Situation analysis to National Biodiversity Strategy and Action Plan – NBSAP

Thematic Direction:

"Biodiversity and Climate Change Issues"

Prepared for:

GIZ Project Sustainable Management of Biodiversity, South Caucasus

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The objective of this report is to promote biodiversity conservation in Georgia and to develop a strategy for updating and presenting the National Biodiversity Strategy and Action Plan (NBSAP). The work is being implemented within the framework of the project "Sustainable Management of Biodiversity in the South Caucasus" and is supported by the German Society for International Cooperation (Deutsche Gesellschaftfür Internationale Zusammenarbeit GIZ).

To achieve the project goals it was planned to conduct a situation analysis around "Biodiversity and Climate Change Issues" and, in particular to assess the potential threats of climate change on Georgia's biodiversity to evaluate the current situation and trends in this sphere, as well as legislation, policy, achievements and shortcomings. In the long-term it is expected that the data detailed here will be used to develop mechanisms for the mitigation of the factors causing biodiversity loss and for the adaptation of any other negative impacts of climate change.

Chapter 1.

Legislative Issues

Presently, the major normative act of Georgian environmental legislation is the Constitution of Georgia, according to article 37 of which "everyone shall have the right to live in a healthy environment and enjoy their natural and cultural surroundings. Everyone shall be obliged to care for the natural and cultural environment (paragraph 3). Taking into consideration the interests of modern and future generations, the State provides environmental protection and engages in the rational use of natural resources, encouraging the sustainable development of the country in line with the economic and ecological interests of society living within a healthy environment.

The Law of Georgia on Environmental Protection was adopted (1996) to implement the provisions of the Georgian Constitution, It creates a legal basis for legislative normative acts in the sphere of environmental protection and so provides: protection of the environment from harmful influence; improvement of environmental quality; sustainable development and sustainable use of natural resources; preservation of biological diversity and ecological balance; protection of unique landscapes and ecosystems; certain efforts to settle global environmental problems; definition of citizens' rights and obligations in environmental sphere; environmental education.

The Law on Environmental Protection is a framework law, which creates a legal ground for development and enactment of a number of environmental laws and subordinate legislation. However, it should be noted that despite its nature, the Law does not have a status of an organic law. As a result the articles of this major normative act are contradicted by other, latterly adopted documents and are, therefore, lessened in their potential impact.

International Conventions and Commitments

Besides it's national legislation, Georgia is also committed to several international rulings. It should also be noted that, according to the Georgian Constitution and the Law of Georgia on Normative Acts, international agreements, memorandums and conventions (including those relating to environmental protection and biodiversity conservation) have prevalence over national legislation, assuming that they do not come in conflict with the Constitution of Georgia.

In the sphere of biodiversity conservation and climate, Georgia has joined the following major international conventions:

- Convention on Biological Diversity (1994);

- Convention on Wetlands of International Importance especially as Waterfowl Habitat (1996);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (1996);
- Convention on the Conservation of Migratory Species of Wild Animals (January 6, 2000);
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (2000);
- United Nations Framework Convention on Climate Change (1994).

In addition, Georgia's international commitments also cover the following agreements: the Kyoto Protocol of the United Nations Framework Convention on Climate Change (1999) and the Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2008).

Convention on Biological Diversity

The objectives of this Convention, to which Georgia has been a Party since 1994, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. While containing general norms and principles, the Convention requires the contracting parties to protect biological diversity and introduce the principles of sustainable use. Each contracting party must regulate or manage biological resources important for the conservation of biological diversity in order to avoid their reduction or irreversible decrease in the long-term. The Convention also defines common obligations for the parties, which have a general nature and do not restrict the sovereignties of the countries involved in terms the use of resources found on their respective territories.

One of the major obligations of the parties is to develop a biodiversity conservation strategy and action plan.

United Nations Framework Convention on Climate Change

The objective of this Convention is to achieve the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The Convention recognizes the priority of economic development of the Parties, but requires the countries to implement relevant measures to ensure the sustainability of the climate system. For this purpose, the Parties should take precautionary measures to minimize "the causes of climate change"

and to "mitigate its adverse effects". This concept refers to changes in the physical environment or biota, resulting from climate change and which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems. Ultimately, these changes can have an impact on the climate.

At the same time, the Convention introduces the Precautionary Principle, whereby a lack of full scientific certainty about the seriousness of a threat should not be used as a reason for postponing precautionary measures against that threat. According to the Convention, developed countries should take the lead in combating climate change but it ultimately requires the countries to promote the implementation of all necessary measures to mitigate or adapt to climate change. Among several identified concrete actions, the Convention discusses the necessity of creating an inventory of greenhouse gasses and preparing national communications.

Important Internal Normative Acts and Policy Documents

The Law of Georgia on Environmental Protection is most important among the legislative acts relating to the loss of biodiversity caused by climate change. Article 51 of this law covers issues relating to climate protection and the regulation of greenhouse gas emissions, while article 53 of the same law defines general issues of biodiversity protection.

The Law on Ambient Air Protection has direct links with climate change. Article 53 of this law determines that in order to protect the climate from global changes it is necessary to observe the norms of greenhouse gas emissions and to implement measures for their reduction. The United Nations Framework Convention on Climate Change obliges Georgia to develop a National Program and Action Plan on Climate Change, and is coordinated by the Ministry of Environment Protection and Natural Resources. It should also be noted that, according to subparagraph 3 of article 53, it was planned to adopt the Law of Georgia on Protection of Climate against the Global Changes within the Jurisdiction of Georgia. However, as a result of an amendment approved in 2011 (No 4386 11.03.2011), this has been repealed.

National Security Concept of Georgia

The National Security Concept of Georgia (adopted on December 23, 2011) gives details of; fundamental national values and interests, the vision of the nation's secure development, threats, risks and challenges, and establishes the main directions for national security policy. The document covers 14 national interests including the environmental security of Georgia. Among the threats and challenges identified within the document are listed environmental challenges, including threats caused by natural processes and man-made crises that might threaten Georgia's natural environment, its bio-diversity, and the well-being of its citizens. According to the Concept, the Georgian

authorities acknowledge that protection of the country's environmental security requires close international cooperation.

National Environmental Action Plan (NEAP)

The National Environmental Action Plan (NEAP) was adopted on January 24, 2012 and it covers the period from 2012 till 2016. It is an official document of the Georgian Government, which creates a foundation for carrying out environmental activities in the country.

Chapter 12 of the action plan covers issues of biodiversity and climate change, identifying several key priorities for the country. These include ;impacts on natural ecosystems and biodiversity, forest and land degradation, desertification, melting of glaciers, decreased water resources and increased damages from disasters are all identified as key priorities. Among the most important issues is the reduction of populations of endangered species and degradation of habitats and the action plan gives special emphasis to problems arising from a lack of information, especially in vulnerable regions. Such regions were identified on the basis of assessments made under Georgia's Second National Communication to the United Nations Framework Convention on Climate Change and are:

- Black Sea coastal zone
- Semi-arid regions
- Highlands/mountainous areas

Among issues that require future study the action plan focuses on an assessment of the vulnerability of ecosystems to ongoing and anticipated climate changes. Special emphasis is also given to planning and the implementation of adaptation measures.

In terms of climate change, the action plan also acknowledges issues arising from low levels of public awareness and the insufficient integration of these issues into various sectoral development plans.

Long-term (20 years) and short-term (5 years) goals have been developed in frames of the action plan. In particular, to achieve the long-term goals the following 5-year targets should be reached:

- Target 1. Implementation of urgent adaptation measures in the regions identified as particularly vulnerable;
- Target 2. Identification of climate change impacts on other regions and sectors, and
- Target 3. Reduction of GHG emissions

Biodiversity Strategy and Action Plan of Georgia

The National Biodiversity Strategy and Action Plan is one of the most important preconditions of the country's sustainable development (adopted on February 19, 2005). The document defines the strategy and concrete actions for the protection and sustainable use of the country's biodiversity (except for that of the Black Sea) for 2005-2010. It represents a framework document, under which coordinated activities should be conducted in the sphere of biodiversity conservation in Georgia.

The document defines the current state of biodiversity, and the key threats facing Georgia's natural environment. It distinguishes nine major issues, covering practically all the aspects of protection and sustainable use of biological resources. These key issues are:

- Protected Areas;
- Species and Habitats;
- Agrobiodiversity;
- Hunting and Fishing;
- Monitoring of biodiversity;
- Biotechnology and Biosafety;
- Environmental education, public awareness and public participation;
- Financial and economic programme;
- Legislation and institutional development;
- Sustainable forestry

Unfortunately, the document does not assess the risks to biodiversity caused by climate change, a shortfall that can be explained by a lack of information at the time of the documents adoption.

Georgia's Second National Communication to the United Nations Framework Convention on Climate Change

This document was prepared according to the United Nations Framework Convention on Climate Change in 2009. The process included anational inventory ofgreenhouse gases (GHGs) and the development ofcurrent and future climate change scenarios. Measures for reducing greenhouse gasses and adaptation projects were also prepared.

The vulnerability of three priority areas, the Black Sea coastal zone and the Dedoplistskaro and Kvemo Svaneti regions, was assessed based on future climate change scenarios. Mean air

temperature, min/max temperatures, precipitation, relative humidity, wetting regimes and wind were investigated. The presence of trends in extreme events (such as high winds, drought, landslides and floods) characteristic to each of the examined regions were also investigated. Adaptation measures were planned based on the anticipated scenarios that include, amongst others, biodiversity issues. For example, in Kvemo Svaneti it is planned to restore damaged forest areas; in the Dedoplistskaro region the creation of permanent monitoring in protected areas free from anthropogenic impact are planned in order, to assess the impact of climate change on land degradation, endemic species of flora and fauna.

Strategic Guidelines for Responding to Impacts of Global Climate Change on Forests in the Southern Caucasus

The Ministerial Conference on the Protection of Forests of Europe 2011 (MCPFE) acknowledged climate change as the key challenge facing the European forest sector. It was the decision of the Conference that the European countries must commit themselves to react immediately to reduce impacts on forests and minimize risks from storms, floods, wildfires, droughts and forest diseases. During the meeting some objectives, scheduled for 2020, contained obligations for forest adaptation to climate change and the need to develop strategies for impact mitigation as well as their integration into national programs (Forest Europe, 2011).

The Georgian Government shared the position of the Ministerial Conference and assumed the responsibility for developing and introducing its forest adaptation strategy in a way that reflects the risks and consequences that accompany global climate change. The document will also outline strategic plans and actions for the mitigation of, and adaptation to, anticipated changes.

To wards the development of the national strategy, the WWF Caucasus Program Office developed its' "Strategic Guidelines for Responding to Impacts of Global Climate Change on Forests in the Southern Caucasus". Its' objective is to assess the risks of climate change on forests and to prepare recommendations for promoting the development of the overall national strategy.

The guidelines provide an analysis of the current situation and climate change models and describe possible scenarios of climate change as well as analyzing possible developments in the forest fund as a result of climate change impacts. It also provides a number of recommendations, including:

- Adapting the management of existing forests by increasing the natural adaptive capacity and resilience of forests;
- Forest restoration and transformation of forest plantations;
- Increasing protected areas of forest fund and creating new protected areas;
- Establishing government policy that introduces relevant strategies and making appropriate changes to forest law; promoting supportive research and monitoring.

The document also provides recommendations for mitigating the impacts of climate change, in particular:

- To immediately begin research to support the development of adaptation strategies;
- To raise awareness within the forestry community about climate change;
- To develop and introduce methods for reducing deforestation and forest degradation;
- To collect information on changes caused by climate change and to monitor these changes.

Chapter 2.

Situation Analysis

Today it is widely recognized that biodiversity and climate change are interconnected. The latest research has confirmed that climate change can be viewed as the fifth key factors contributing to biodiversity loss: the other four are habitat degradation, unsustainable use, environmental pollution and invasive species (Global Biodiversity Outlook 3. 2010). (1) It is also universally recognized that biodiversity provides the sustainability of ecosystems and respectively, represents the major component of services provided by ecosystems.

According to data gathered by the Ad Hoc Technical Expert Group (AHTEG) (2), the post-industrial period has seen an increase in temperatures that is already having a negative impact, including in the regions, which are characterized by high biodiversity parameters (Biodiversity hotspots). The same group suggests that approximately 10% of species assessed so far will be at an increasingly high risk of extinction for every 1°C rise in global mean temperature. Particularly worrying when we consider that the global mean surface temperature is projected to increase from 2.4ºC to 6.4ºC by 2100. Along with an increase in temperature, the frequency of extreme climatic phenomena, often accompanied by changing precipitation, are also expected to increase. Changes in vegetation, flowering times and migration schemes are currently being widely observed throughout the world. For example, during the past 40 years the vegetation period comes in Europe about 10 days earlier. Such changes may trigger concurrent changes in associated food chains, possibly leading to broader ecological disruptions within the ecosystem.

It is also widely recognized that changes in biodiversity affect the functioning of ecosystems that, in turn, can accelerate the process of climate change. At a global level, both water and carbon cycles, themselves dependent on global biodiversity, play a major role in the preservation of climate stability, providing crucial ecosystem services at a global level. According to the Millennium Ecosystem Assessment (3), human activity has led to the extinction of about one third of the planets' species, while 60%of the world's ecosystem services have been degraded over the past 50 years.

These processes support each other so that the joint negative impacts of human endeavors and climate change create a tendency for biodiversity loss.

Unfortunately, the process has a cyclic, self-perpetuating nature; climate change causes biodiversity reduction that, in turn, reduces the sustainability of ecosystems and accelerates the process of climate change. Equally, it should be noted that each step of the cycle increases the complexity of the relationship, further accelerating the processes.

Respectively, biodiversity conservation also plays an important role in the mitigation of, and adaptation to climate change. Moreover, the role of biodiversity is also important in regulating certain processes, such as the hydrological regimes of the rivers. Climate change will have predominantly adverse impacts on many ecosystems and their services essential for human wellbeing. Climate change will also exacerbate other pressures acting on natural systems, including land use change, invasive species and disturbance by fire. Obviously, today the management of ecosystems is discussed as an important tool in the mitigation of climate change.

The regulation of these issues is one of the key tasks of the modernity. The Tenth Conference of the Parties to the Convention on Biological Diversity (Nagoya 2010) adopted the plan of action to be implemented by 2020 (known as Aichi Target). Targets 10 and 15 of this plan are directly related to issues of mitigation and adaptation to climate change. They aim at restoration of at least 15 per cent of degraded ecosystems and minimizing the acidification of the planets' oceans by 2020.

Certain positive effects are not ruled out. Although, the number of such precedents is not high. For example, according to existing scientific data, the number so around one-third of 122 bird species in Europe may increase with rising global temperatures as a result of expanding ranges.

Key Risks Facing Biodiversity

Negative consequences of climate change may be different for various regions. Globally, the most serious impact is anticipated in the Arctic Circles. Moreover, Alpine, arid and semi-arid ecosystems, as well as forests and wetland ecosystems will also be quite sensitive. In addition, increase in sea acidification is already being observed and is caused by the uptake of anthropogenic carbon dioxide (CO_2) from the atmosphere. It may lead to damage of marine ecosystems and a reduction of the phytoplankton that are responsible for a significant part of photosynthesis. Although taken in the global perspective, all of these risks are also relevant to Georgia.

High Mountains

Mountain ecosystems tend to support a high number of endemic species, many of which are adapted to extreme conditions, including low temperatures. According to current forecasts, increase in annual mean temperatures, caused by climate change, may be especially dangerous for high-

mountain species vertical migration of less adapted (warm-adapted) species to high mountainous regions occurs. The process will be followed by fierce competition between species mountainous regions many species have already achieved their maximum vertical spread. Plants adapted to low temperatures with a slow growth rate are likely to lose out to such competition and may be replaced by thermophilic species whose spread is limited by low temperature existing in the upper parts of mountainous regions. Along with increase in annual mean temperature this temperature barrier will raise vertically to comparatively higher mountainous areas. It will stimulate the vertical migration of heat-loving plants (characterized with high rate of propagation). Invasion of new species in high mountains that should, at least, be followed by the increase in the competition existing among the species, will lead to a change in the plant community. In Alpine zones, for example, we are likely to see a reduction in typical alpine species (especially in the nival zone) there may be a complete loss of certain communities.

In the Caucasus generally, and Georgia specifically, there is an especially high rate of endemism amongst for example, the plants of nival zone. Plant species that have adapted to life within the glacial zone face specific rates as the glaciers melt (average glacial retreat is 15-30 meters per year). The rate of their propagation and vertical migration cannot exceed a mere several meters per year and they simply fail to follow the process of glacial retreat losing their habitats. Ultimately, they will be replaced by plant species more adapted to subalpine and alpine regions, which have higher rate of propagation. Such developments are already observed in the European Alps where a long-term observation program, GLORIA, monitors more than 60 sites. This research, launched in 2001, has showed that heat-tolerant species are actively occupying the sub-nival where previously they were absent (Michael Gottfried& Herald Pauli *et. al.*) (4). Similar observations are now being carried out within the Caucasus mountains by Ilia State University and similar trends are being observed raising real fears of extinctions amongst local endemic species (G. Nakhutsrishvili, M. Akhalkatsi and Otar Abdaladze) (5) and (M. Akhalkatsi, J. Ekhvaia, M. Mosulishvili, G. Nakhutsrishvili, O. Abdaladze, and K. Batsatsashvili) (6).

Forest Ecosystems

Forests are one of the planets' most important and well-studied ecosystems and cover 31% of the land. More than half of the world's terrestrial plant and animal species live in forests whilst 15% of worldwide CO_2 emissions result from the destruction of forests (according to IPCC 2007) (7); the strongest source, after carbon dioxide, released as a result of burning hydrocarbons. The largest amount of carbon, about 548 Gigatonnes of Carbon (Gt. C), is stored in the world's tropical and subtropical forests, followed by boreal forest with 384 Gt. C. Naturally, the conversion, degradation or unsustainable management of forest ecosystems reduces the planets ability to sequester carbon dioxide which will lead to an increase in greenhouses gasses in the atmosphere and, inevitably, to global warming. Forest ecosystems play a significant role in terms of global substance turnover and ecosystem services.

The influence of climate change on forest ecosystems has a complex nature and has not been comprehensively studied. It is commonly recognized that climate change strengthens the process of forest degradation. Among various risks there are forest fires, strong winds, washing away of soil, erosion and spread of forest diseases. Changes in the composition of forest species is yet another problem that is connected with the migration of heat tolerant species which is facilitated by rising annual mean temperatures. Moreover, climate change also creates favorable conditions for the spread of invasive species.

The impacts of climate change on the planet's forests are drawn out over long periods of time. Forest formations, occupying various sites, suffer permanent impacts and as a result are held under conditions of increasing stress. This in turn causes a reduction in cereal germs and a loss of forest regenerative ability. Initially, vulnerable species suffer most of all but, eventually; forest density is expected either to decline or to disappear completely. Those species, which better adapt to changeable natural conditions, gradually take the place of other, less adaptable species. The worse case scenario is realized, of course, when the forest biota disappears completely.

In order to forecast possible changes, the global scientific community has been conducting ecological research on forest ecosystems as well as using various types of climatic models (Iverson and Prasad, 2001 and Thompson *et. al.*1998) (8) The research enables us to evaluate the reactions of various species and various forest types to climate change and provide a good basis for the preparation of forest management plans, as well as adaptation and mitigation plans. Similar models have been created for the North European forests, where possible influence of climate change on the spread of 19 species was studied (Sykes et. al 1996) (9).

The WWF Caucasus Programme Office has conducted similar research here in the Caucasus. Using the CART (Classification and Regression Tree Analysis) (10) model of assessment, they were able to analyze large sets of data in a relatively short period of time. According to the forecasts, negative developments are anticipated against a background of climate changes in the South Caucasus. This will be expressed in a reduction of favorable conditions for the remaining forests in the region. According to comparatively optimistic forecasts, forest types may be reduced by 8%, while the more pessimistic forecasts predict a33% loss. Moreover, along with the rising temperatures, the number of organisms carrying forest diseases may also increase. For example, in the Lentekhi region, where, according to Georgia's Second National Communication, temperatures have increased over the past 20 years, the area of damaged forests also increased by 20%. Some positive changes may take place for certain formations; however, negative developments are anticipated for most types.

If certain measures are not taken, climate change will cause:

1. Sharp declines in the number of timber and non-timber products (such as mushrooms, berries and nuts);

2. Reduction of ecological services provided by forest ecosystems, such as:

- Water amount and quality;
- Protection from erosions and landslides;
- Reduction of regional biodiversity, including within protected areas;
- Reduction of recreational value of landscapes;
- Creation of favorable conditions for the spread of invasive species.

Arid and Semi-Arid Ecosystems

Another important issue is the change anticipated in arid and semi-arid ecosystems. Models developed in the last five years have already indicated that climate change will have clear and dramatic impacts on such environments (Wu et. al. 2007) (11). Typically, precipitation is expected to decrease and temperatures to rise in such regions and this will be followed by the invasion of thermophilic species, which are more resistant to lack of precipitation (Midgley and Thuiller 2007) (12).

More frequent and drawn-out periods of drought forecast for arid and semi-arid regions, will inevitably disrupt plant communities, with reduced growth in vegetation cover and in some cases, the disappearance of certain plants. The risks of fire may increase as a result of prolonged droughts, and this will further destroy vegetation cover and lead to soil erosion. All this may increase the risk of desertification, which, once established, is often irreversible (Kolström, Vilén and Lindner 2011) (13).

According to Georgia's Second National Communication to the United Nations Framework Convention on Climate Change, the Dedoplistskaro region, which is wholly located in arid and semi-arid zones, represents one of the countries most sensitive regions in terms of climate change. Numerous data provided in the report, and particularly that which shows an increase in annual mean temperature of 0.6^0C, indicate a process of ongoing climate changes in the region. Specific coefficients, such as the Hydrothermal Coefficient that demonstrate the links between precipitation during the vegetation period and air temperature, as well as the Desertification Climatic Potential (DCP), used to evaluate humidity, confirm that climate change is especially damaging during the. The survey has shown an increase in the average duration of drought (60 days) by 22%, as well as a five-fold increase in the occurrence of high winds, between 1963-1981 and 1982-2006.

In addition to current measurements, climate change forecasts are also extremely alarming for the region. According to the HADAM3P model (14), annual mean temperature is expected to increase from 4.6^oC to 15.4^oC that, against the background of a likely decrease in precipitation, will create an extremely dangerous situation, especially during the vegetation periods. According to existing forecasts-there is a significant probability that the region's semi-arid climate will move to the

category of arid during the next 100 years. In terms of biodiversity the area has been recognized, through the designation of both Vashlovani Protected Areas and Chachuna Managed Reserve, as important areas and so, the risks posed by climate change detailed above, may be considered particularly pertinent. It should also be noted that over 80% of active pastures located in the Dedoplistskaro region are degraded, with some areas facing a significant risk of desertification. Biological research carried out in the area also reveals some worrying patterns. For example, some wildlife species (e.g. *Hystrix indica*, *Allactaga elater*, *A. williamsi* and *Nitaria schoberi*) more typically associated with the regions' desert and semi-desert systems have begun to appear. However, these species are not necessarily indicators of arid or semi-arid environments (*H. indica* for example is equally at home in the rainforests of South and Southeast Asia) and their apparent expansion range has not, yet, been directly linked to climate change..

Wetland and Marine Ecosystems

Wetland ecosystems also face a risk that is mainly connected with changes in the periodicity of precipitation but also with the unsustainable management of these ecosystems. Internal waters, especially marshlands which represent unique and valuable ecosystems in terms of biodiversity, are also have a important role in global climate processes due to their ability to accumulate and store carbon. One hectare of virgin peatland, for example, contains 1 300 tons of carbon that makes 550 Gigatonnes of Carbon globally (Parish, F., A. Sirin, D. Charman, H. Jooster, T. Minayeva and M. Silvius 2007) (15); Assessment on Peatlands, Biodiversity and Climate Change, Global Environment). Peatlands, which globally cover less than 3% of the land, contain as much carbon as was accumulated in all other terrestrial ecosystems. Unfortunately, as a direct result of human activity in these ecosystems, such as draining for agriculture or extraction for fuel, a great amount of this stored carbon is released into the atmosphere.. It is acknowledged that in the process of draining the swamps, each one-meter section of a drain causes emission of 90 tons of carbon dioxide per drained hectare(Global Assessment on Peatlands Biodiversity and Climate Change. UNFCCC COP 13. Integrate Management of Peatlands for Biodiversity and Climate Change) (16).

In this respect, the current situation in Georgia is unclear. The KolkhetiLowlands and Javakheti Plateau are two extremely important wetland ecosystems. However, there has been no research to investigate the risks facing biodiversity as a result of climate change in these regions although a number of risks related to marine ecosystems were discussed in Georgia's Second National Communication to the United Nations Framework Convention on Climate Change:

- Eustasy – arise of ocean (sea) levels as a result of water thermal expansion and a change of fresh water balance in favor of the ocean;
- Storms – increase in frequency of storm surges and their power;
- Sedimentation – activation of solid sediment accumulation processes in glacier-fed river deltas;

- Change in sea surface water temperature – essential changes in thermal characteristics of the aquatic environment

The report also provides a long-term forecast (prepared for the territories adjacent to Poti, using the PRECIS regional climate model) showing an increase of 1.2^{o}C ambient air temperature an 8-10% decrease in precipitation and an increase the vegetation period of 66 days (29%),by the year 2050.

According to the existing data, we can group the risks facing these ecosystems into three categories:

1. Flooding of coastal habitats by the sea

   According to some forecasts, by 2050, as a result of climate change induced increases in the temperature of the Black Sea, the sea level may increase by 0.8 meters during storm surges and is further aggravated by an increasing rate of eustasy). As a result, some unique habitats may become inundated.

2. Partial or complete replacement of fresh water by saline water in estuaries or other habitats:

   Increases in sea levels in the region can result in freshwater systems located near by to become brackish systems, which, in turn triggers changes in the biophysical parameters of associated habitats. In some cases the total replacement of fresh water habitats is expected. In Georgia's Rioni River Delta the eustasy (the rise of sea level relative to land) has amounted to 20-25 cm since 1925, while sea transgression has increased up to 40-45 km in the Rioni River bed. Lake Paliastomi, which has been linked to the Black Sea since 1970, faces the same risk.

Unfortunately, the Javakheti Plateau region is not discussed in Georgia's Second National Communication to the United Nations Framework Convention on Climate Change and so there is no data available.

Marine Ecosystems

Marine ecosystems face a huge risk of change because of climate change as the climate has a strong influence on the productivity and biodiversity of marine ecosystems. During the past 200 years the seas and oceans have been intensively absorbing large amounts of carbon dioxide as it has been released by human activity. In fact, according to various data, the world's oceans has absorbed up to one third of anthropogenic CO_2. As a result, the acidity of the oceans has been increasing by 0.02 units every ten years resulting in a cumulative increase, since the pre-industrial period, of 0.1 units. Changes of this magnitude will alter the ocean's physical and chemical processes, reducing the concentration of carbon ions fragmented in water. These ions play an extremely important role in the physical development of planktons, mollusks and crustaceans and it is thought that atmospheric CO_2concentration of 450 ppm are critical. Should these levels be exceeded there will be a sharp reduction in ecosystem productivity (J. Rockströmet. al 2009) (17). Unfortunately, no studies have

been carried out in the Black Sea and so we are not able to speculate on its current condition in these respects.

An increase in the sea's surface temperature can also causes serious problems. The displacement of cold and warm layers, or example, can damage or change the habitats of many sea organisms. This phenomenon has the strongest impact on the marine plankton; the basis of marine food chains as demonstrated in 1998 (M. J. Behrenfeldet. 2006) (18). It should be noted that at the beginning of 2010 the surface temperatures of the world's oceans was one of the highest ever recorded (Ove Hoegh-Guldberg et. al. 2010) (19) and exceeded the annual mean temperature of the 20th century by 0.6°C.

There is some data about the current situation in Georgia in this respect. For example, according to Georgia's Second National Communication to the UNFCCC, the habitat horizon of some plankton species has dropped by 5-10 m, causing a relevant displacement of habitats for some kinds of fishes. From this point of view, the authors of the report believe that the territories adjacent to Rioni and Chorokhi Deltas are the most vulnerable zones, while the Sokhumi coastal area is less vulnerable to climate change. However, it should be emphasized that there are no relevant data to demonstrate this in Georgia. In addition, it should be noted that among the key targets of the Aichi meeting, the need to assess the influence on marine ecosystems by 2015, as well as to undertake the steps aimed at reduction of acidification, is included (target 10).

Protected Areas

Protected areas play an important role throughout the world in the conservation of biodiversity and habitat protection. They can also play a significant role in the mitigation of climate change. According to the World Database on Protected Areas, for example, 15% of carbon dioxide is absorbed and preserved within protected areas throughout the world (Campbell et al. 2008a) (20). They play, then, a unique role in regulating the carbon cycle and, by extension, mitigating climate change. At a local level, it has been estimated that Mtirala National Park, in western Georgia, stores 143 000 tons of carbon.

Protected Areas also preserve many ecosystem functions, such as freshwater provision, and can thus be described as playing a significant role in the process of mitigation and adaptation to climate change processes. For example, 33% of the world's major cities rely on river basins within protected areas for their fresh water supplies. The seaside resort city of Batumi, in western Georgia, is a good local example of this, as it takes its water from the Mtirala National Park.

It should also be noted that among the targets of the Aichi meeting is the necessity of for increasing the sustainability of ecosystems as major mechanisms for reducing levels of atmospheric CO_2. To this end, it is essential to preserve the existing ecosystems and to restore at least 15% of degraded ecosystems. This issue is especially important against the backdrop of ongoing economic projects in Georgia. To balance them, it is vital to expand the existing protected areas, to create ecological corridors and to improve management.

However, as we have seen some of Georgia's protected areas may already be facing a high risk of damage caused by climate change. Both Vashlovani and Kolkheti National Parks require special attention. The Vashlovani National Park, located in Georgia's most sensitive zone Dedoplistskaro, needs constant monitoring as increases in annual mean temperature, coupled with decreased precipitation, are expected. Similarly, arid Kolkheti National Park faces major problems associated with ecstasy and the intensive use of adjacent territories. Moreover, various ongoing and planned infrastructural projects in the coastal zone may have negative impacts on local biodiversity and carbon dioxide emissions.

It is crucial to study and assess the possibilities of Georgia's protected areas in terms of mitigation of and adaptation to climate change and some research being conducted in this direction (IUCN, as well as the National Agency for Protected Areas). It is also necessary to create a strategy, with mechanisms, for ecosystem adaptation to climate change, which will be based on biodiversity and ecosystem services and, first and foremost, on the necessity of improving the management of protected areas and the creation of ecological corridors (Conference of the Parties to the Convention on Biological Diversity. Tenth meeting Nagoya, Japan, 18-29 October 2010); COP 9 decision Biodiversity and climate change ix/16 (goal 1.2, activity 1.2.3)) (21-22).

The protected areas, which have a uniform management system (implemented by the central (Agency of Protected Areas), established infrastructure and borders, and state funding, represent a potential for effective mitigation and adaptation to climate change. Applied correctly, this system can be used effectively for both implementing Georgia's international commitments and for addressing issues that exist at a national level. The creation of a uniform monitoring system, both within and outside the protected areas, will enable us to effectively assess the changes caused by climate change and to rule out any anthropogenic factors.

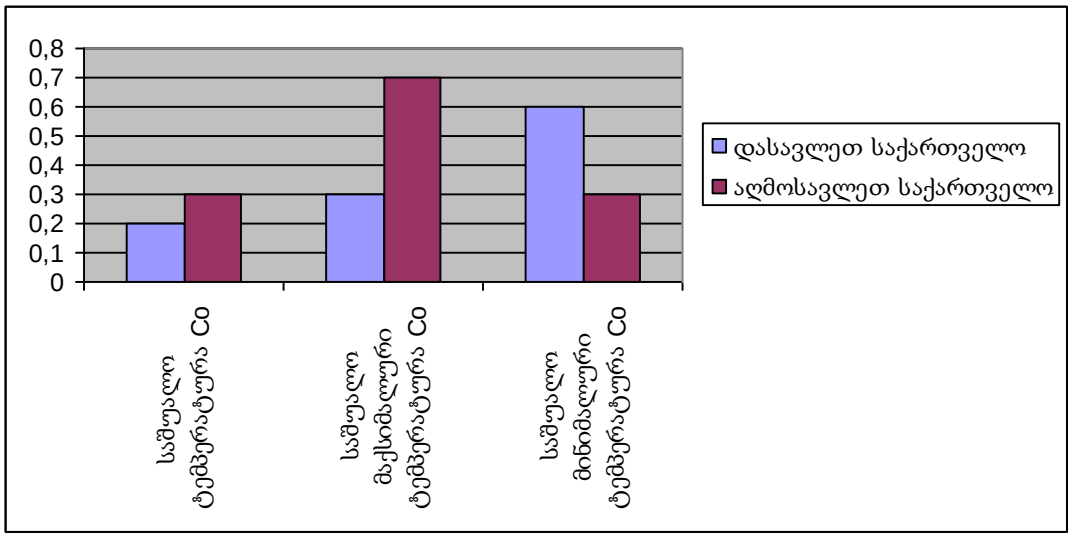
The issue of informing society and the representatives of various governmental branches about the functions of protected areas is one of the major challenges. It is essential to popularize these potential roles of protected areas outlined above and to increase the quality of public awareness.

Chapter 3

National Context

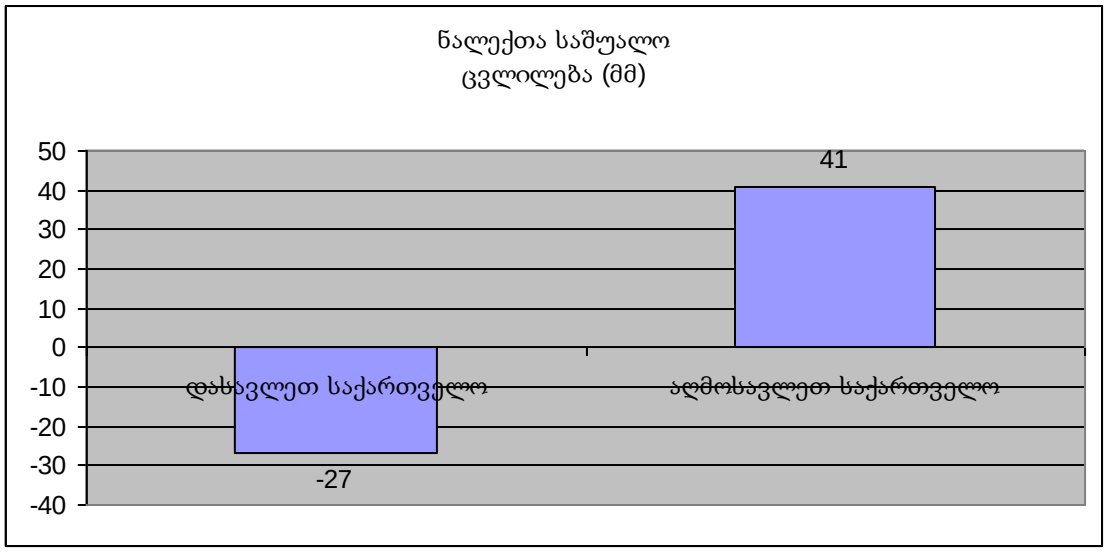
Climate change is a global problem. It concerns all the countries of the world, including Georgia. According to the Intergovernmental Panel on Climate Change (IPCC) (23) the most significant increase in annual mean temperature since the mid-20th century has been observed and is apparently connected with high levels of greenhouse gasses released as a result of human activity.

Climate change and its negative influence is a serious threat for both ecosystems and economies, discussed by Georgia in the context of sustainable development. The process of climate change, the first signs of which appeared in Georgia in the 1960s, has sharply increased since the end of last century. During the past 10 years annual mean temperatures have increased, in separate regions of western Georgia, by 0.7 °Cand in separate regions of eastern Georgia by 0.6 °C (pic.1).



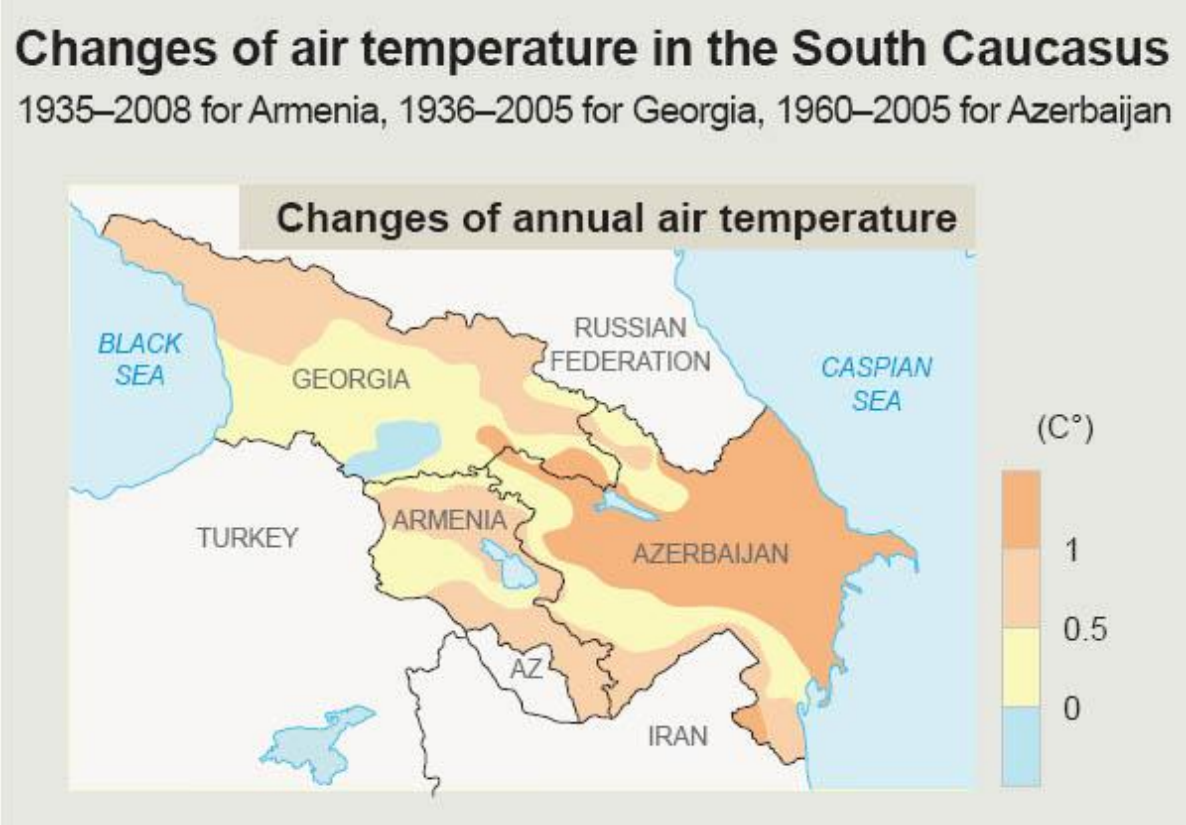
pic.1

It can be said that since the 1960s, slight declines in precipitation have been observed in many of Georgia's western regions; however, precipitation has increased in separate localized territories (pic.2) with a maximum increase of 6% observed in eastern Georgia. As a result of these changes, the intensity and frequency of extreme phenomena caused by global warming has increased during past years; droughts and spring winds have become more frequent in semi-arid regions; the process of coastal erosion and washing away has strengthened in the Black Sea coastal zone. Moreover, satellite observations show that the average speed of retreat in several glaciers of the Greater Caucasus amounts to 8 meter/year, while the total area of glaciers decreased by 6-9%.



Pic.2.

It should be noted that these changes in both temperature and precipitation manifest in different ways depending on the region. The figure below shows the change of annual mean temperature in the South Caucasus from the beginning of 20th Century up to 2008 (the research was conducted on the basis of PRECIS outputs and the MAGICC-SCENGEN modeling tool (Zoï Environment Network publication produced in close cooperation with the ENVSEC Initiative and the Governments of Armenia, Azerbaijan and Georgia; Based on official country information from the communications to the UNFCCC, scientific papers and news reports, sources: UNDP/ENVSEC Study on Climate Change Impact for the South Caucasus)) (24).



As the research confirms, in the case of Georgia the semi-arid zone and the southern slopes of the Caucasus Mountains, especially Svaneti, are the most sensitive regions.

The country has developed certain models outlining possible changes during the next 50-100 years. The authors of the Second Communication to UNFCCC have used several options of the PRECIS package and the statistical program package, MAGICC/SCENGEN, as well as several global circulation models (for example HadAM3P and ECHAM4). According to the resultant models, the increases in global temperatures is fully observed in Georgia, while according to various forecasts, annual mean temperature may increase from 1.8°C to 3.9°C. Noteworthy that, according to forecasts, maximum temperature increases in eastern Georgia are expected in winter, while in western Georgia, they are forecast for – summer.

Precipitation is expected to reduce over the entire territory of Georgia. In western Georgia maximum declines in precipitation are expected during the transition seasons (spring and autumn), while in eastern Georgia, in summer and autumn (data of the Second National Communication to UNFCCC).

Chapter 4.

Identified Problems

Major Identified Risks

Published materials (literary sources, reports, etc.) as well as materials received directly from the various organizations and experts involved in climate change and biodiversity issues were used during this research.

The survey was conducted among the following organizations and interested persons.

Name of the project	**Name of participating organization**	**Issues covered by the project**
Integrated Natural Resources Management in Watersheds of Georgia	Global Water for Sustainability GLOWS[1] Florida International University (FIU) UNESCO Institute for Water Education(UNESCO-IHE) CARE International Warnock International (WI)	The influence of climate change on biodiversity in three target areas, covering the Alazani, Rioni and Iori river basins.

[1]**The Global Water for Sustainability (GLOWS**) program is a consortium financed by the United States Agency for International Development (USAID) working to increase social, economic, and environmental benefits to people of the developing world. GLOWS works on-the-ground to implement water supply, sanitation, and hygiene (WASH) services, improve water management practices, and build local capacity. The GLOWS Consortium is led by Florida International University. Together the partners possess skills and worldwide experience in water supply/sanitation/hygiene, water productivity, and water resources management. The program was launched in 2005, which along with international and local partners introduces the practice of integrated management of natural resources on the ground; strengthens the potential of local population through holding trainings at various levels and shares knowledge and experience. Information about Integrated Natural Resources Management in Watersheds of Georgia Program (INRMW) and GLOWS is posted at the following website: www.globalwaters.net

	Caucasus Environmental NGO Network (CENN) and their subcontractor, Sustainable Development and Policy Center	
Natural Solutions to Climate Change: the role of Protected Areas	IUCN Caucasus Cooperation Center	Assessing the role of protected areas as a significant source of CO_2absorption and conservation of water resources.
Adaptation of Forest Sector to Climate Change	WWF Caucasus	Restoration of natural forest areas (Chianuri Forest) and strategy of forestry sector adaptation to climate change.
Identification and Implementation of Adaptation Response to Climate Change Impact for Conservation and Sustainable Use of Agro-biodiversity in Arid and Semi-arid ecosystems of South Caucasus	REC Caucasus	The issues of agro-biodiversity conservation under conditions of climate change
Enhancing local capacity and regional cooperation for climate change adaptation and biodiversity conservation in Georgia and the South Caucasus	MercyCorps	Along with other issues, the project aims at assessing those risks, which are related to the issues of biodiversity reduction caused by climate change.
Identification of upper boundaries of the forests (GRDF-CRDF)	Ilia State University	In frames of the project the influence of climate change on the diversity of high mountain vegetation cover is being studied.

Scientific-research program of Ilia State University		
Foundations of International Environmental law and Climate Change Law for Ilia State University Students and Short Climate Change Law Course for Decision Makers.	Center of Environmental Education at Ilia State University	With financial support of the U.S. Civilian Research and Development Foundation (CRDF) and under the guidance of the Pace Energy and Climate Center (www.law.pace.edu/environment), Ilia State University implemented the project, which aims at teaching the foundations of international environmental law and climate change law to Ilia State University students, as well as offering a short climate change law course to decision makers. The Environmental Education Center of Ilia State University and the International Union for Conservation of Nature (IUCN) are involved in the project as partners.

The research has identified the following key problems, which have an impact on biodiversity under conditions of climate change (the research results):

- Absence of the state strategy in respect to climate change;
- Lack of research and factual information;
- Threat of extinction of plants in sub-nival zone as a result of rising temperatures connected with vertical migration;
- Non-sustainable use of forests and pastures;
- Possibility of increasing occurrence of forest diseases;
- Increase in forest fires and their impacts;

- Neglect of climate change factors by the state (the Ministry of Agriculture, the Minister of Energy and Natural Resources, the Forest Department, the Ministry of Environment Protection);
- Non-sustainable land use and its influence on habitats;
- An increase in occurrence of extreme conditions such as droughts, floods and mudslides;
- Change of water regime and a reduction in water flow;
- High anthropogenic press on water ecosystems.
- The interviewed experts gave the following recommendations:

1. To create adaptation plans against factors influenced by climate change at both state and regional levels and to create mechanisms for their implementation;
2. To inform local populations, to raise and strengthen their awareness in respect to climate change and enable them to adapt to possible changes resulting from climate change;
3. To reduce natural calamities at the expense of implementation of preventive measures;
4. To strengthen protected areas in respect to biodiversity conservation through research and monitoring;
5. To provide and stimulate effective use of water resources;
6. To conduct research and monitoring;
7. To develop and increase a system of protected areas that increase CO_2 absorption;
8. To restore forests using local species;
9. To introduce the principles of sustainable management of resources;
10. To develop the vulnerability plans and the regional adaptation plans on the ground; to create the mechanisms for introducing these plans;
11. To protect forest boundaries and to prohibit pasturing in the forest area;
12. To restore windbreaks.

The most vulnerable regions in respect of climate change (the research results)

1. Dedoplistskaro
2. Gardabani

3. Sagarejo
4. Black Sea coast
5. High mountainous regions, especially Svaneti
6. IvrisZegani (plateau in Georgia)
7. Karsani Range

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