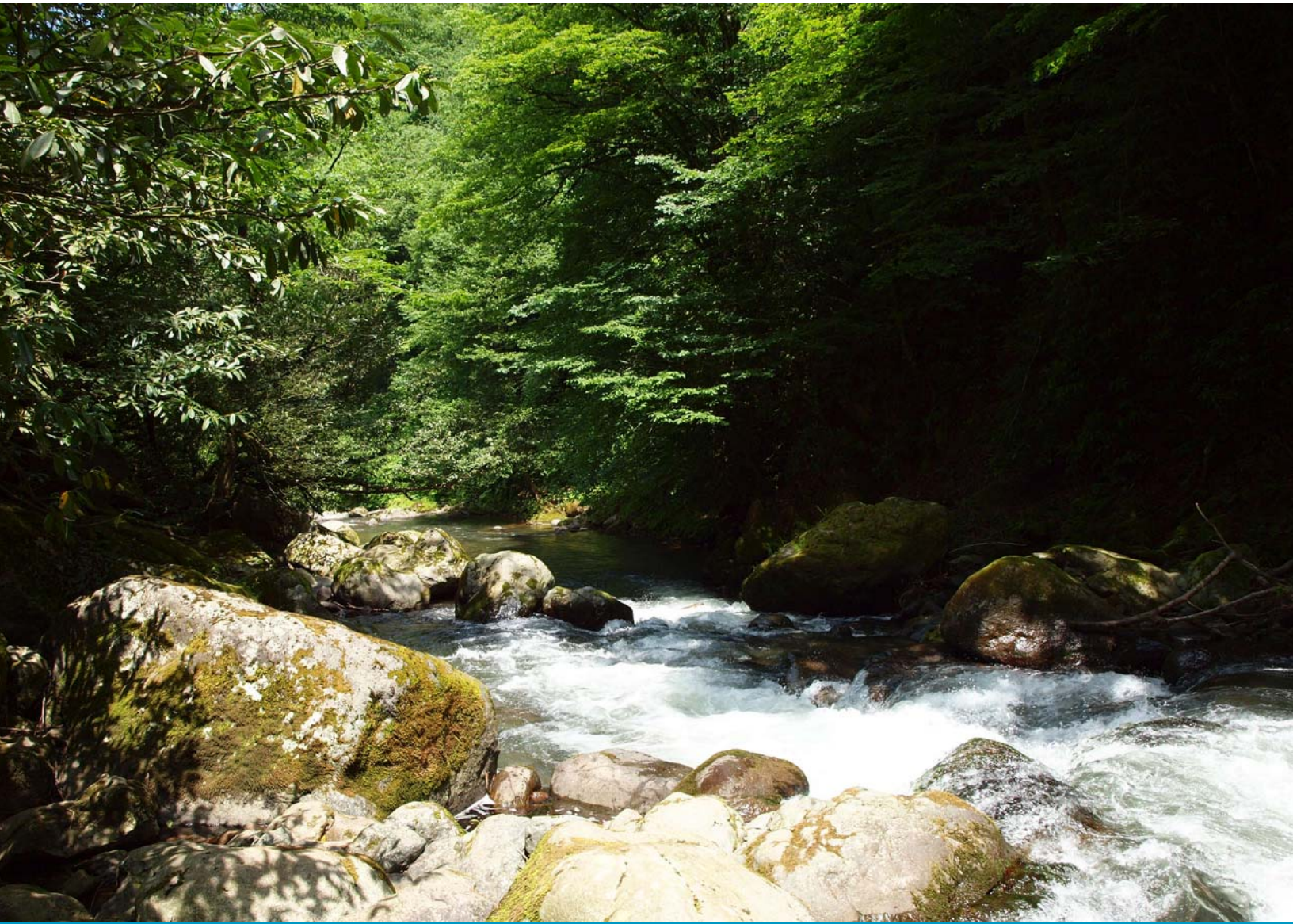
The Role of Protected Areas in Regard to Climate Change

Scoping Study, Georgia



IUCN CAUCASUS COOPERATION CENTRE

On behalf of

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

The Role of Protected Areas in Regard to Climate Change

Scoping Study, Georgia

2012

TABLE OF CONTENTS

Introduction

Protected areas play a vital role in contributing to climate change mitigation and adaptation, both on global and local scales. However, their role in responding to climate change is currently insufficiently recognized in the development of national strategies and policies of Georgia. In order to identify the role of protected areas as natural, cost-effective solutions to climate change and to initiate a process of better realizing mitigation and adaptation potentials of Georgia's protected areas, the IUCN Caucasus Cooperation Center (IUCN CCC) initiated the project "Natural Solutions to Climate Change: the Role of Protected Areas", financed by the GIZ on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). The project aims at (1) incorporating the role of protected areas as natural solutions to climate change into national sector strategies and the communication to international conventions, e.g. UNFCCC[1]; and (2) contributing to the effective management of protected areas under conditions of climate change.

The current report represents a scoping study, which identifies the role of protected areas in regard to climate change. The report was developed based on relevant IUCN guidelines, existing background data and reports for Georgia.

[1] United Nations Framework Convention on Climate Change

1. Role of Protected Areas in response to Climate Change

Although just very recently recognized as such, protected areas are an essential part of the global response to climate change. They play an important role in climate change mitigation and adaptation by reducing greenhouse gas emissions and helping society cope with impacts of climate change by maintaining essential services on which people depend.

1.1. Existing Challenges

Ecosystem degradation and loss are one of the main causes of Greenhouse Gas emissions, accounting for 20% of global Greenhouse Gas emissions (Dudley, et al., 2010).

Because of habitat destruction and degradation, some ecosystems can switch from carbon sinks to carbon sources. To address this threat adaptive management responses are needed.

Degradation of ecosystem services globally contributed to the significant increase of floods and wild fires worldwide since the 1940s. For the last 50 years, economic losses from climate-induced disasters have increased 10 times and the frequency and intensity of natural disasters from floods, storms, tidal surges, droughts and avalanches is expected to increase.

Climate change may also intensify shortages of potable water, food and traditional medicines. Food and water shortages will likely be unpredictable and sometimes severe. Climate change is also likely to exacerbate the spread of certain diseases, such as malaria, leishmaniasis and yellow fever.

All this will increase the costs of humanitarian aid for the most vulnerable communities, as well as ecosystem conservation and restoration costs.

1.2. Role of Protected Areas

Protected areas provide a wide range of ecosystem services for the sake of human populations. There are four general categories of ecosystem services:

- Provisioning services (food, water, minerals, pharmaceuticals, energy)
- Regulation services (carbon sequestration and climate regulation, waste decomposition, water and air purification, crop pollination, pest and disease control)
- Supporting services (nutrient dispersal and cycling, seed dispersal, primary production) and
- Cultural services (cultural and spiritual inspiration, recreation, scientific discovery) (CBD, 2009).

Protected areas maintain essential ecosystem services which can increase resistance, resilience and reduce the vulnerability of livelihoods against climate change. Protected areas are often the source of both pure water and increased water flow. For example, 33 of the world's largest cities receive drinking water from catchments in forest protected areas. Protected areas are also source of sustainable food for communities. Protected areas conserve and help rebuild fish stocks in marine and freshwater areas. Different studies showed that fish size and populations are increased in marine protected areas (Côté et al., 2001; Roberts et al., 2001). Protected areas protect crop wild relatives to facilitate crop breeding and pollination services. Healthy ecosystems in protected areas additionally prevent the expansion of vector-borne diseases and provide access to traditional medicines.

Protected areas can also contribute to alleviate climate change causes and effects through mitigation and adaptation measures included in their management. Protected areas can prevent the loss of carbon that is already present in vegetation and soil. For example, in 39 national parks of Canada 4,432 million t of carbon is sequestrated; in Madagascar, new protected areas covering 6 million ha are responsible for 4 million t of avoided CO2 per year. In total, about 15 % of the world's terrestrial carbon is stored in the world's protected area network (Table 1). Protected areas can be an effective land management strategy that prevents conversion of land uses and loss of carbon.

	Region	Carbon stock (Gt)		Percentage
		Total	In protected area	In protected area
1	North America	388	59	15.1
2	Greenland	5	2	51.2
3	Central America and Caribbean	16	4	25.2
4	South America	341	91	26.8
5	Europe	100	14	13.6
6	North Eurasia	404	36	8.8
7	Africa	356	49	13.7
8	Middle East	44	3	7.8
9	South Asia	54	4	7.2
10	East Asia	124	20	16.3
11	Southeast Asia	132	20	15.0
12	Australia and New Zealand	85	10	12.0
13	Pacific	3	0	4.3
14	Antarctic and peripheral islands	1	0	0.3

Note that figures for carbon stock have been rounded up but percentage figures were calculated from the actual numbers

Table 1. Global carbon storage in protected areas per region. Source: Dudley et al., 2010

In summary, protected areas are important to:

1) help maintain ecosystem integrity; they:

- maintain watersheds and water retention in soil;
- limit incursion into fire-prone areas,
- help maintain traditional management systems.;
- limit land-use transformation;
- reduce other pressures such as poaching, grazing, logging or harvesting within their boundaries.

2) Buffer local or regional climate, depending on the scale; they

- help reduce the impacts from extreme climatic events, such as storms, floods, droughts and sea-level rise;
- provide space for floodwaters to disperse and absorb impact with natural vegetation;
- block storm surges with barrier islands, mangroves, coral reefs, dunes and marshes;
- stabilize soil and snow to stop slippage and reduce the movement once a slip is underway;
- help mitigate the effects of climate change by the capture and storage of CO_2 from the atmosphere

Pressures from climate change or other factors can undermine carbon dioxide sequestration. To address these pressures, management of protected areas can be modified in a way that it will increase their role as natural sinks. These activities include active restoration and support of natural regeneration. Reforestation and effective protection of forest ecosystems provide high biomass and carbon storage. Therefore, long-term protection provided by existing PAs and the establishment of new protected areas help increase carbon storage.

1.3. Why Protected Areas?

In order to combat Greenhouse Gas emissions from land use change and sustain ecosystem services which are vital to climate change adaptation, various land use management strategies will be needed. In this regard protected areas are in a unique position to support national climate change mitigation and adaptation strategies, as they are already established as efficient, successful and cost effective tools for ecosystem management. They benefit from existing policies, laws and management institutions, as well as from knowledge, capacities and expertise.

Protected areas cover about 14% of the world's land surface containing the only remaining large natural habitats in many areas (Jenkins and Joppa, 2009). Well managed protected areas are inspirational models for the management of natural ecosystems. They can provide a cost-effective option to implement climate change response strategies, as start-up costs have already been met and socio-economic costs are often offset by other services that protected areas supply.

Safeguarding ecosystem services and biodiversity benefits in protected areas cost much less than the valued benefits ecosystems and biodiversity provide.

Conserving is also a much more efficient and cheaper strategy than restoring ecosystem goods and services once they have been degraded or lost.

2. Climate Change in Georgia

2.1. Background Information

Georgia ratified the United Nations Convention on Climate Change (UNFCCC) in 1994 and in October 1999 accessed the Kyoto Protocol (KP) to the UNFCCC, as a non-Annex I Party.

In 1997-1999 Georgia prepared and submitted the Initial National Communication (INC) to UNFCCC. While preparing the INC a few initiatives for the promotion of renewable energy were developed and some were implemented. For example, research on rehabilitation of heat-supply systems and small Hydro Power Plants was carried out; activities regarding the use of solar energy and biogas were conducted in several villages in Racha region; the council and procedure for consideration of Clean Development Mechanisms projects were established; the Greenhouse Gas inventory process was improved; and awareness-raising campaigns were held for different target groups (i.e. local municipalities and farmers).

In the period 2006-2009 the Second National Communication (SNC) to the UNFCCC was prepared. The focus of the SNC was on the vulnerability assessment of different systems and economic sectors to climate change and the elaboration of adaptation projects and strategies. Several activities are being implemented during this period (the list is not exhaustive):

- From 2008-2011, GIZ implemented the project “Climate-tolerant rehabilitation of degraded landscapes in Georgia”, with the objective of rehabilitating degraded arid and semi-arid steppe landscapes in the context of climate change. The project focused on the rehabilitation of windbreaks through reforestation activities in the Dedoplistskaro region.
- Coast fortifying works have begun in the coastal area - Adlia-Batumi.
- A plan for Greenhouse Gas reduction from the business as usual (BAU) in the energy sector has been elaborated.
- From 2008-2010, the WWF Caucasus Programme Office, with support of the German Government, implemented the project: “Rehabilitation of forest landscapes to reduce climate change caused impacts in Southern Georgia”. Rehabilitation measures of forests in the watersheds and mountains in Lagodekhi (Chiauri forest) and Kharagauli (former “kolkhoz” forests) were out.

- The Regional Environmental Centre for Caucasus (REC) implements the project “Identification and implementation of climate change adaptation measures in arid and

semi-arid ecosystems of the South Caucasus in order to ensure the conservation and sustainable development of agro-biodiversity";

- In 2009, Caucasus Environmental NGO Network (CENN) started the implementation of the project "Climate Change Adaptation and Disaster Mitigation" with the objective to develop flexible and resilient societies in rural areas of Georgia capable of coping with the impacts of current climate variability and future climate change.

- In 2011, IUCN Caucasus Cooperation Center (IUCN CCC) started the implementation of the project "Natural solutions to climate change: the role of protected areas", financed by BMU/GIZ. The aims of the project are to incorporate the role of protected areas in regard to climate change into national sector strategies and the communication of any steps to international conventions, e.g. UNFCCC and to contribute to the effective management of protected areas under conditions of climate change. The main concept is to build knowledge and capacity in the country relating to the incorporation of protected areas as tools to mitigate and adapt to climate change.

In 2012 preparation of the Third National Communication to the UNFCCC has started.

2.2. Existing Regulations

The Georgian Laws on Environment Protection (1996) and on Ambient Air Protection (1999) identify the importance of meeting greenhouse gas emissions (GHG) standards and carry out reduction measures in order to protect the Earth's climate from global changes. However, Georgia, being a non-Annex I Party to the UNFCCC (0.03% of global emissions in 2006), has no international commitments to mitigate GHG emissions and hence, national standards have not been set up for GHG emissions. Although, it is likely that due to current population and development trends in the country, Georgia's contribution to global Greenhouse Gas emissions will increase.

The Law on Environment Protection states that the legal regime for protection from global climate change is legitimated by the Georgian legislation. However, relevant legislation has not been prepared or adopted so far.

Currently, there is no legislation promoting increased energy efficiency. This requirement was however defined in the document "Major Directions of Georgia's State Policy in the Energy Sector", adopted by the Parliament in 2006.

National legislation does not regulate the periodicity of national GHG inventories and the provision of economic activity data. Climate change impacts are usually not considered in sectoral development plans, as there is no legal requirement to do so. Finally, there are no legal regulations for the inclusion of climate change issues in the educational system. However, it is important that the environmental education was identified in the National Environmental Action Plan as a cross-cutting issue which should apply to all sectors.

In January 2012, the National Environmental Action Plan was approved. The document includes long- and short-term goals and planned actions regarding climate change. The long-term (20 years and more) goals are:

1. Ensuring security of Georgian population by means of implementation of measures of adaptation to climate change; and
2. Reduction of GHG emissions.

In order to achieve the long-term goals the following near-term (5-year) targets should be reached:

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

2.3. Observed and Predicted Changes

Climate change processes in Georgia have become noticeable since the 1960s and they intensified since the 1990s.

Based on average statistical values of weather stations in Western and Eastern Georgia separately, annual temperature increased in both parts of Georgia, annual sum precipitation in Eastern Georgia increased and in Western Georgia decreased, while locally in Poti and Lentekhi a small increase is being observed (estimated between two different periods: until 1960 and average values of 1957-2006). The results of annual precipitation trends of Western Georgia do not coincide with the results obtained from the local conditions of selected regions (Dedoplistskaro, Black Sea coastal zone, Kvemo Svaneti) for the Second National UNFCCC Communication. Here, increased tendency for average annual air temperature and annual precipitation is shown for all three regions - in Western Georgia in a range of 0.2–0.4^{0}C and by 8-13%, and in eastern Georgia by 0.6 ^{0}C and up to 6% (estimation were made for two time periods - 1995-1970 and 1990-2005).

In recent years, the intensity and frequency of extreme events driven by global warming has risen. Frequency of droughts and strong winds in spring has increased in semi-arid regions. Climate change related problems in Georgia are of greatest concern in those areas most vulnerable to it: coastal areas, mountain areas and semi-arid areas. Coastal erosion and abrasion processes have intensified in the Black Sea coastal zone. In addition, satellite images taken in the period of 1985-2000 show that the average speed of glacial withdrawal on the Great Caucasus mountain range is 8 m per year, and that their total surface decreased by 6-9%. The glaciers of the Caucasus are withdrawing and leaving behind huge masses of stones,

pieces of rock and mud, which may become mud-streams endangering the safety of local populations during intense rains.

It remains unclear what the potential climate change impacts are on other regions and specific sectors of Georgia.

Based on the different models used, the climate scenario for Georgia has been developed. According to these scenarios mean annual temperature, in both Western and Eastern Georgia, will increase by 3-5^{0}C. The annual precipitation will decrease by 9-13%. This process will be especially sharp during the summer season, when the temperature and precipitation trends are starker.

2.4. Regions of Particular Vulnerability to Climate Change

In the assessments made in the frame of Georgia's Second National Communication to the UNFCCC, three regions of particular vulnerability to climate change were identified. These regions are: 1. The Black Sea coastal zone, to the west; 2. semi-arid regions, especially, agricultural lands/croplands and grasslands, to the east of the country; and 3. highlands/mountainous areas, to the north.

The Black Sea coastal zone is considered as the most vulnerable to CC. Georgia's coastal zone is affected by several geophysical processes, such as tectonic movements, sea level rise, storms, floods, underwater flows, river sedimentation, etc. Some of these processes have intensified due to CC-related effects. During the past century, the sea-level rise at the eastern coast was 2.6 mm/yr. Sea surface temperature rose by 0.2 ^{0}C. The frequency of powerful storms has increased in Poti and Batumi during the past four decades. Assessment of the vulnerability of the coastal zone indicated the River Rioni Delta, surrounding the city of Poti, to be the most vulnerable part of the coastal zone.

Map 1. Regions of Georgia

Semi-arid regions are also considered as vulnerable to CC, because of increased frequency and strength of droughts, high winds, changes in temperature regimes and precipitation totals. Dedoplistskaro region has a dry climate and is prone to land degradation. In recent years, due to increasing temperature and strong winds possibly exacerbated by CC, land degradation has apparently intensified. In the past 50 years, annual temperature has increased by 0.6 ^{0}C and main annual precipitation by 6%, although it is now more concentrated in time; as a result, the drought period has extended from 54 to 72 days annually; the frequency of high winds has increased by five times since the 1980s. Extreme weather events affecting agricultural productivity may threaten food security.

The highlands are considered vulnerable regions too. Frequency and intensity of flashfloods, landslides and mud-streams/mudflows has increased in the last years, causing serious damage to agriculture, forestry, roads and other infrastructure. Kvemo Svaneti (Lentekhi region) has been studied as a mountainous 'pilot region', vulnerable to extreme events. During the last 50 years, annual air temperature has increased by 0.4 ^{0}C and precipitation by 8%. Glaciers in Kvemo Svaneti are shrinking and it is predicted that they may disappear by 2050.

3. Protected Areas of Georgia

The first official nature reserve in Georgia was established in 1912. Since then, a number of protected areas were created throughout the country.

The main law on protected areas in Georgia is the “Law on the System of Protected Areas” (136-IIc; 07 March 1996). The law sets the legal basis for the establishment, development and management of protected areas. The law regulates the following issues: objectives; categories of protected areas; ownership; protected areas system planning; designation; development and abolishment issues; management plans; buffer zones; governance; management (guidance, leadership) and representation by the Agency of Protected Areas; financing; activities on protected areas; and cooperation.

The Georgian Law on “System of Protected Areas” defines the following national categories of protected areas:

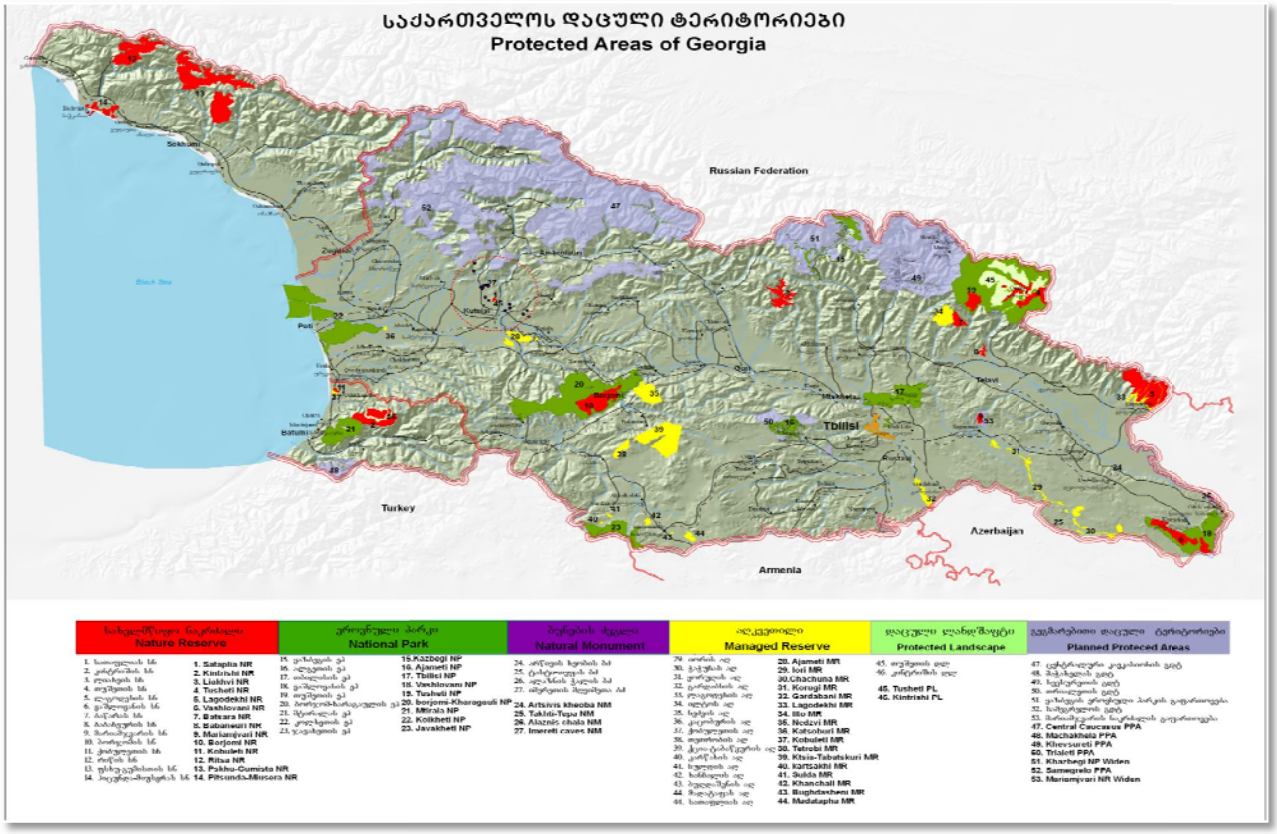
Table 2. Categories of protected areas of Georgia

Type of Protected Areas	**Goals**	**IUCN Category**
Strict Nature Reserve / State Reserve	Strict protection	I
National Park	Ecosystem conservation and recreation	II
Natural Monument	Conservation of nature features	III
Managed Reserve / Sanctuary	Preservation through active management	IV
Protected Landscape	Landscape and/or sea conservation and recreation	V
Multiple Use Territory	Sustainable use of natural ecosystems	VI

According to the law, establishment of Biosphere Reserves, World Heritage sites and Wetlands of International Importance is also possible.

At present, in Georgia, there are 14 Strict Nature Reserves / State Reserves, 9 National Parks, 21 Natural Monuments, 18 Managed Reserves / Sanctuaries, 2 Protected Landscapes and 1 Multiple Use Territories. In addition, there are two Ramsar sites – central Kolkheti situated within the boundaries of Kolkheti National Park and Ispani II wetlands area situated within the boundaries of Kobuleti State Reserve.

Protected areas in Georgia currently cover about 512,123.17 ha, which is 7.35 % of the country’s area (See Map 2).



Map 2. Protected Areas of Georgia

The main authority for the management of protected areas is the Agency of Protected Areas (APA), under the Ministry of Environment Protection of Georgia. Individual protected areas are managed by the Territorial Administrations of the APA. There are 22 Territorial Administrations fulfilling the objectives of the APA at local level. Additionally, one Protected Landscape and one Multiple Use Territory are managed by local authorities in collaboration with APA.

The primary function of protected areas is to conserve biodiversity. However, the protected ecosystems contribute to the socio-economic development of local populations and the country as a whole, as they provide water, food, energy, recreation, medical plants, and other goods and services. Additionally, protected areas play an important role in responding to climate change impacts. Thus, the enhancement of the protected areas system would have a significant contribution in this regard.

4. Protected Areas of Georgia and Climate Change

Protected areas in Georgia are important tools helping the country mitigate and adapt to climate change. They store significant amounts of carbon, increase resilience and reduce the vulnerability of livelihoods against climate change.

Protected areas maintain ecosystem integrity, buffer local climate and help to protect communities and reduce the impact of natural disasters. For example, forests of Borjomi-Kharagauli National Park and its surroundings have an important role in soil stabilization as well as in prevention and mitigation of natural hazards such as avalanches, landslides, floods, erosions. As the forests in the region are relatively well protected, only few cases of natural disasters are recorded in the region (Flores and Adeishvili, 2011).

The forests in the Caucasus Mountains, including Tusheti Protected Areas, play an important role in slowing down runoff flows into the streams. This helps reduce the elevation of water levels in the rivers and the flood risk to downstream villages, towns and agricultural fields, especially in the rainy season. In the absence of protected forests, the areas downstream (especially agricultural fields) can also be impacted by droughts as a result of altered climate regimes, which will have very negative impact on crops and human well-being.

The forests of Mtirala National Park reduce the floods in spring and autumn and prevent drying out of the rivers in summer and winter season. Additionally, forests of Mtirala National Park protect soil from erosion.

By maintaining the essential ecosystems services upon which people depend, protected areas help communities to cope with climate change impacts.

The rivers and springs originated on the territory of the Borjomi-Kharagauli National Park supply Borjomi (population about 10,000) and several other villages with drinking water. The springs in Borjomi-Kharagauli National Park are also very important for the production of the famous mineral water Borjomi. The settlements around the Mtirala National Park, including Batumi (population about 137,000), receive drinking water from the Mtirala National Park.

The water resources of protected areas sustain marine and fresh water fish stock. For example, many rivers originating in Borjomi-Kharagauli National Park or its surroundings flow into Mtkvari River (traditionally used for commercial fishing) and Rioni River, which are rich in fish resources. There are about 30 fish farms in the Mtirala National Park buffer zone and 3 fish farms in Borjomi-Kharagauli National Park buffer zone.

Rivers and streams originating in the Caucasus Mountains help maintain Georgia's agricultural productivity in eastern Georgia. The Alazani River, in the Kakehti region, originates in the South-Western part of Tusheti Protected Areas. Some of the tributaries of Alazani originate in the territory of Lagodekhi Nature Reserve. The river itself is used very intensively for irrigation in the region to sustain agricultural productivity.

Protected areas ecosystems provide benefits to the local communities in relation to non-timber forest products, such as fruits, berries, mushrooms, medical plants, etc. Grassland ecosystems of Tusheti Protected Areas support sheep breeding. In Borjomi-Kharagauli National Park about 143 households use alpine pastures in summer season; and in Mtirala National Park buffer zone, approximately 2,400 households are engaged in livestock breeding and dairy production. Some households in the buffer zones of protected areas are also engaged in bee keeping.

Agricultural areas located close to protected areas benefit also from the pollination services provided by ecosystems. Many products are produced in the buffer zones of the Borjomi-Kharagauli National Park, Mtirala National Park and Tusheti Protected Areas, ecosystems which provide this service.

5. Case studies

5.1. Mitigation and Adaptation Measures in International Protected Areas

Numerous climate change mitigation and adaptation measures are realized in different protected areas worldwide:

5.1.1. Mitigation measures

5.1.1.1. Through logging, fire damage and land conversion to agriculture and settlements The conservation of mature forests in Gabon within the country`s protected areas network has prevented the release of thousands of tons of GHG to the atmosphere, as well as steadily increased carbon storage;

5.1.1.2. Tropical forests in the protected areas of Bolivia are estimated to store around 745 million t C, worth between 3.7 billion US$ to 14.9 billion at international carbon market prices. However, deforestation poses a real threat: almost 10% of forest cover has been lost.

5.1.1.3. Extensive peatland restoration of 40,000 ha by mining companies in Belarus has permitted an annual reduction of GHG emissions equivalent to 448,000 t CO2 from peatland fires and mineralization while enhancing ecosystem goods and services for the sake of local populations. It also saved the state approximately 1.5 million USD per year in fire-fighting operations.

5.1.1.4. Restoration of the natural drainage regime and reforestation of a degraded wetland with native tree species within the Nariva Protected Area in Trinidad and Tobago hopes for carbon sequestration through afforestation and reforestation, and for methane and nitrous oxide mitigation through restoration of surface hydrology.

5.1.2. Adaptation measures

5.1.2.1. A seminar focused on the needs of protected area managers and workers to strengthen their capacity to respond to climate change was held in the Cape Floristic Region, South Africa.

5.1.2.2. The government of Kazakhstan has improved the management and protection of the Barsakelmes Nature Reserve in the Aral Sea Basin, to reinforce protected areas effectiveness. It also increased the size of the reserve by almost 10 times to enhance ecosystem resistance to climate change and other global change impacts. The additional establishment of a Biosphere Reserve is under consideration for further integrating and coordinating measures for conservation and socio-economic development in the area.

5.1.2.3. The protection, restoration and effective conservation of the Whangamarino Wetland is calculated to save New Zealand millions of dollars in flood control and sediment trapping.

5.1.2.4. 17% of Swiss alpine forests are protected, managed and restored to prevent and protect from landslides and avalanches, providing services to the country worth approximately US$ 2-3.5 billion per year.

5.2. Mitigation and Adaptation Measures in and around Georgian Protected Areas

In protected areas of Georgia no direct climate change mitigation or adaptation measures have been implemented so far. However, some actions and activities carried out during the last two decades significantly had positive side effects in this regard.

For the last 20 year the coverage of protected areas in Georgia increased three times. Additionally, during the coming years the establishment of new protected areas is planned. This, consequently, contributed to prevent the loss of carbon that is already stored in vegetation and soil within the protected areas. Some studies estimated the amount of carbon storage in selected ecosystems in Georgia. For example, the study carried out by V. Gulisashvili Forest Institute estimated that the pine forests (6,983 ha) in Borjomi State Reserve can store 767,250 tons of carbon (approximately 110 tons per ha). Annual CO2 absorption in these forest equals 8 tCO2/ha, or 50,976 tons of CO2.

Under the WWF Caucasus Programme project “Valuation of the Contribution of Borjomi-Kharagauli and Mtirala National Parks’ Ecosystem Services to Economic Growth and Human Well-being” carbon storage was estimated in two protected areas in Georgia. Using general numbers for references, it was estimated that Borjomi-Kharagauli National Park alone included over 85.000 hectares of mainly native spruce forest, which could store 9.1 tCO2/ha, or 771,000 tons of CO2. The total market value of this forest is about US$ 6.010,000 per year (€ 4.5 million).

Almost 100% of Mtirala National Park is covered with forest and dense shrubs. In Mtirala National Park the forest is more diverse and an assessment of the C02 storage value is more challenging. It was estimated that 15,800 ha of standing forest could store about 143,000 tCO2. The total market value of this forest can be around USD 1.117,000 (837,000 €) per year, considering a conservative market value of US$ 7.8 per/tCO2.

The total value of the forest of Borjomi-Kharagauli National Park and Mtirala National Park, in terms of CO2 storage capacity can thus be approximately € 5.3 million. Further research is needed in order to estimate the total value of the standing forest in PAs in Georgia. In addition, further research is needed to estimate carbon storage in other ecosystems such as soils, peatlands, etc., especially within PAs.

Some small restoration activities were carried out in and nearby protected areas. Restoration of Imeretian oak has started in Ajameti Managed Reserve; Rehabilitation of the forest to reduce climate change caused impacts were carried out in Lagodekhi region (Chiauri forest) in 2008-2010; Climate-tolerant rehabilitation of degraded landscapes and windbreaks where conducted in Dedoplistskaro region in 2008-2011.

During the past years the protection of protected areas was improved and cases of illegal activities, like logging, have decreased.

Different trainings were conducted in order to enhance adaptive and effective management of protected areas. For example, trainings on fire management were conducted for the protected areas administration staff by the USDoI/ITAP.

References

Côté, I.M.; Mosqueira, I. and Reynolds, J.D. 2001. Effects of marine reserve characteristics on the protection of fish populations: a meta-analysis. Journal of Fish Biology, 59: 178-189.

Dudley, N.S, et at (Ads) (2010). Natural Solutions – Protected Areas Helping People cope with Climate Change. IUCN-WCPA, TNC, UNDP, WCS, WB, WWF, Gland, Switzerland, Washington DC and New York, USA.

Flores, M., and Adeishvili M. (2011). Valuation of the Contribution of Borjomi-Kharagauli and Mtirala National Parks' Ecosystem Services to Economic Growth and Human Well-being. WWF Caucasus Programme.

Flores M. and Adeishvili M. ECFDC/GCCW/AMECO (2011) Economic Valuation of the Contribution of Ecosystems to Economic Growth and Human Well-Being: The Cluster of Protected Areas of Tusheti and the Georgian Network of Protected Areas. Catalyzing Financial Sustainability of Georgia's Protected Areas System. UNDP/GEF

Jenkins, C.N. and Joppa, L. 2009. Expansion of the global terrestrial protected area system. Biological Conservation 142 (10): 2166-2174.

Ministry of Environmental Protection (2012). National Environmental Action Plan of Georgia for 2012 – 2015.

Ministry of Environmental Protection and United Nation Development Programme. (2009). Georgia's Second National Communication to the UNFCCC.

Roberts, C.M.; Bohnsack, J.A.; Gell, F.; Hawkins, J.P.; and Goodridge, R. 2001. Effects of Marine Reserves on Adjacent Fisheries. Science, 294(5548): 1920-1923.

Shadie, P. and Epps, M. (Eds) (2008) Securing Protected Areas in the Face of Global Change: Key lessons learned from case studies and field learning sites in protected areas. IUCN Asia Regional Office, Bangkok, Thailand.

TEEB – The Economics of Ecosystems and Biodiversity for National and International Policy Makers – Summary: Responding to the Value of Nature 2009.

Tiginashvili Z. (2011). Estimation of phytomass, absorbed and annually deposited carbon storage in pine stands in Borjomi State Reserve. Georgian State Agricultural University, V. Gulisashvili Forest Institute. Shota Rustaveli National Science Foundation (ppt).

Zazanashvili N., Garforth M., Jungius H., Gamkrelidze T. Montalvo C. (Eds) (2012). Ecoregion Conservation Plan for the Caucasus. 2012 reviews and updated edition. CBC Caucasus Biodiversity Council (Draft).