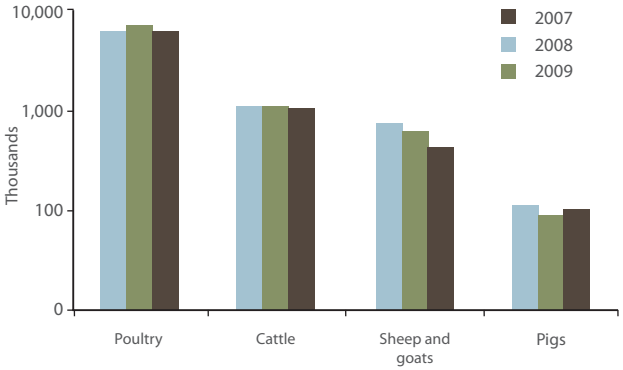


Figure 16.4 Number of livestock

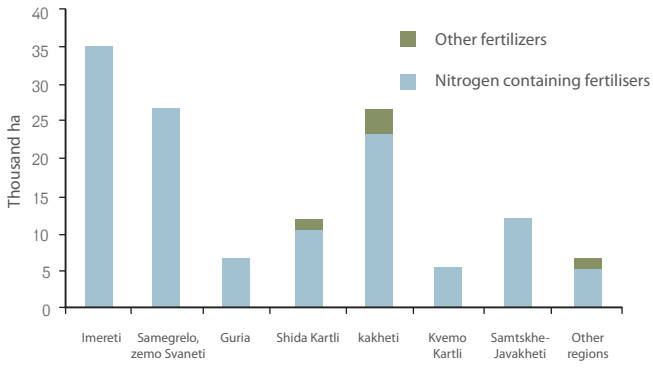


Figure 16.7 Area of application of mineral fertilizers to crop land, by Region (2008)

[1]Under "other fertilizers" phosphorous, Potash and complex fertilizers, ameliorants and agronomical ore, peat and fertilizers produced from it are implied.

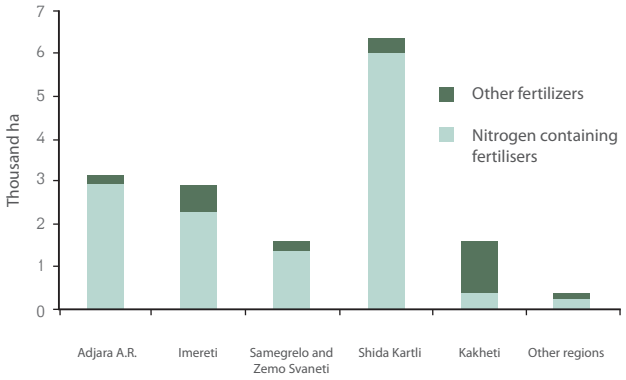


Figure 16.8 Area of application of mineral fertilizers to perennial crop land, by Region (2008)

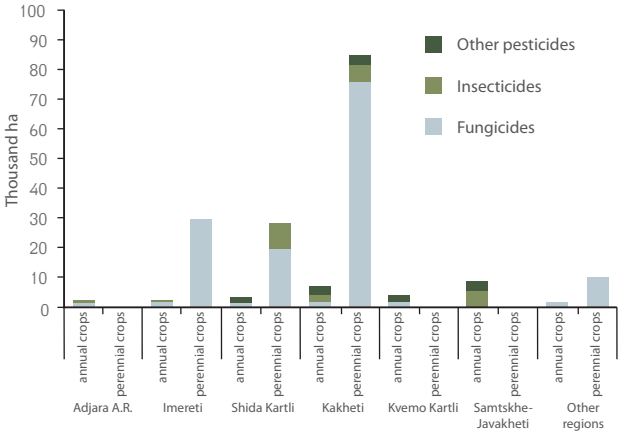


Figure 16.10 Land area treated with pesticides in Georgia in 2008, by region and crop type

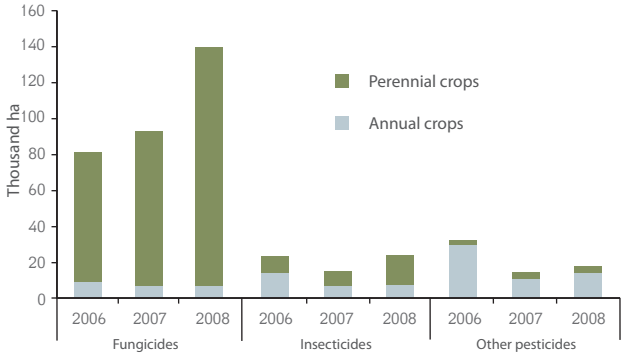


Figure 16.9 Area treated with various types of pesticides in Georgia between 2006 and 2008

Horizons of subterranean waters are less liable to anthropogenic pollution than surface waters. Despite this, in certain cases deterioration of ground waters has been observed under the influence of significantly polluted surface waters. In the late twentieth century, excessive use of agro-chemicals on agricultural lands resulted in the pollution of both surface and ground waters with nitrates and pesticides. Pollution of ground waters was observed at depths of 100-150 m in deep artesian aquifers in densely populated areas such as Samegrelo, Adjara-Guria, Karla, Cachet and Keno Imereti. However, pressurized artesian and pressurized intermediate waters are not considered to be polluted in general.

The main point source emissions from the agriculture sector arise form cattle and poultry breeding. The closure of several large scale cattle and poultry breeding facilities resulted in many smaller scale facilities being established. This has distributed the emissions from a small number of sources to a larger number of smaller sources. This has overall reduced the impact of emissions form intensive agriculture facilities as their impact is much more localised due to their scale.

The National Biodiversity Strategy and Action Plan of Georgia (2005) determines two strategic goals regarding agriculture: the conservation of Georgia's agro-biodiversity; and bio-safety, in particular dealing with the use of genetically modified organisms. Both goals are targeted at the prevention of negative impacts associated with the global trends in agriculture on the biodiversity of Georgia.

VILI/16. 3. FORESTRY

Only one type of forest ownership exists in Georgia: State ownership. The political crisis of the 1990's and the controversial processes of free market development had a negative impact upon the forestry sector. Simultaneously, growing demand for timber on both the interior and world markets gave rise to intensive, and often illegal, exploitation of the country's forests. This lead to the degradation of a major part of Georgia's forest fund, and the balance between the growth and use of forest resources was broken.

Since 2005, the government has changed its policy regarding the forestry sector. These changes resulted in the most commercial activities within the forest sector being undertaken by private companies.

The Forest Fund includes forested territories of the country as well as territories not covered with forests but designated for forestry needs. The total area of the Forest Fund is stable at an estimated three million hectares, of which 2.7 million hectares are covered with forests, or 40 % of all Georgian territory. Georgian forests are divided into highland and plain forests. Highland forests occupy 97.7% of the total area under forestry. Average timber stock is 160 cubic metres per hectare. It is estimated that the total annual increase in timber stocks is 1.8 cubic metres per hectare, representing 4.6-4.8 million cubic metres nationally.

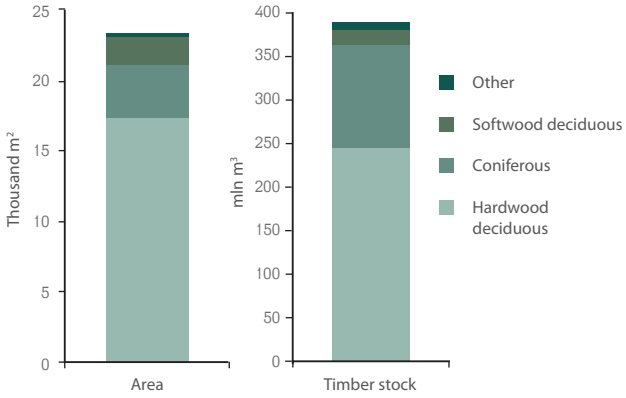


Figure 16.12 Composition of Georgian forests by main species.

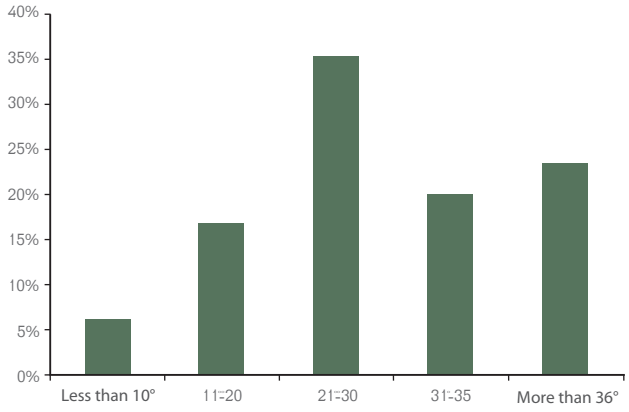
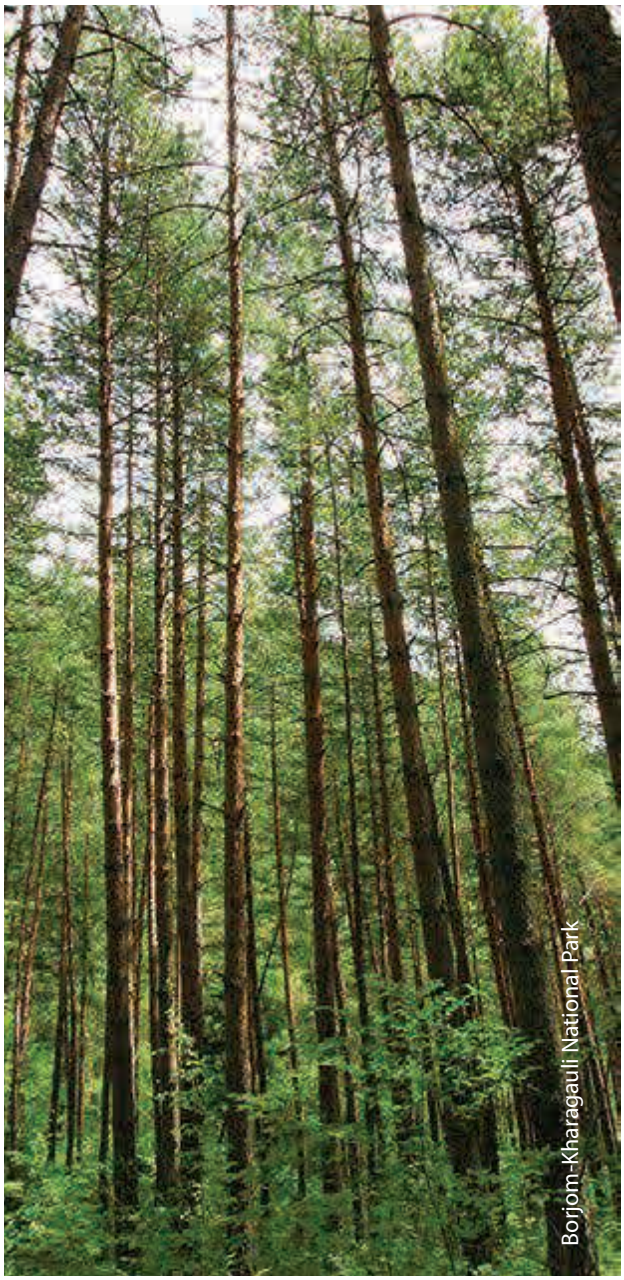


Figure 16.11 Share of slopes of various angles in the overall forest land cover



As of 2007-2009, forest use was conducted in accordance with the Georgian law "On licenses and permits" and the Governmental Provision "On rules and terms for licensing for forest use". Of the total area of 2,456,232 ha of Forest Fund, licenses for long term use were issued in 2007 for 47,912 ha, in 2008 for 58,140 ha, and 2009 for 35,536 ha. In total during 2007-2009, 160,108 ha of Forest Fund was licensed for long-term commercial use.

The adoption of modern approaches to commercial forestry within the State Forest Fund, including the implementation of multi-functional and long-term forests, aligned with a more diverse range of uses for forest products, will result in the improved use of forest resources, product range and quality. At the moment only part of the national forest resource, timber, is managed in economically sustainable way. Currently, the main products from the forestry sector are timber and firewood. The state budget income from forest products was 4 million GEL in 2009.

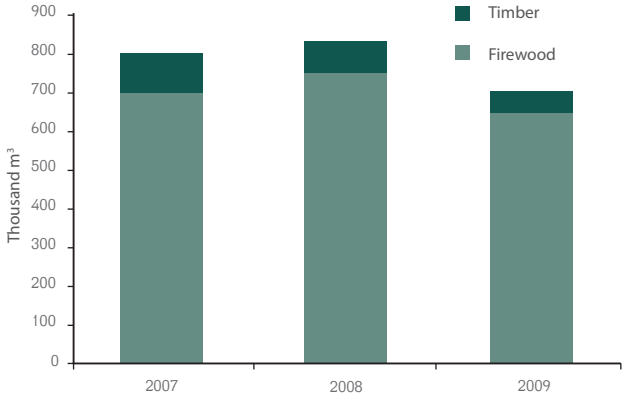


Figure 16.13 The use of timber resources from forestry.

Another significant commercial activity undertaken within the State Forest fund is the gathering/harvesting of silver fir cones. The quantities legally harvested have increased during 2007-2009.

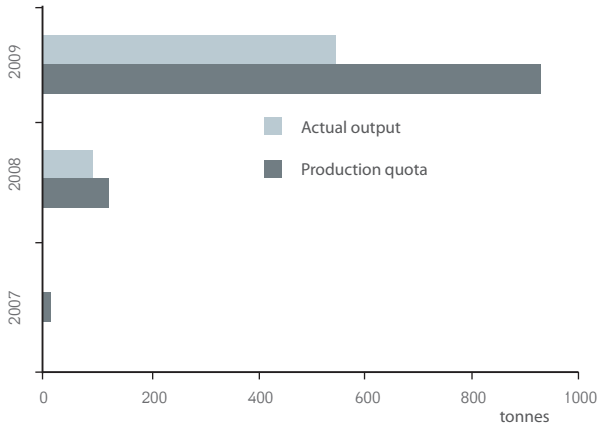


Figure 16.14 Forestry: Silver fir cones production.

On the basis of studies conducted in previous years, the major pests and diseases posing a threat to Georgian forests are identified as: Pale Tussock Moth Caterpillars (affected area 41,000 hectares), Bark beetles (19,000 ha), Fall Webworm (22,000 ha.), Ips typographic (3,000 ha.), and chestnut blight: (153,000 ha.). No complete phytopathological examination of the state forests has been conducted during the last decade, and as such no measures have been employed to deal with forest pests. A programme of "sanitary felling" and removal of trees affected with the chestnut blight is being undertaken in the Imereti region.

Forest fires also pose local threats to forestry and affect environmental condition. The area destroyed by fires was particularly large in 2008, approximately 1,300 hectares. This was due to forest fires caused by aerial bombings by the Russian air force (total 1,080 ha). On-going hostilities at the time hindered efforts to bring the forest fires under control. In 2009, the area damaged by forest fires did not exceed 70 ha.

The role of the forests in the capture of greenhouse gasses such as carbon dioxide is considerable. In Georgia, forests capture approximately 1.4 million tons of carbon annually, while the amount of carbon released as a result of timber stock production and traditional use of fire wood is approximately 0.3 million tonnes. Thus there is a net capture of 1.1 million tonnes of carbon, which is equivalent to 4 million tonnes of carbon dioxide.

Efforts in the field of conservation have increased substantially in recent years. During 2004 and 2009, approximately 40 000 hectares of state forests were allocated to the Agency of Protected Areas. The National Biodiversity Strategy and Action Plan of Georgia (2005)lists protection of forest bio-diversity and its maintenance through the implementation of sustainable management of forest resources (sustainable forestry) as its principal strategic goal.

VII/16. 4. MAIN CHALLENGES

Increase of infrastructural investments in the agricultural sector and the reduction of water loss from irrigation canals and traditional irrigation systems are considered high priority environment issues in developing countries. The government plans to undertake significant works in this regard. The rehabilitation of irrigation-drainage systems will be undertaken during 2010-2013 to improve agricultural productivity and support development of the sector. However in the longer term, with the local impacts of climate change becoming more evident, the availability of water resources for irrigation purposes in some parts of the country may become problematic and further depress the situation with the agriculture.

To improve the situation, forest reform is underway aimed at growing the role of private investors within the sector.

Control over illegal logging improved considerably after the creation of Environmental Inspectorate in 2005. However, the forests within the occupied regions represent another problem. As of 1st January 2010, 527,600 ha of total 2,456,000 ha of the state forest fund are located in the occupied territories where no inspection could be undertaken. Unconfirmed reports from these territories, for example in Abkhazia, a significant level of unauthorised logging of valuable forests is taking place.

Algeti National Park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VII/17

TRANSPORT

The Georgian transport sector is a significant source of environmental pressure. The number of transport vehicles has doubled since 2001 and the number of busses and minibuses has tripled. It is expected that vehicle numbers will at least double over the next decade. The majority of private car owners are concentrated in urban centres, mainly Tbilisi, and this trend is set to continue.

The vast majority (90%) of pollutants emitted into the air in Georgia arise from motor transport. The compulsory regular testing of the private light vehicles has been temporarily suspended until 2013. The high average age of the national fleet is the primary reason for the high levels of vehicle emissions and the resultant air pollution problems.

In order to address the situation, a range of projects are being implemented, including the rehabilitation and improvement of local and national roads, improved traffic management in urban centres, improving public transport, and changing the parking scheme. In the future, more attention must be given to integrated transport planning including the management of mobility demand. The use of electrically powered transport, low-carbon fuels and the introduction of new technologies in the country should also be explored.

VII/17. 1. INTRODUCTION

Georgia's geographical location has determined its importance as a transport corridor since the time of the Silk Road. Further development of this function is a priority for the government.

The transport sector is of major importance for the Georgian economy. Income from the transport sector in 2009 was 6.6 per cent of GDP.

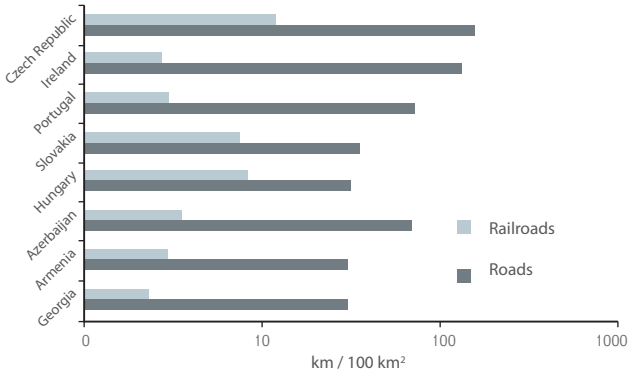

Figure 17.1 Density of the arterial roads and railway networks in Georgia and countries of similar size

The density of the transport infrastructure in Georgia is considered to be comparable to that of other small countries with similar terrain (Figure 17.1). The modes of transport within Georgia include maritime, air, railway (mostly electric), motor transport and pipe lines. Tbilisi has a 26 kilometre metro line with 22 stations. Cable transport is used for the transportation of passengers and in industry. Motor transport is by far the biggest means of transport in Georgia and has a significant negative impact on the environment. For this reason this chapter focuses mainly on this sub-sector.

VII/17. 2. CURRENT SITUATION

The number of transport vehicles in the country has doubled since 2001, while the number of busses and minibuses has tripled (see Figure 17.2).

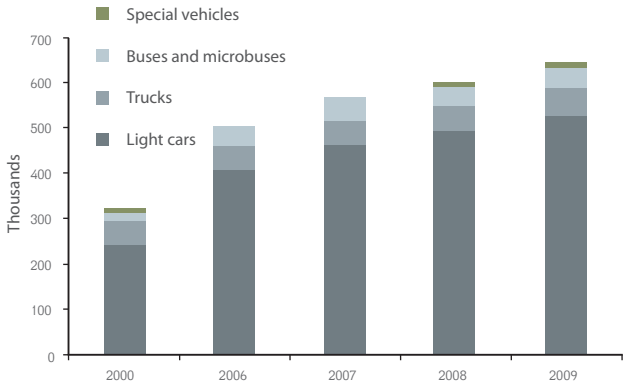

Figure 17.2 Number of motor cars registered in Georgia. Source: data of the Patrol Police

As Georgia does not manufacture cars, all cars are imported. Many of the imports are second hand cars coming from European, American and Japanese markets. In 2005, 85% of the national fleet was more than 10 years old.

Three quarters of passenger movement by public transportation are undertaken by bus (Figures 17.3 and 17.4). In freight transportation, motor transport is slightly ahead of the railway, although considering the freight transport demand, the latter occupies 90% of the market (Figures 17.5 and 17.6).

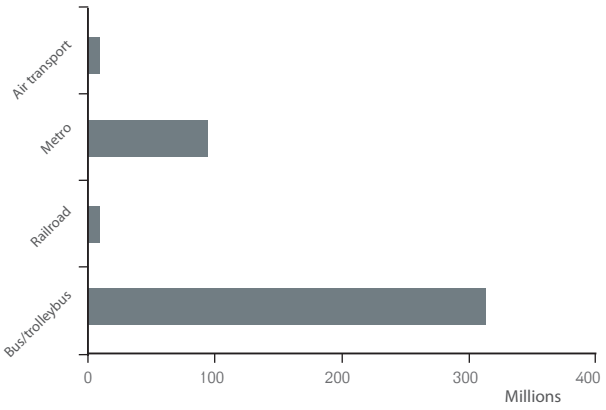

Figure 17.3 Number of transferred passengers by different means of transport, 2009

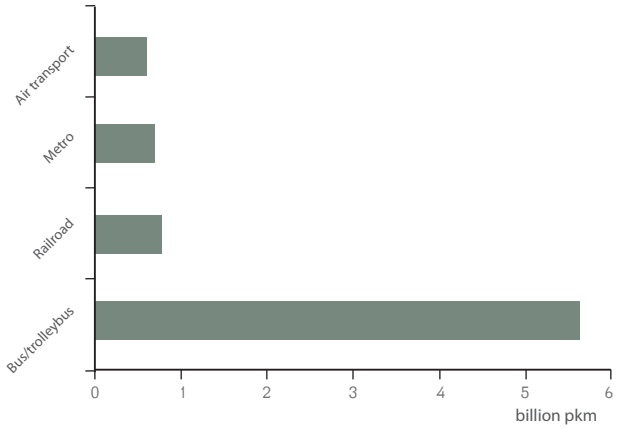

Figure 17.4 Passenger transport demand for different means of transport, 2009

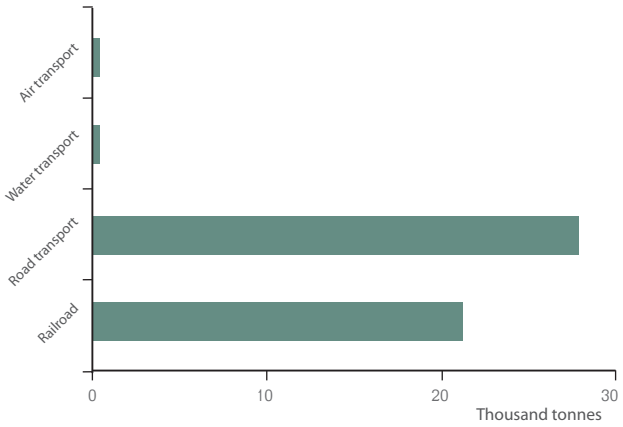

Figure 17.5 Freight transported annually by different transport means, 2009

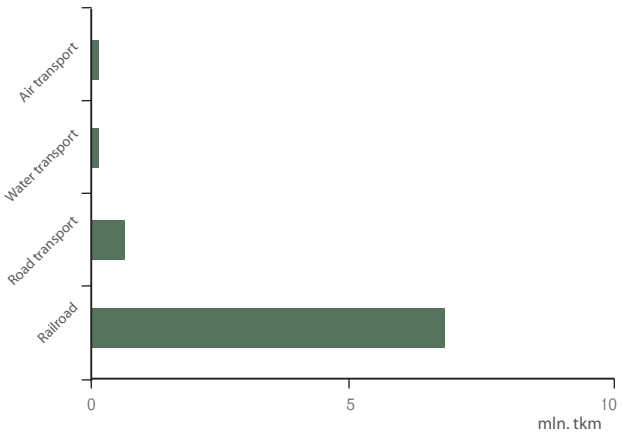

Figure 17.6 Freight transport demand for different means of transport, 2009

Georgia imports fuel to meet its transport needs. Fuel quality standards are analogous to Euro 2 for petrol and Euro 3 for diesel. Taxes on fuel are not differentiated in line with quality and are approximately half that of the European Union average. Fuel consumption is growing rapidly and has more than doubled between 2003 to 2007.

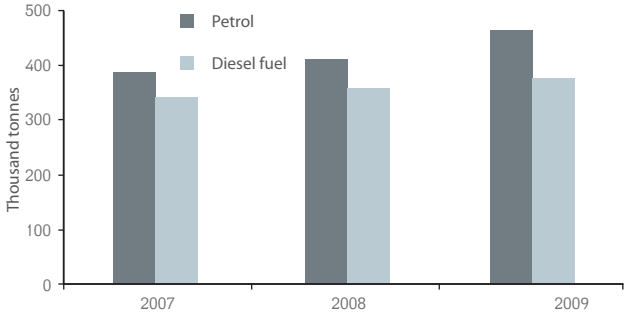

Figure 17.7 Import of motor fuel in Georgia

The main environmental impact from the transport sector is the degradation of air quality (see Chapter 2). The impacts on water and soil are less intensive.

Over 90% of pollutants discharged into the air in Georgia arise from motor transport. The reason transport makes up such a high percentage is due to the reduction of emissions to air from industrial point sources, due to the economic collapse of the 1990's. From the beginning of 21 century air pollution levels were dominated by emissions from a growing transport sector. The regular compulsory technical inspection of private light vehicles has been suspended until 2013. High age of the car park also contributes to the high air emissions from the transport sector.

VII/17. 3. KEY CHALLENGES

Sustainability of the transport sector depends on many aspects, the energy efficiency of the transport fleet, integrated transport management, management of demand (not only the supply), the use of low-carbon fuels, and introduction of new technologies (hybrid, fuel cells), all of which are important in the short as well as long-term economic and environmental perspective.

Development of the transport sector is a priority in Georgia. A range of projects both at national and municipal levels are being implemented to support this objective. These include simplification of transport taxes, investing in national and local roads, investing in municipal infrastructure, reform of the public transport system, and upgrading parking schemes.

Significant investment has been made and further investment is planned for improvement of the transport infrastructure. Planned investments for the period 2010-2013 include the construction of the Vaziani-Gombori-Telavi road in the Kakheti region; finalization of the East-West freeway; construction of the Mtskheta-Kazbegi-Larsi road in Mtskheta-Mtianeti; alternative artery (Batumi-Choloki) in Adjara; rehabilitation of the artery connecting the capital and country's south and western regions, etc. A rail line will be constructed between Karsi and Akhalkalaki and the Tbilisi roundabout railroad artery. A number of infrastructural projects are underway and planned aimed at reducing traffic congestion within Tbilisi.

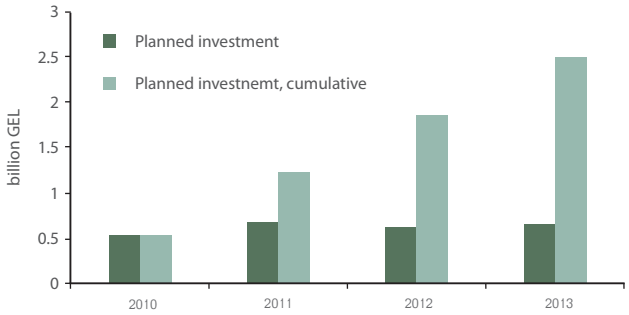

Figure 17.8 Planned budgetary investments in road infrastructure, 2010-2013.

Integrated transport planning is a modern approach towards solving transportation problems. It envisages integration in narrow terms (integration between different transport means) as well as on broader terms (integration of transport policy into the land use, environmental, education, health and other policies to balance all related interests).

Demand management in transport is also a comparatively new approach. It aims at limiting the continuous growth of transport infrastructure by regulating demands. The elements of demand control are numerous including financial and tax incentives to public awareness raising.

It is important to consider transport policy within the sustainable development framework. This requires management of not only the supply side but also the demand side of transportation. This is particularly relevant in urban areas where most car owners are located. Despite improvements in infrastructure, the current trend in growth of vehicle numbers is unlikely to be halted. This will result in increased pressure on the environment, particularly on air quality, but also increased nuisance from noise and vibration associated with increased traffic, which will affect the health of the citizens.

As such, significant efforts are required to address current trends and to mitigate their effects. This will include initiatives such as the promotion of the use of electric transport, limiting motor transport in central areas of the cities, and promotion of the use of public transport and environmental friendly methods such as walking and cycling.

VII/18

INDUSTRY AND ENERGY

The collapse of the economy in the 1990s resulted in a significant decrease of the impact of the industry and energy sectors on the environment. There has been some growth in these sectors in more recent times, particularly in the energy sector. However, growth within the sector has been based on improved and more environmentally sound technologies and as such has not impacted the environment to the same degree. The majority of technologies that remain from the Soviet era within the industry and energy sector are obsolete.

Targeting energy supply security, the country aims to make maximum use of internal energy resources, which are primarily sourced from renewable resources. At the moment, approximately 40% of Georgia's energy needs are met by domestic renewable energy sources, namely hydro resources and firewood.

In general, Georgia's GDP (nominal) energy intensity is 2.5 times higher than that of EU which indicates a significant potential for energy savings. Household energy use has an especially high potential with this regard. A recent assessment shows that about 40% of Georgia's energy consumption is used for household heating and lighting. The average house in Georgia consumes 4-5 times more energy per square meter for heating as compared with European Union countries, located in the same climate zone. Therefore, in the future more attention must be given to more economic and efficient use of energy in this sector.

VII/18. 1. INTRODUCTION

In 2009, the industry sectors contributions to theG-DP of the Georgian economy are as follows; mining industry 0.6%; manufacture industry 7.3%; energy and water supply sector2.6% and construction 5.3%. In 2009, 4.2% of the economically active population were employed in industry, and 1.7% in construction.

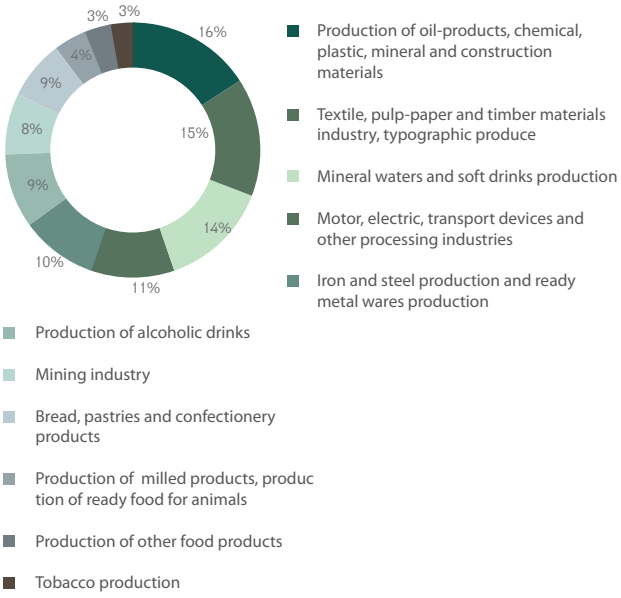

Figure 18.2 Share of different industries in GDP in 2009

VII/18. 2. INDUSTRY

The trend over the past five years has been largely positive: Industrial production doubled over the period from 2004 to 2007, while construction increased by a factor of 5 over the same period. During 2007 to 2009, there was a downturn due to the Russian aggression in 2008 and the recent global financial crisis. It is anticipated that growth in the sector will return in 2010.

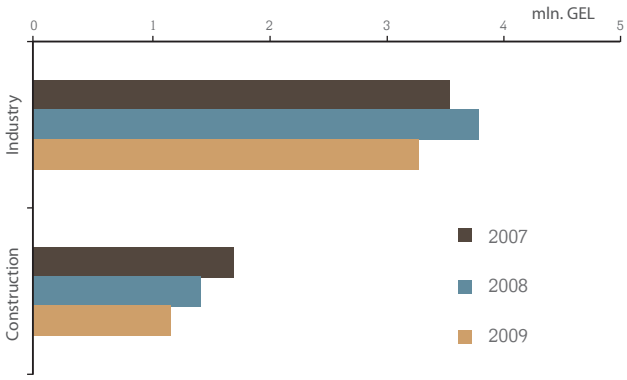

Figure 18.1 Economic value by sector2007 to 2009

Approximately half of the GDP generated by the industry sector in 2009 was generated by the food sector (including tobacco and beverages). The relative contribution from various industrial sectors has remained relatively constant over recent years, however, this may be subject to change in the medium term as a result of attracting investment into the industrial sector.

The environmental impact of the industry sector varies from one industrial sector to another. The impacts include pollution of air, generation of solid wastes, the use of water and waste water discharges.

Since the Soviet period, air pollution from point sources (which are mainly industrial and energy establishments) has decreased rapidly. According to GEOSTAT data the total emissions of hazardous substances decreased from 767,000 tonnes (54 % out of which was treated) in 1990 to 29,000 tonnes (35% treated) in 2000. Similar trends are observed for greenhouse gas emissions. These reductions were achieved as a result of the collapse of the heavy industry and energy sector in Georgia during the 1990's.

In the last 10 years, there has been a growth in pollution levels from the industry sector, which is as a result of the some level of recovery in this sector. However, emission levels are much reduced in comparison to those of the 1990's and seem likely to remain so. These positive trends are results of investments in modern technologies and improved environmental management practices. This has resulted in a much better indicator of air emission treatment, with 78% being treated in 2008 versus 54% in 1990.

The cement, non-ferrous-alloys and metallurgical sectors were the main sources of local air pollution in the past. Improvements have been made to emission controls within these sectors as a result of investment by the investors arising from the signing of agreements-memorandums with the Ministry of Environment Protection. Despite this, there are some"hot spots" which remain a problem.

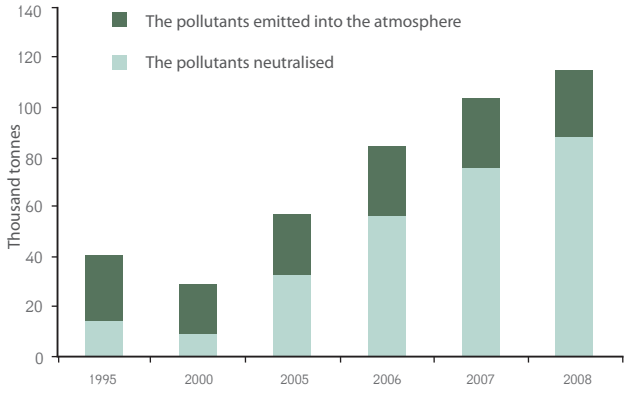

Figure 18.3 Annual emissions from point sources, the quantity of treated substances and emitted substances

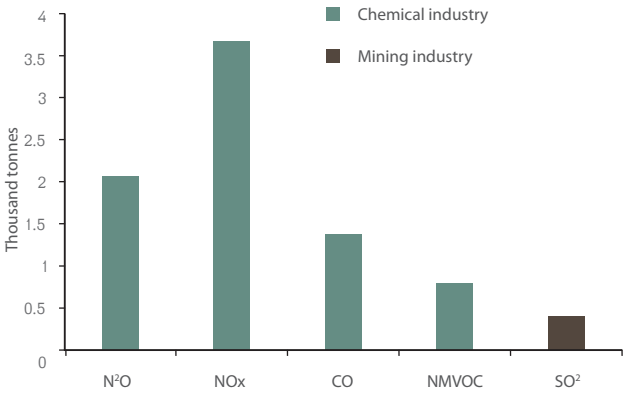

Figure 18.5 Emissions of some greenhouse gasses (except carbon dioxide) in two industrial sectors, 2006

There are no accurate statistics for the generation of hazardous waste by the Georgian industrial sector. The amount of accumulated solid waste has been estimated as a minimum of 6 million tons (see chapter "Waste"), mostly in the form of mining wastes. The majority of this waste arose during the Soviet period and is still stored at the sites of the enterprises. The majority of industrial wastes produced annually is also derived from the mining industry.

The pollution of surface waters by wastes which were either accumulated in the past or are being currently produced and poorly managed, is of significant concern. Regarding pollution from facilities which are currently operational, the main areas of concern include the Kvirila River, polluted by wastes from a manganese recovery facility, and the Mashavera River and its tributaries, polluted by wastes from poly-metal ore processing facility. The main hot spot impacted by historic wastes storage/ disposal includes the area located between the mountainous Racha and Kvemo Svaneti regions where tens of thousand tons of Arsenic containing waste were accumulated during the Soviet period, and abandoned after the collapse of the Soviet Union.

Ore mining is the main industrial source of greenhouse gas and sulphur dioxide emissions in Georgia, while the chemical industry contributes the majority of Nitrous Oxides (N^2O), Nitrogen Oxides (NOx), Non-Methane Volatile Organic Carbons (NMVOC) and carbon monoxide (CO).

Georgia is a party to the UN's climate change convention, the Kyoto Protocol, which provides for the use of "Clean-Development Mechanisms" (CDM),to provide additional investments for the industry and energy sectors.

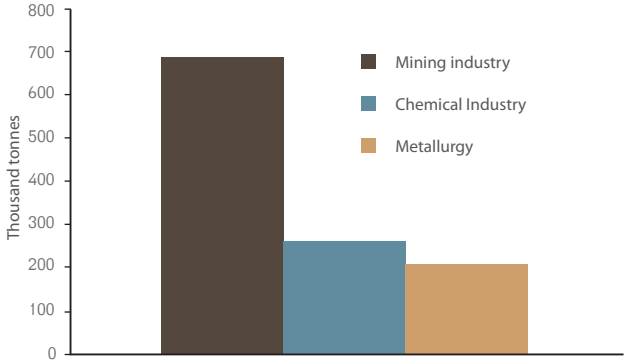

Figure 18.4 Carbon dioxide emissions in industrial sector, 2006

VII/18. 3. ENERGY

All sectors of the economy depend on energy. Thus, the sustainability of the energy sector is a key issue not only for the development of the economy but sustainable development in general.

Due to the absence of baseline data, the indicators presented below are partly based on expert judgement and should be relied on accordingly:

According to 2007 estimates, supply/consumptions of energy carriers was 3.25 million tonnes of oil equivalent (TOE). Approximately one quarter of this was accounted for by transformation and distribution losses, and 8% by non-energetic consumption. Energy that reached the final consumers accounted for 2.25 million TOE[1].

[1]Tones of Oil Equivalent (TOE) – energy unit, equals ten gig calories or 41.868 gig joule

Year	Electricity production mln. kWh			Electricity consumption mln. kWh	Electricity loses and own use mln. kWh	Electricity import mln. kWh	Electricity export mln. kWh
	total	hydro	thermal				
2002	7,224.9	6,711.5	513.4	7,713.0	1,279.8	739.7	251.6
2003	7,132.4	6,497.2	635.2	7,976.7	1,328.1	1,079.8	235.5
2004	6,902.2	6,027.8	874.4	8,109.8	722.3	1,278.1	70.5
2005	7,061.0	6,030.4	1,030.6	8,337.7	495.3	1,398.5	121.8
2006	7,621.9	5,401.6	2,220.3	8,302.5	423.2	777.0	96.4
2007	8,346.4	6,831.8	1,514.6	8,146	333.8	433.5	633.94
2008	8,441.4	7,162.3	1,280.0	8,410.8	343.3	649.2	679.4
2009	8,402.0	7,411.6	990.7	7,907.9	273.1	255.0	749.3

Table 18.1 Main characteristics of Georgian energy balance. Source for tables 18.1-18.6 – Ministry of Energy and Natural Resources of Georgia

Year	Oil
2006	63.5
2007	65.6
2008	52.8
2009	67.3

Table 18.2 Oil extraction (thousand tonnes)

Year	Extraction	Internal use
2000	7.4	
2001	1.3	
2002		
2003	5.4	
2004	8.1	
2005	4.1	
2006	2.5	2.1 (August-December)
2007	16.6	3.2
2008	57.4	49.4
2009	146.3	1,115

Table 18.3 Coal extraction and internal use (thousand tonnes)

	2007	2008	2009
Baqo-Supsa	-	5.6	31.4
Baku-Tbilisi-Jeihan	222.3	246.7	285.8

Table 18.6 Oil transit by arterial pipelines in 2007-2009 (million barrels)

Year	Consumption (mln. m^3)	Extraction (mln. m^3)	Import (mln. m^3)
2000	1,025.9		
2001	839.6		
2002	699.8		
2003	856.8		
2004	1,102.4	10.913	1,091.487
2005	1,331.5	14.827	1,316.673
2006	1,806.4	21.337	1,785.063
2007	1,700.1	22.388	1,677.712
2008	1,471.2	18.174	1,453.026
2009	1,188.8	7.652	1,181.148

Table 18.4 Consumption, extraction and import of natural gas (mln m3)

	2007	2008	2009
Petrol	383.9	407.5	281.0
Kerosene	44.3	58.0	33.9
Diesel fuel	339.6	350.9	206.2
Mazut	9.2	15.8	13.8
Lubricants and other oils	14.2	15.4	20.2
Other	0.5	0.1	0.2

Table 18.5 Import of oil products in 2007-2009 (thousand tonnes)

Energy consumption patterns, in comparison with the European Union index, are characterized by a large share by the domestic sector, 45 per cent in Georgia, as compared with 27 per cent within the European Union (average of 27 states (EU27)), and the agricultural sector, which accounts for 7 per cent in Georgia against 3 per cent within the EU27.

Energy supply in Georgia offers an interesting picture. Of the 3.25 million TOE consumed in 2007, approximately 70% arises from imported resources (47% Natural gas and 24% oil products).

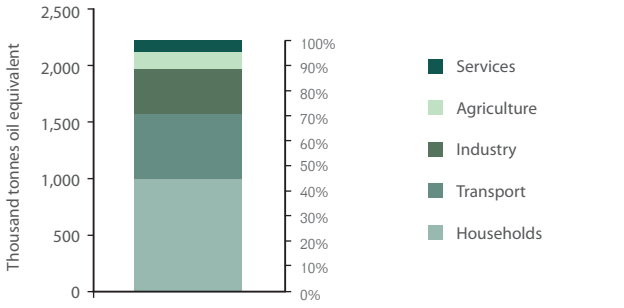

Figure 18.6 Final energy consumption in Georgia by final consumer (2007)

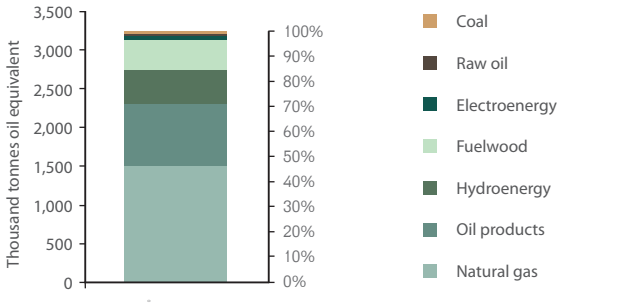

Figure 18.7 Total Energy Consumption for Georgia by energy source (2007)

Local energy resources include hydro-energy, mostly the so called "big" hydrostations (the hydroelectric stations of capacity more than 10 mega watts) used for electric generation, and biomass, in the form of fire wood, used for cooking and heating in households. These two energy sources provide a similar share in terms of energy supply.

The energy export-import balance and the economic and political risks associated with it, copper-fastens the government's intention to further develop domestic energy resources, with an emphasis on renewable resources. While certain stock of coal and small reserves of oil and gas exist within the country, Georgia is not rich in fossil fuel resources. However, the country possesses significant potential for renewable energy sources. At the moment, approximately 40% of Georgia's energy needs are satisfied by domestic renewable energy sources, namely hydro resources and fire wood. Though the means by which these renewable resources are used are different:

The use of hydro-resources for electricity generation is growing quickly. As a result, during recent years (from 2007) Georgia has become a net exporter of electricity within the region.

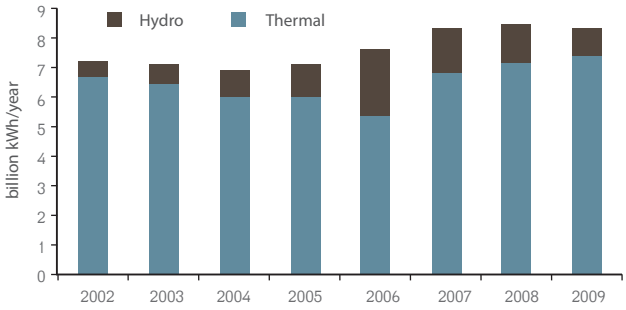

Figure 18.8 Electricity production in Georgia

By comparison, firewood remains a low technology energy source. According to certain indexes more than 80% of households in villages use firewood as their primary energy resource.

Other renewable energy sources include: geo-thermal energy, used on a small scale in urban areas for hot water supply and the use of biomass other than firewood, e.g. the generation of biogas from organic waste,which is only implemented at the pilot scale by some domestic enterprises at the moment, however there is significant interest in this technology from the farming sector. The same could be said of solar energy; its use is minimal, but the interest of consumers is growing, which has led to an increase in the number of producers and importers of the these technologies (mainly solar water heaters for household use) and competition on the market. Wind energy is not yet used on a commercial basis, however recent studies suggest that there is significant economic potential in this area.

The renewable energy potential of Georgia is estimated as follows:

The total estimated attainable energy potential for small hydro, wind, bio-masses (except fire wood) and geothermal energy is approximately 15 billion kWh per year, equivalent to 1.2 million tons of oil. The attainable energy potential of large hydro is estimated as 32 billion kWh per year.

Assessments for the energy for wood as an energy source vary. As consumption must be sustainable, it cannot be greater than the overall annual natural productivity of the Forest Fund, currently estimated as 4.6-4.8 million m^3. If half of this amount is assumed to be available for energy production, then the maximum of energy supply is about 6 billion KWh of energy per year, approximately 500,000 TOE.

The economic potential of solar energy use is about 277 million kilowatthours (about 23.7 thousand TOE); the figure increases year on year as the efficiencies of technologies (solar collectors) in the marketplace increase.

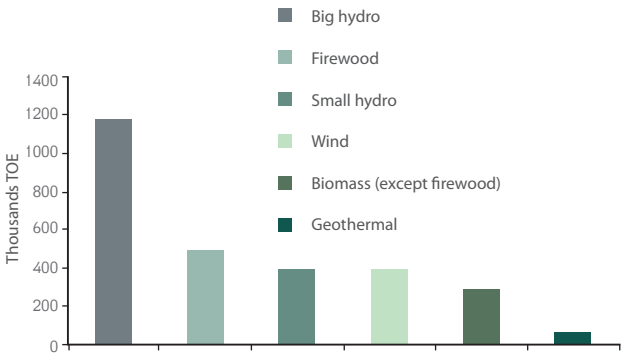

Figure 18.9 Achievable potential of renewable energy in Georgia by type of source (assessment minimum)

Sustainability of the energy sector is based not only on the use of renewable energy sources on the supply side, but also the efficient use of energy by consumers. The two sides, sustainable supply and sustainable use represent the basis of energy sustainability.

The energy intensity of a country in terms of GDP is an important indicator of the overall efficiency of energy use in production. In 2007, Georgia's GDP (nominal) energy intensity was 0.27 TOE per thousand US dollars; In other words, the production of goods valued at one thousand US dollars in Georgia requires an energy input of 270 kg oil equivalent. By comparison the average EU27 nominal GDP energy intensity was 0.11 TOE per thousand US dollars during the same period. In simple terms, the creation of each nominal unit of production in Georgia, requires two and a half times more energy as compared with the European Union average.

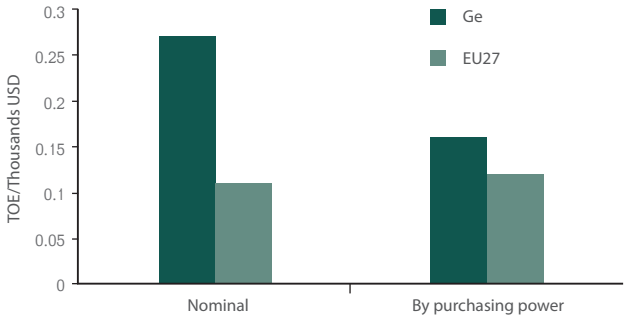

Figure 18.10 GDP energy intensity according to the energy supply. 2007 assessment

Recent pilot projects confirmed that there is considerable scope for improved energy-efficiency and the use of cleaner production approaches within in Georgia industry. The potential of energy demand side management (especially in the household sector) is particularly noteworthy. A recent assessment shows that about 40% of Georgia's energy consumption is used for household heating and lighting. The average house in Georgia consumes 400-500 percent more energy per square meter for heating as compared with other European Union countries, located in the same climate zone.

The level of air pollution from the energy sector depends largely on individual facility characteristics. The energy sector is a significant emitter of pollutants to the atmosphere such as volatile organic compounds, carbon monoxide and particulates (see Chapter 2).

Due to the cessation of district heating systems in major cities and settlements across Georgia in the 1990's, most people now use individual heating systems which use fuels such as natural gas and fire wood. In poorer areas, especially in villages, people tend to use fire wood because of affordability. As a result there are potential indoor air pollution problems arising from the burning of solid fuels in inefficient stoves and burners. This can give rise to related health problems.

Three large thermo-electric stations, located in Gardabani, are fuelled by natural gas and as such are not considered a significant source of waste. No problems are registered at the national level concerning disposal of wastes arising in households and small enterprises as a result of solid fuel consumption.

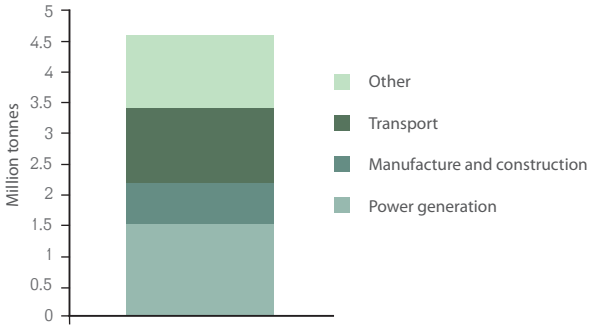

Figure 18.11 Carbon dioxide emissions in the energy sector, 2006 (see comment to the figure 3.17)

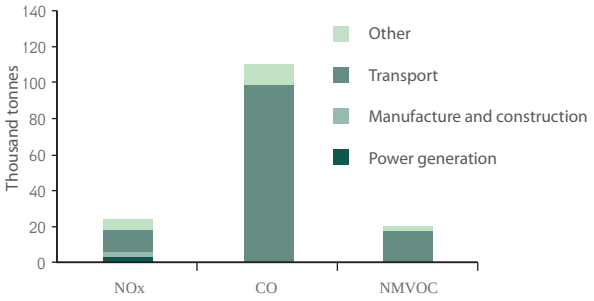

Figure 18.12 Emissions of other greenhouse gasses (except carbon dioxide) in energy sector, 2006 (see comment to the figure 3.17)

The Ministry of Energy and Natural Resources of Georgia has estimated that renewable energy sources, could provide up to 20 billion KWh of electric energy in the near future. This will reduce the requirement for hydrocarbon based fuels for energy consumption and accordingly reduce greenhouse gases emissions by the following amounts, carbon dioxide by 9 million tonnes, carbon monoxide by 5,000 tonnes, and nitrogen dioxide by 44,000 tonnes.

VII/18. 4. MAIN CHALLENGES

There are significant opportunities for Georgian industry to make significant cost savings as well as to improve environmental performance with improved technologies that use less energy and resources. The number of important efforts of the Ministry of Energy and Natural Resources of Georgia should be mentioned with this regard. Efforts include: the substantial rehabilitation of the energy sector and introduction of metering devices; and introduction of a progressive electricity tariff as an useful energy saving tool; the noted measure is directed at energy-saving because in accordance with the tariff policy main principle, wherein the power consumer pays less when he/she consumes less power. It should be also noted, that with the support of the Ministry of Energy and Natural Resources, a number of pilot projects have been implemented in this direction. There are also projects underway with the purpose of public awareness raising, with regard to the mentioned issues. Other measures to be highlighted are the number of projects within the EU INOGATE program; promotion of CDM projects; cooperation with European Energy Charter and European Energy Union; and cooperation with other governmental and nongovernmental organizations.

It is worth noting in this regard, the initiative of the Tbilisi Municipality, which joined the so called "Mayors' Agreement" on 12 April, 2010, working under the aegis of European Union. In joining this agreement, the municipality committed to reduce greenhouse gas emissions through the sustainable energy use.

As previously mentioned, government policy is firmly focused on the expansion of the production of energy using renewable sources of energy. Current priorities are focused on electricity generation at large hydro power plants. The construction of hydropower stations with total capacity exceeding 500 MW is planned to start 2010-2013. In the future, additional efforts will be directed towards the better use of other renewable sources.

Attention must be also directed to other aspects of energy security including not only energy supply but also the demand side management. The efficient use of energy has many benefits including, increasing energy-independence, improving trade balance, reducing environmental impacts, and thus deserves more attention.

References:

1. Energy Efficiency Investment Project Development for Climate Change Mitigation. Final Report. UNECE, 2009.
2. "World efficiency in energy efficiency and its importance for Georgia's energy supply". Fund "World experience for Georgia" 2008.
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4. Georgia "Strategic environment protection of energy system development assessment". Final report. "South East Europe consultants" Ltd. On the request of World Bank Group. 2008.
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VIII

STATE ENVIRONMENTAL MANAGEMENT


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VIII/19

ENVIRONMENTAL POLICY AND PLANNING

In order to ensure the constitutional right of citizens to live in a healthy environment, the state provides for the protection of the environment and the rational use of natural resources. While doing this, the economic and environmental interests of the society must be balanced. One of the roles of a Sustainable Development Strategy is to provide a framework to achieve this balance. Georgia has not yet developed such strategy.

National Environmental Action Plans are used as a vehicle for medium-term environmental planning, in addition to sectorial environmental plans and environmental plans of administrative units. The priority issues highlighted in these plans are reflected in the medium-term expenditure framework (MTEF) of the government, which is the basis for annual budgetary expenditure planning. In addition, Georgia receives substantial funding from international donors to support projects in the environmental sector.

A comprehensive assessment of the state of the environment and the effectiveness of the current environmental activities is the basis for good environmental planning. This report, describing the state of environment, is intended for both decision makers and the broader public.

VIII/19. 1. INTRODUCTION

According to art 37 of the Georgian Constitution, citizens of Georgia have the right to live in an environment safe for their health. The state shall guarantee protection of the environment and the rational use of nature with the aim to meet the ecological and economic interests of the population, and in doing so, to take into account the interests of future generations.

The Ministry of Environment Protection of Georgia is responsible for state governance in the field of environmental protection. The mission of the Ministry is the development and implementation of effective environmental policy and establishment of principles of sustainable nature use. The Ministry of Energy and Natural Resources of Georgia is responsible for rational use of natural resources of the country. Other ministries, such as the Ministry of Economy and Sustainable Development, the Ministry of Finances, the Ministry of Labour, Health and Social Protection, and the Ministry of Education and Sciences, the Ministry of Foreign Affairs, the Ministry of Agriculture, the Ministry of Regional Development and Infrastructure, also participate in these activities, when within their statutory remit.

VIII/19. 2. ENVIRONMENTAL PLANNING

Article 15 of the Law of Georgia on Environment, the framework law on environment, defines the environmental planning system, which includes three interconnected levels of planning:

1. The Sustainable Development Strategy of the country is a long-term strategic plan based on sustainable development principles, which ensures the balance of economic development and environmental interests. This strategy has not been developed in Georgia yet.

2. National Environmental Action Programme (NEAP). This is a 5-year plan of environmental activities on the national scale. It is also desirable that similar plans/programmes are developed at the levels of regions and municipalities;

3. Environmental management plans for specific activities should comply with the national plans.

The first NEAP in Georgia was developed in 1999 and covered the period 2000 to 2004 (approved by the President of Georgia by Decree #191 in May 20, 2000). Due to insufficient financing, most of the measures defined by the Action Program have not been implemented.

In November 2009, development of the second NEAP began, which will cover the period of 2012-2016. NEAP-2 priority directions were selected, in consultation with relevant stakeholders, and the development of an action program is underway in accordance with these priority directions:

- Waste management;
- Water resources;
- Ambient air;
- Land resources;
- Nuclear and radiation safety;
- Biodiversity (including protected areas);
- Disasters (hydrometeorology and natural disasters);
- Mineral resources;
- Climate change;
- Forestry;
- Black Sea.

Specific short-term or strategic action plans are also developed to address certain environmental issues. The priority actions from those sectoral programs/plans are also reflected in the NEAP. As such, a National Strategy and Action Plan for the Protected Areas System is being developed as well as a Water Resources Integrated Management Strategy. Development of a Waste Management Strategy is also planned.

In addition, some international conventions (see Table 19.2) require the country to develop national programmes for their implementation and regularly reports on performance according to those programmes. Such programmes/strategies/plans have been developed for the Biodiversity Convention, the Convention to Combat Desertification, the Montreal Protocol on Ozone Depleting Substances, and the Convention on Persistent Organic Pollutants.

VIII/19. 3. FINANCING OF ENVIRONMENTAL PROTECTION

The medium-term expenditure framework (MTEF) of the Government of Georgia is the basis for the allocation of state budget expenditures. It includes justifications for the priorities identified by different institutions, potential implementation dates for specified plans or programmes, as well as the expected outcomes and information on the assessment criteria used to evaluate these outcomes.

According to the Action Plan for 2007-2010, the Ministry of Environment Protection and Natural Resources focused on three key areas:

1. Effective resource use and reform of the forestry sector;
2. Improvement of the environmental protection system and development of protected areas system, and eco-tourism;
3. Improvement of environmental monitoring and forecasting systems and the prevention of the hazardous natural phenomena;

Cartography and geodesy allow the development of detailed and precise environmental information, which is also easy to understand and helps the authorities to make objective and timely decisions.

Comprehensive digital spatial data and maps of the country are currently under development. These will form a key baseline GIS data set for state of environment. This will allow the topography and relief of the landscape to be visualised and overlain by data on a wide variety of key issues such as the impact of natural disasters, agricultural activities and infrastructural development. This allows for an integrated analysis of the combined effects of all of these activities on the environment.

Within these priority areas the following targeted budgetary programs have been implemented in 2009:

1. A program for storage-disposal of obsolete pesticides existing in Georgia;
2. Measures to ensure carrying out ecological expertise of the activities;
3. Topographic-geodesic and cartographic works at Georgia-Azerbaijan border;
4. Measures to ensure provision of fuel wood for the population;
5. Forestry activities;
6. Measures for fire and pest protection of protected areas;
7. Ecotourism development;
8. Riverbank protection works;

The total budget allocated for financing these works in 2009 was 12 million GEL.

The budget of the Ministry of Environment Protection and Natural Resources of Georgia and the budget lines for financing target programs in 2005-2009 are given in Table 19.1. As can be seen from the table, state financing of the ministry and the target programs increased substantially from 2005 though more funds are necessary to properly address environmental problems.

A number of projects have been implemented in Georgia during 2005-2009, financed from international donor organisations. The main donors active in the environment sector in Georgia are: the Global Environmental Facility (GEF), United Nations Development Program (UNDP), United Nations Environmental Program (UNEP), European Community, the Governments of Germany (GIZ, KfW, BMZ funds), USA (USAID), Netherlands, Norway, Japan and others.

Year	Budget of the Ministry, thousands GEL	Program financing, thousands GEL
2005	24,478.3	1,107.1
2006	29,157.6	1,576.9
2007	37,546.5	3,455.7
2008	29,010.0	4,339.8
2009	36,255.8	12,006.6

Table 19.1 The budgetary funding of the Ministry of Environment Protection and Natural Resources of Georgia

VIII/19. 4. ASSESSMENT OF ENVIRONMENTAL PROTECTION

Any environmental plan should be based on an assessment of the existing and expected state of the environment. According to the legislation, the National Report on State of Environment (SOE) is the reference document for providing information on the state of the country's environment. During 2001-2005, the Ministry of Environment Protection and Natural Resources prepared SOE reports on annual basis[1]. Though the reports were not published and distributed, they are available at the Aarhus Centre web-site: http://www.aarhus.ge. This report is the first attempt to make information on State of Environment and its analysis easily available not only for decision makers but also for the general public. We hope that this report will form a basis for the future NEAPs and create favourable conditions for the improvement of environmental policy and activities.

The Environmental Performance Review (EPR) which is periodically produced by the UN Economic Commission for Europe (UNECE) is another document which assesses the performance of the country in meeting its environmental objectives. The latest EPR for Georgia was prepared in 2009. The document contains recommendations for strengthening environmental requirements and increasing the efficiency of environmental activities. Taking into account the recommendations given in this document, it will be possible to solve certain environmental issues on the governmental level. Some of the problems can be solved by achieving the better coordination between different institutions connected to environmental activities.

VIII/19. 5. INTERNATIONAL COOPERATION

The strengthening of regional and international cooperation is the one of the main driving forces for current environmental reform ongoing within the country. Cooperation between countries can be of great benefit when addressing environmental problems, as there is significant scope for learning from the experience of others. Moreover, cooperation on environmental protection builds strong bilateral relationships which are important preconditions for peace and stability in the region and on the wider scale.

Generally, cooperation in the environmental sector is undertaken within the frames of bilateral or multilateral treaties, agreements and environmental conventions; Georgia is party to 24 international environmental agreements (see Table 19.2). Detailed assessments of the implications of the provisions of any proposed treaty are undertaken before accession to ensure the provisions may be effectively implemented and to enhance international relations. This approach ensures that benefits can be obtained for Georgia, as for other signatory countries, within the framework of the international treaties.

The Ministry of Environment Protection will continue to participate in the EU Neighbourhood Policy and Eastern Partnership, as well as with UNECE, GEF, and other appropriate international processes. Regional cooperation at the Caucasus scale and bilateral cooperation with other countries will remain a priority for Georgia.

[1]the changed legislation now requires development of such reports only once every three years

Title	Date of ratification by Georgia
Convention on the Protection of the Black Sea Against Pollution • The Black Sea Biodiversity and Landscape Convention Protocol • Protocol on the Protection of the Marine Environment of the Black Sea from Land-Based Sources and Activities	September 1, 1993 September 26, 2009 September26, 2009
International Convention for the Prevention of Pollution from Ships	November 15, 1993
United Nations Framework Convention on Climate Change • Kyoto Protocol of UNFCCC	May 16, 1994 May 28, 1999
Convention on Biological Diversity • Cartagena Protocol on Biosafety	June 2, 1994 September 26, 2008
The Vienna Convention for the Protection of the Ozone Layer • Montreal Protocol on Substances that Deplete the Ozone Layer	November 8, 1995 November 8, 1995
Convention on International Trade in Endangered Species of Wild Fauna and Flora	September 13, 1996
Ramsar Convention on Wetlands	April 30, 1996
Convention on Long-range Transboundary Air Pollution	January 13, 1999
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposals	May 4, 1999
United Nations Convention to Combat Desertification	July 23, 1999
Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters	February 11, 2000
Convention on the Conservation of Migratory Species of Wild Animals • Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area • African/Eurasian Migratory Waterbird Agreement • Agreement on the conservation of Bats in Europe	February 11, 2000 March 21, 2001 May 1, 2001 July 25, 2002
Agreement between Georgia and International Atomic Energy Agency for the application of safeguard in connection with the threat on the non-proliferation of nuclear weapon • Protocol Additional to the Agreement between the Republic of Georgia and the International Atomic Energy Agency for the Application of Safeguards in Connection with the treaty on the Non-proliferation of Nuclear Weapons.	April 24, 2003 April 24, 2003
Stockholm Convention on Persistent Organic Pollutants	April 11, 2006
Convention of Physical Protection of Nuclear Materials	June 7, 2006
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	December 1, 2006
Convention on the Conservation of European Wildlife and Natural Habitats	December 30, 2008
Joint Convention Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	June 26, 2009

Table 19.2 The International environmental agreements which Georgia is a party

VIII / 20

ENVIRONMENTAL REGULATION AND CONTROL

As of 2010, environmental regulation within Georgia was undertaken through licensing and permitting as well as through the establishment of norms, rules and technical regulations. The Environmental Inspectorate ensured compliance with all of these requirements. Inspections were undertaken to detect activities operating without licenses/permits or operating in breach of the relevant license/permit. Inspections also uncovered breaches of the environmental norms, rules and technical regulations. Companies or individuals who are in breach of environmental requirements are fined and additionally have to pay the state for damage caused to the environment. If there is criminal infringement, the case is transferred to the relevant investigation authorities.

Many initiatives have been undertaken to improve the environmental regulation system. Firstly, the development of the system of inventory and monitoring of biological resources, which allows scientifically based quotas to be established, which provide for the sustainable use of these resources and prevent their degradation.

Optimization of environmental inspection activities are underway. Namely it is planned to concentrate on inspection of stationary sources with emphasis on prevention of violations through facilitating the environmental compliance.

VIII/20. 1. INTRODUCTION

The universal mechanism for protecting the environment and natural resources from damage as a result of the impact of human activity is to regulate the potentially dangerous activities by a system of licenses and permits.

The moves to liberalise the economy since 2004 have also had a significant influence on legislation in the field of environmental protection and use of natural resources. It has resulted in a change of approach in regulation, aimed at reducing bureaucracy and streamlining the permitting process. Since 2005, the number of environmental licenses and permits was significantly reduced and the procedures for obtaining them substantially simplified.

The use license (or the license for use) is also issued to a person but is associated with a specific resource, which is the subject of regulation. A license of this type can be transferred in total or in part to another person. A "use license" is obtained (purchased) at auction.

Both types of licenses can have conditions which must be complied with. Compliance with these conditions are regularly checked by the relevant enforcement body. Failure to meet the license conditions may result in the license for the activity being withdrawn.

As per 2010, licenses for the use of natural resources were issued by the Ministry of Economy and Sustanable Divelopement of Georgia. The quotas for the use of these resources and the licensing conditions to be attached were established in consultation with the Ministry of Environment Protection and Natural Resources of Georgia.

Environmental licenses

Licenses for use of natural resources:

- License for extraction of mineral resources;
- License for use of underground space;
- License for use (exploration or extraction) of oil and gas resources;
- License for forest use (forest harvesting or establishment of hunting farms);
- License for fishery;
- License for use for export purposes of the snowdrop bulbs and cyclamen tubers listed in the CITES Appendixes.

Licenses on activities:

- License on nuclear and radiation activities.

Year	Number of licenses	Number of auctions	Income from auctions (mln GEL)
2005	67	3	2.2
2006	900	50	75
2007	710	38	24.2
2008	400	35	49.3
2009	340	42	39.2

Table 20.1 Number of auctions and licenses issued in 2005-2009

VIII/20. 2. LICENSES

In Georgia there are two classes of licenses, use licenses and activity licenses.

The activity license (or the license for an activity) is issued to a specified person to ensure their ability to adequately perform a specific activity. This type of license can not be transferred to another person.

During the period 2008 to 2009, the number of environmental licenses issued decreased, primarily due to the fact that long-term licenses were issued in previous years (2005-2007). In recent years, the enforcement of these licences has become stricter and a number of licenses were revoked, especially within the mining sector.

	Type of license	Number of issued licenses	License validity duration
1	Forest use	47	5-10 years
2	Endangered species of flora and fauna	35	10 years
3	Establishment of Hunting farms	12	20 years
4	Fishery	7	10 years
5	Extraction of natural resources (solid mineral resources, mineral and fresh ground waters)	2,316	1 – 25 years

Table 20.2 Long-term environmental licenses issued in 2005-2009

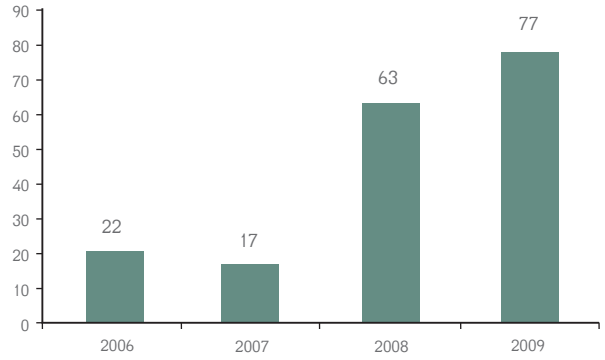


Figure 20.1 Licenses for nuclear and radiation activities issued in 2006-2009

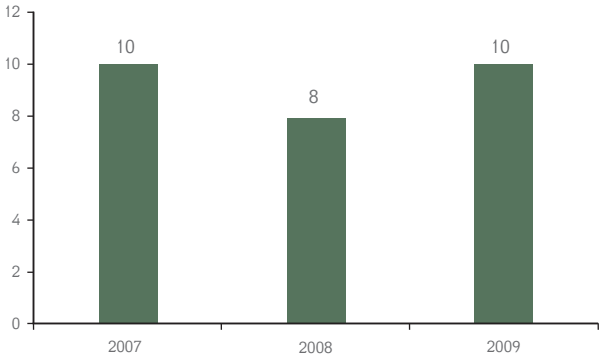


Figure 20.2 Licenses for use of snowdrop bulbs or/and cyclamen tubers issued in 2007-2009

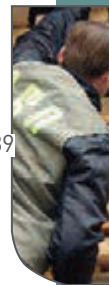
Environmental permits:

- Environmental Impact Permit ;
- Permit on transportation, import, export, re-export, or transit of restricted market materials;
- Permit on acquiring nuclear and radiation sources, nuclear materials, radioactive substances or radioactive waste.
- Permit on import, export or transit of nuclear or radiation sources, nuclear materials, radioactive substances, and minerals from which nuclear materials can be extracted; all derivatives of nuclear materials or radioactive substances, or contain them as the integral parts; as well as the import, export or transit of nuclear technologies, or know-how.
- Permit on import, export, re-export of specimens listed in the Appendices of the Convention on International Trade with Endangered Species of Wild Flora and Fauna (CITES).

VIII/20. 3. PERMITS

There are two types of permits in Georgia which serve the purpose of protection of the environment; 1) The Environmental Impact Permit; 2) Permit for movement/ marketing of certain types of products, resources or dangerous materials.

The aim of the Environment Impact Permit is to check whether the specific facility or infrastructural or other works are designed in a manner that minimizes its impact on the environment. For this purpose, the operator has to assess the perceived impact of this activity on the environment and propose measures for minimizing their impact. This information is prepared in the form of an "Environmental Impact Assessment" (EIA) document. This document must be displayed in a publicly accessible place, for example the municipality administration building, or at the offices of the Ministry of Environmental Protection, for at least 45 days. In addition, notice of public disclosure of EIA reports, and indeed the



reports themselves, are regularly placed on the webpage of Aarhus Centre (www.aarhus.ge).

The aim of public consultations on the EIA report is to clarify if the people living in the area of the proposed development are satisfied with the environmental measures which have been proposed by the operator to ensure that the environment and people's health are sufficiently protected. The activity/facility designs are often upgraded and the planed environmental activities improved, as a consequence of the public consultation process. The EIA report together with results of public consultations is submitted for ecological expertise by the Ministry of Environment Protection. If the application is deemed acceptable an Environment Impact Permit is issued for the development.

The Environmental Impact Permit has a large number of conditions attached to it to ensure that the operation of the facility does not impact human health or the environment. The EIA report itself is also appended to the permit and implementation of all measures specified in the report are also made obligatory.

Activities subject to Environmental Impact Permitting:

1. Processing of mineral resources (ecological expertise is not needed for inert materials, except those listed in paragraph c).
2. Any manufacturing technology using asbestos.
3. Cement, asphalt, lime, gypsum, and brick production.
4. Glass and glass products industry.
5. Treatment of solid domestic wastes (including construction of incinerators), or/and construction of landfills.
6. Disposal of toxic and other dangerous wastes, construction of depositories for them and/or their treatment and neutralization.
7. Industries of any capacity related to coal gasification, liquefaction, briquetting, and carbonization.
8. Construction of oil and gas pipe-lines.
9. Disposal of storages and terminals of oil and oil products, as well as of liquid and natural fuel, in case if the volume of at least one of their tanks is over 1,000 cubic m, or if their sum volume exceeds 1,000 cubic m.
10. Highways and railways of international and internal importance, bridges over them, tunnels, as well as the construction of engineering protective facilities of highways, railways and their territories.
11. High voltage (35 kilowatt and more) air and cable electric transmission lines and installation of substations (of 110 kilowatt and more).
12. Installation of hydropower (2 megawatt and more) and thermal power stations (10 megawatt and more).
13. Construction of subway.
14. Arrangement of water bodies (over 1,000 cubic m).
15. Waste water treatment facilities (1,000 cubic m of volume and more per day), as well as installation of sewage collectors.
16. Installation of aerodromes, airports, railway stations, and marine ports.
17. Installation of dams, piers, or docks.
18. Chemical industry, in particular: chemical treatment of semi-manufactured products and production and treatment of chemical substances: pesticides, mineral fertilizers, chemical dyes, lacquers, peroxides, and elastic substances (rubber or plastic substances); production of gunpowder and other explosives; production of graphite electrodes; production of accumulators.
19. Oil processing and gas processing industries (capacity – over 500 t per day).
20. Any kind of metallurgic industry (capacity – over 1 t per hour), except metal cold working and jewellery.
21. Storage of toxic and other dangerous substances.

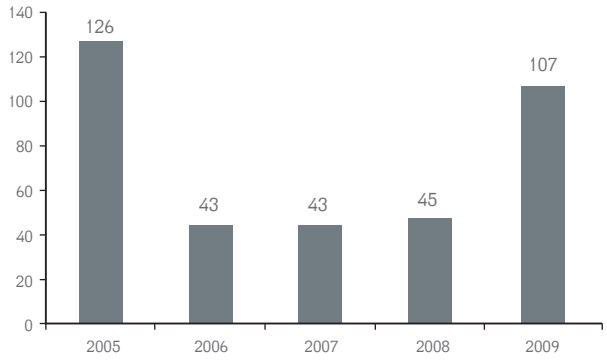


Figure 20.3 Environmental Impact Permits issued in 2005-2009

The number of Environmental Impact Permits issued per annum increased significantly in 2009, due to the requirements stipulated in the Law on Environmental Impact Permits of 2007, requiring that planned and existing activities which did not have Environmental Impact Permit, had to acquire an Environmental Impact Permits by January 1st 2010.

VIII/20. 4. ENVIRONMENTAL RULES AND TECHNICAL REGULATIONS

Small scale activities which pose less risk to the environment are not regulated by licenses and permits. They are regulated by means of environmental rules and technical regulations which are applicable to all activities and persons. Those rules include:

- Permissible emission levels of pollutants into the environment;
- Standards for the concentrations of pollutants in the environment, food, and fuel;
- Rules governing the use of nature resources (hunting, fishing, logging).

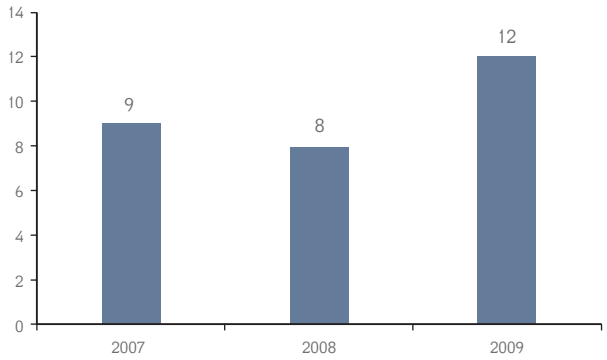


Figure 20.4 Permits on Export, Import, Re-export and the harvesting form the Sea of any specimens, parts and derivatives of the species listed in the Appendices of the CITES issued in 2007-2009

VIII/20. 5. STATE ENVIRONMENTAL CONTROL

As of 2010 the Environmental Inspectorate of the Ministry of Environment Protection and Natural Resources of Georgia was responsible for statutory control in the field of environment. Inspection uncovered incidents of illegal extraction of natural resources; unauthorised use of natural resources, and breaches of environmental rules or technical regulations. In addition, facilities which are the subject of environmental licences or permits were obligated to regularly report compliance data to the Inspectorate in accordance with the conditions of their licence or permit.

When a breach of environmental legislation is detected the controlling authority reacts in several ways:

- Activities undertaken without an appropriate environmental permit or license are generally subject to confiscation of illegally acquired natural resources and are subjected to fines or criminal sanctions where relevant.
- Where the case includes illegal pollution of environment by hazardous substances or the ille-

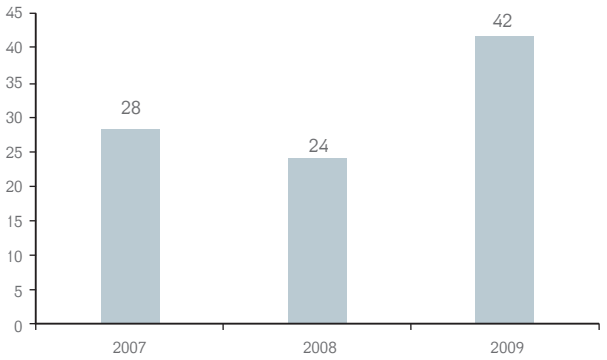


Figure 20.5 Permits on export, import or transit of nuclear and radiation sources, nuclear materials, radioactive substances issued in 2007-2009

gal extraction of mineral resources, the damage caused by these activities is calculated and these damages are levied against the non-compliant company or person. In practice this is done by civil proceedings filed against the perpetrator in the name of state.

- If non-compliance with the permit/licence conditions continues the authority may temporarily close the facility or cease the activity, or may consider revoking the relevant permit or licence.

In 2009, the total staff of the Environmental Inspectorate consisted of 306 specialists, of which 62 specialists work in the central office and 243 in local bodies.

Illegal logging, fishing and mining were the key areas target for inspection during the period 2005 to 2009, as these were known problem areas. As a result, a high number of violations were recorded in these sectors (see Figure 20.6).

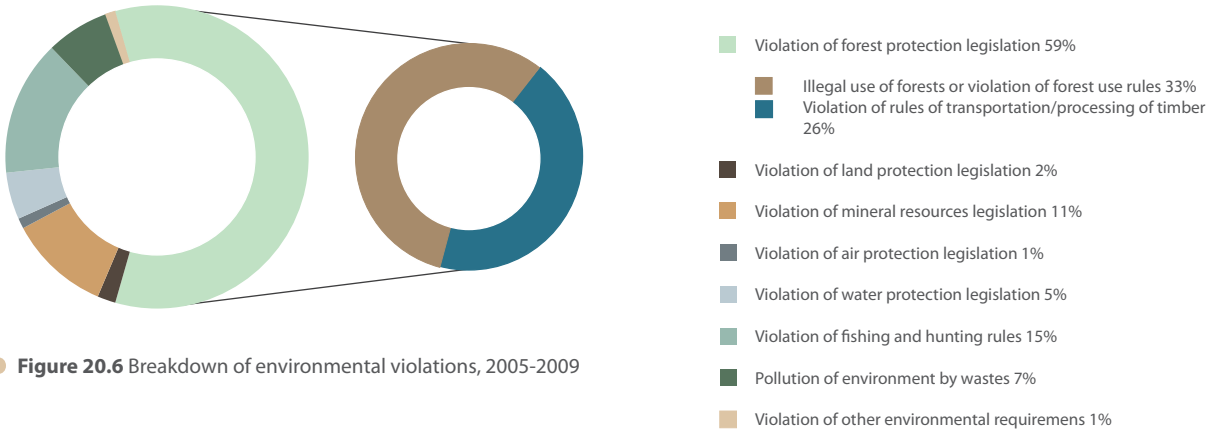


Figure 20.6 Breakdown of environmental violations, 2005-2009

VIII/20. 6. MAIN CHALLENGES

As mentioned above, there is a specific procedure for issuing an environmental impact permit, which is ensured by Georgian legislation.

In order to improve effectiveness of the EIA system it is necessary to:

- Amend the legislation to extend the timeframe for assessing and granting the EIA permit, to review the list of activities subject to the environmental permitting according to the sectors potential to impact on environment and related health risks;
- Develop guidelines for the development Environmental Impact Assessments in different sectors, including the guidelines on the content and structure of the reports;
- Undertake an awareness raising campaign aimed at improving public participation in the Environmental Impact Assessment process.

Further improvements of the control mechanisms are necessary to establish a more consistent, comprehensive, equitable and economically effective system of state control.

	Facts of violation of the Environmental legislation			Fines (GEL)	Calculated damage to the environment (GEL)		
	Total	Including			Total	Including	
		Administrative	Comprising criminal signs			Administrative	Comprising criminal signs
2005 September-December	622	553	69	66,877.6	2,372,670.3	77,261.7	2,295,408.6
2006	2,990	2,661	329	1,090,676.5	4,385,500.1	586,826.5	3,798,673.6
2007	5,293	4,593	700	1,723,439.0	6,458,842.9	1,031,152.0	5,427,690.9
2008	2,980	2,671	309	1,335,292.0	4,828,044.3	633,443.9	4,194,600.4
2009	3,963	3,617	346	1,875,573.0	5,069,688.0	1,506,939.6	3,562,748.4
Total 2005-2009	15,848	14,095	1,753	6,091,858.1	23,114,745.6	3,835,623.7	19,279,121.9

Table 20.3 Main characteristics of the state control provided by the Environmental Inspectorate
* Note: Inspection started operating in September of 2005.

VIII / 21

ENVIRONMENTAL RESEARCH, EDUCATION, AND AWARENESS RAISING

According to Georgian legislation, citizens have the right to receive comprehensive, objective and timely information on the state of their working and living environment, and take part in decision making processes in the field of environment.

The Ministry of Environment Protection of Georgia focuses significant efforts on raising the environmental awareness of the population. The Ministry organizes meetings, conferences, briefings, greening and cleaning actions, ecotours for students and school pupils, and media briefings on a regular basis to achieve this objective. In addition, information and educational brochures are published, and documentary films focusing on specific environmental issues are made. The web-pages of the Ministry and the Georgian Aarhus Centre's also serve to inform the public on environmental issues.

The Agency of Protected Areas of the Ministry of Environment Protection of Georgia, is undertaking training of geography and biology school teachers. Training for primary school teachers is also planned. Scientific-popular lectures for school children are regularly conducted.

Notwithstanding these efforts, environmental awareness of population is still considered low. Planning and implementation of joint initiatives by the Ministry of Environment Protection and the Ministry of Education and Sciences for improvement of environmental education are of high importance.

VIII/21. 1. INTRODUCTION

According to the Law of Georgia on "Environment Protection", citizens have the right to receive comprehensive, objective and timely information on the state of their working and living environment, and take part in decision making processes in the field of environment.

It is essential to continue environmental awareness raising activities such that the population are aware of the problems facing the environment and in order to promote the sustainable use of natural resources.

The Ministry of Environment Protection of Georgia places a high priority on issues related to environmental awareness raising among the population. The Ministry holds regular meetings and conferences, media briefings, and undertakes a number of initiatives such as planting trees, clean-up campaigns, adventure tours for students, art exhibitions for school children, and media tours, all aimed at highlighting various environmental issues for the public. The Ministry supports the publication of many different informational and educational brochures, in addition to the production of TV documentaries. Several TV and radio channels report regularly on environmental initiatives conducted by the Ministry of Environment. During 2009-2010, Radio "IMEDI" aired a two hour program "Green Broadcast" every week, which was lead by the Minister, Mr. Khachidze, himself. In addition, the Ministry's web site: http://www.moe.gov.ge, serves as a significant source of information on the activities of the Ministry and on the active legislation in the field of environment, international treaties, and conventions. The web site also provides up-to-date news in the field of environment and the Ministry's press releases. The Ministry uses the Caucasus Environmental NGO Network (CENN) and the Aarhus Centre for dissemination of electronic information.

The Public Council established by the Ministry in 2009, is made up of well-known people from different fields such as businessmen, lawyers, journalists, and artists. The Council members meet regularly and discuss environmental issues. On the recommendation of the Public Council, the Ministry produced 5 minute video entitled "Plastic bag – enemy of Nature", which was shown on almost all TV channels. In addition for environmental awareness raising the PR department of the Ministry prepared the following video-clips: "Do not cut a Christmas-tree", "Happy new year", "Plant a Christmas tree", "Plant a tree" (2 clips), "Help us to help them", and "Do not cut a Christmas-tree" including addresses from well-known people (6 clips). Information videos: "Fuel wood is enough for everybody" (2 clips), a clip describing functions of the Environmental Inspectorate (2 versions), "Report to Georgia", "Voucher for fuel wood", "20-year-term license", "Ramsar-2010" and others.

The Aarhus Centre (http://aarhus.ge) was established in 2005 on the joint initiative of the Ministry of Environment and the OSCE Mission in Georgia to provide access to information and to promote public participation in environmental decision making processes. Since 1st June of 2009, the Aarhus Centre has operated under the auspices of the OSCE project "Environment and Safety Initiative" (ENVSEC).

The main goal of the Aarhus Centre is to support the implementation of the provisions of the Aarhus Convention at a national level. In essence, this means access to environmental information for citizens, participation in decision making processes and access to justice in the case of violation of these rights. In particular the Aarhus Centre provides the following services:

- Provides environmental information by means of an up-to-date web site, provision of an environmental library, and by undertaking various environmental information campaigns.
- Conducts monitoring on public participation in decision making processes and periodically issues recommendations to the Ministry of Environment Protection for increasing the effectiveness of these processes.
- Develops guidelines for the wider population explaining the provisions of the Aarhus Convention and existing mechanisms for their implementation.
- Provides legal advice for interested citizens on environmental issues, as well as other kinds of consultations.
- Supports awareness raising and environmental education using different means, such as distribution of information, seminars, working meetings, training, and various campaigns.

Several NGOs also carry out environmental awareness raising actions and projects. The Caucasus Environmental NGO Network (CENN) is especially active in this field. The NGOs NACRES (Noah's Ark for the Reintroduction of Endangered Species) and WWF Caucasus Office are working in the field of Biodiversity, Elkana is working in the Agro-biodiversity and Biofarming field. The Centre for Strategic Research and Development, Green Alternative, Caucasus Regional Environmental Centre, Greens Movement of Georgia also have an active role.

VIII/21. 2. ENVIRONMENTAL EDUCATION

In order to increase environmental awareness, it is essential to provide environmental education at all levels within the school curriculum, starting with preschool children. In general, the importance of environmental education is underlined in the document adopted by the Resolution of the Government of Georgia #84 on 'Education National Goals' (2004).

Preschool Education

In 2009, the National Education Programs and Assessments Centre, with the support of UNICEF, established educational standards for preschool institutions, aimed at developing environmental awareness and a positive attitude to the environment in children.

General School Education

Reform of the Education System has been undertaken since 2004. The Ministry of Education and Science has developed the document "National Education Goals", defining the objectives for "what kind of citizens" should graduate from our schools. The objective is that schools should develop independent, patriotic, creative, environmentally conscious people who can apply the knowledge they have gained in practice.

Environmental education is one of the main areas within the field of 'life and social sciences'. Environmental issues are included in the curriculum for different grades under many subjects including physics, chemistry, biology, geography (until VII grade) and the social sciences (geography, civil education: economy, practical law, citizenship, and other selective courses), taking into account the age, abilities and demands of the children.

These subjects are designed to develop the skills required to enable a person to understand their place in the environment, and to watch the natural processes, to analyse their own and other's actions, taking into account the global interests of mankind. Overall the development of environmental awareness is a common goal of both subject blocks.

From grades I-VI (Primary Grade), the main goal of environmental education is to develop a proper general attitude to the environment among the pupils.

By the end of the basic grades VII-IX, the pupils should be aware of spatial aspects of natural, socio-economic, and the political processes at a local, regional, national, and global level. This includes aspects such as the spatial distribution of population, industrial, and non-industrial sectors. All of which leads to developing environmental understanding.

At the secondary grades, X-XII, pupils should be able to discuss and analyse environmental problems including sustainable development, alternative approaches to these issues, possible solutions, and the global nature of environmental problems. They should understand that an educated and experienced person can significantly contribute to the protection and improvement of the environment.

Based on observations of the current situation, the children should be able to define the potential environmental problems facing the population, and to propose relevant solutions.

Professional Development of Teachers

Appropriately qualified and trained teachers are essential for successful reformation of the education system.

In 2007, the Centre for the Professional Development of Teachers with the assistance of the Centre for Education Programs and Assessments, produced proposals on Professional and Subjective Standards for Educators. The proposed standards were the subject of considerable discussion among the relevant professional societies. Teachers have been certified according to these standards since 2010. Teachers can opt to take these exams on a voluntary basis up until 2014. In 2010, certification was conducted for teachers of the Georgian language, mathematics, and foreign languages. Teachers of life sciences and social sciences will join the process from 2011. According to the established standards, teachers of life sciences and social sciences (teaching in I-IX grades) must be highly competent in the environmental field. They should also have appropriate teaching skills to develop an appropriate environmental attitude in pupils.

Since 2008, the Protected Areas Agency of the Ministry of Environment Protection and Natural Resources of Georgia, with the support of the National Education Programs and Assessment Centre, has undertaken training of public school teachers. They retrain teachers of biology and geography in different regions of Georgia. At the moment, over 120 teachers from 60 schools have been retrained. The aim of the programme is to raise awareness of Georgia's protected areas within schools and to develop teachers, environmental skill set.

The government intends to undertake similar training for primary school teachers. At the moment professional standards for these teachers are being developed. The document pays particular attention to improving the competence of teachers and raise awareness of the environment and environmental issues among school children. In order to provide for more effective study of environmental issues at higher levels, it is essential that a student receives the basics of environmental knowledge at primary school.

	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010
Number of students, (thousands)	143.9	140.8	112.1	93.6	102.7
Students studying environmental programs (thousands)	0.1	0.1	0.1	0.1	0.1

Table 21.1 Number of students in state and private high education institutions
Source: National Statistics Service

Higher Education

In Georgia, higher education institutions are autonomous organizations that, together with the Quality Services, are authorized to determine the courses and content made available within their institutions. Several courses include modules dealing with environmental aspects, for example bachelor degrees in geography, ecology, applied bio-sciences, and bio-technology, and master's degrees in physical geography and sustainable use, offered by Tbilisi State University. Bachelor degrees in life sciences, ecology, environment, and sustainable development, and master's degrees in environmental bio-technologies, ecological genetics, geo-ecology, natural disaster risk assessment, eco and agro-tourism management, and the biological resources of the Earth, Caucasus, and Georgia (in the context of sustainable development) are available at Ilia State University.

Information on the total number of students studying in third level institutions between 2005 and 2010, and the number studying environmentally related courses are provided in the Table 21.1. As the table shows, the number of students studying environmental programmes is almost the same during these years.

Adult Education

Environmental awareness raising and education of adults is very important in this dynamic modern society. It is evident, that an educated and informed people and society can contribute significantly to the improvement of the state of environment, and the sustainable use of resources.

There is still significant work to be done in raising people's awareness regarding environmental issues. In particular, increasing environmental awareness of people involved in decisions making processes and those who can influence public opinion are seen as a priority actions. The publication of this report is one initiative aimed at achieving this objective.

VIII/21.3. RESEARCH INSTITUTES AND SCIENTIFIC RESEARCH

As of 2010, there were 62 research institutes in Georgia, some of which have an environmental profile and work actively in this field.

One of the main financial sources for research institutes are state budget grants, which are awarded on a competitive basis for the implementation of particular projects. Besides that, institutions are encouraged to compete for international research grants and obtain funding from any other potential funding sources such as industry, etc.

Information on the these research projects is available on the web site of the National Scientific Fund: http://gnsf.ge.

#	Scientific directions	Number of projects	Budget , GEL
1	Information technologies, telecommunications	8	808,539
2	Life sciences	14	1,537,879
3	Mathematics, mechanics	17	2,034,298
4	Nature sciences	27	2,999,230
5	Earth studying sciences and environment	27	3,371,647
6	Medicine sciences	18	1,902,608
7	Engineering sciences, high technology materials	24	2,379,578
8	Agrarian sciences	26	3,007,034
	Total	161	18,041,613

Table 21.2 Projects financed from the state grant fund by scientific field

Topical Scientific Lectures Series for Public Schools

The delivery of a series of lectures on a number of popular scientific topics has been underway in Public School since 2007. The aim of this project is to make the field of science more interesting and appealing to public school children, and to promote its uptake as a subject in schools.

As part of this project, lectures and practical demonstrations have been delivered in Tbilisi, Telavi, Mtskheta, Gori, Kutaisi, Senaki, Rustavi, Akhalkalaki, Ozurgeti, Poti, Khelvachauri, Borjomi, Oni, and Mestia.

The program covers a wide range of topics including: chemistry, physics, biology and medicine, cosmology and astronomy, geography, ecology, geology, information and communication technologies and mathematics.

The lecture series has been targeted at the higher grades but is open to all other interested pupils. Thousands of pupils have attended these lectures during the three year period.

Georgia's Pupils' Competition - "Olympiad"

The Ministry of Education and Sciences of Georgia conducted a National Awards Initiative for school students called "Olympiads". There were two thematic groups covered: education for sustainable development; and civil projects and humanities. The thematic group on Education for Sustainable Development included the following topics:

1. Quality of life in my city/village – subjective and objective criteria;
2. Conservation of the Black Sea coastal zone (Sarphi-Batumi or Supsa-Natanebi);
3. Conservation and rational use of forests;
4. Natural disasters and safety of people;
5. Inclusion of local natural and historic relics into tourism development;
6. Quality of environment and health

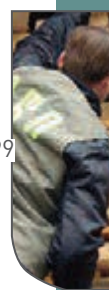
In 2006, there were 48 environmental projects out of a total of 400 entries. The following year the number of environmental projects increased to 248 out of a total of 830 projects entered in the competition.

VIII/21. 4. MAIN CHALLENGES

Notwithstanding the efforts already undertaken to raise public environmental awareness and to improve environmental education, there is still much to do in this area. Through its work, the Ministry of Environment Protection interacts with all sectors of society and has generally encountered a low level of environmental awareness and education on many environmental issues, such as, environment pollution, the effective use of natural resources, poaching, illegal forest use, etc.

It is therefore necessary to increase efforts to improve environmental awareness and education in Georgia. In this regard, the joint initiatives of the Ministry of Environment Protection and the Ministry of Education and sciences are seen as extremely important and these actions should be planned and implemented without delay.

It is also very important to prepare and implement the strategy document "Education for Sustainable Development". The Ministry of Environment Protection and the Ministry of Education and Sciences are developing this document in cooperation. The involvement of other State and non-governmental stakeholders in the process is also envisaged.



LIST OF FIGURES

LIST OF TABLES

LIST OF MAPS