NATIONAL CLIMATE VULNERABILITY ASSESSMENT: GEORGIA

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The overwhelming scientific consensus is that the climate has been changing over the past 150 years, due largely to human activity. Global temperatures are rising, rainfall patterns are becoming more unpredictable, and the sea level is rising, with these trends expected to continue over the coming decades. A warmer climate has also been linked with more frequent and intense climate-related disasters and extreme weather. Records indicate that the number of climate-related disasters has risen significantly over the past century, and these now affect over 250 million people a year.

The humanitarian impacts of climate change and changing patterns of extreme weather are likely to be significant. There is increasing worldwide concern about the negative impacts a changing climate could have on societies and economies, affecting sectors from agriculture to water resources. The most severe effects of climate change are likely to be disproportionately felt by the poorest and most disadvantaged members of societies, who already have very few resources to fall back on in the case of disaster, and are ill-equipped to cope with the new challenges posed by climate change;

While efforts to mitigate the rate of climate change through cutting greenhouse gas emissions are ongoing, the failure to reach a binding international agreement to significantly reduce global emissions means that the planet will continue to experience warming over the coming decades. Mitigation is not enough; societies must take steps to adapt to the projected impacts of climate change, and build their capacity to manage changing risks at every level in the face of an increasingly unpredictable climate.

Civil society and the Red Cross Red Crescent Movement have a major role to play in alerting decision makers and the public to the risks of climate change and motivating people to take action based on these risks. Climate Forum East is a project in the six countries of the Eastern Partnership, aimed at building the capacity of civil society to engage with decision makers on these issues, and mobilising youth and communities to respond to the challenges faced by their country in a changing climate. Thus one of the key activities of the project is the assessment by national civil society organisations of the main climate risks and vulnerabilities in each country, and the development of recommendations to civil society and decision makers on possible approaches to take towards climate change adaptation in their country. It is to this end that this National Climate Vulnerability Assessment report is presented.
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# Abbreviations and Units of Measure

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<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>°C</td>
<td>Celsius degree</td>
</tr>
<tr>
<td>CC</td>
<td>Climate Change</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>FNC</td>
<td>First National Communication of Armenia to the UNFCCC</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GEF</td>
<td>Global Environment Facility</td>
</tr>
<tr>
<td>GNPO</td>
<td>Governmental non-profit organization</td>
</tr>
<tr>
<td>GoA</td>
<td>Government of the Republic of Armenia</td>
</tr>
<tr>
<td>ha</td>
<td>hectare</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>km</td>
<td>kilometer</td>
</tr>
<tr>
<td>m</td>
<td>meter</td>
</tr>
<tr>
<td>m/s</td>
<td>meter per second</td>
</tr>
<tr>
<td>m³</td>
<td>cubic meter</td>
</tr>
<tr>
<td>mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>SPAN</td>
<td>Special protected areas of nature</td>
</tr>
<tr>
<td>RA</td>
<td>the Republic of Armenia</td>
</tr>
<tr>
<td>RSA</td>
<td>Rescue Service of Armenia</td>
</tr>
<tr>
<td>SGP</td>
<td>Small Grants Program</td>
</tr>
<tr>
<td>SNC</td>
<td>Second National Communication of Armenia to the UNFCCC</td>
</tr>
<tr>
<td>sq.km</td>
<td>Square kilometers</td>
</tr>
<tr>
<td>t</td>
<td>tonna</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
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<tr>
<td>UNO</td>
<td>United Nations Organizations</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>---------</td>
<td>---------------------------</td>
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<tr>
<td>EaP</td>
<td>Eastern Partnership</td>
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<td>EU</td>
<td>European Union</td>
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<tr>
<td>HAP</td>
<td>Heat Action Plan</td>
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<tr>
<td>HI</td>
<td>Heat Index</td>
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<tr>
<td>GRCS</td>
<td>Georgia Red Cross Society</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
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<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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<td>WWF</td>
<td>World Wide Fund for Nature</td>
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1. Georgia

1.1 SITUATION IN GEORGIA

1.1.1 Main geographical and climatic characteristics
Georgia is located in the South Caucasus region. The area of the country equals to 69,875 km². From the north the state is bordered by Russian Federation, from the south-west – by Turkey, from the south – Armenia and from the east – Azerbaijan. From the west Georgia is bordered by the Black Sea, coastal band equals to 320 km.

69 self-government entities (municipalities and 2 autonomous republics (Abkhazia and Adjarian Autonomous Republics) are in Georgia.

The country is characterized by sharply expressed vertical zoning. The territory of Georgia is spread vertically from the Black Sea level up to 5068.8 meter height (Mt Schkhara). Two thirds of the territory of Georgia is mountainous. 20% of the country is located at an altitude of 2000 m or more above sea level.

Low mountain relief occupies less than a quarter of the territory of Georgia. Along the northern limit of the country more than one third of the area is occupied by the Great Caucasus mountain ridge. In the south there is a mountainous part of Small Caucasus and volcanic mountainous territory of south Georgia. The inter-mountain plain is entrapped between these two mountain systems. The Likhi mountain ridge divides the country into west and east parts.

The climatic diversity of Georgia is conditioned by its geographical location, its location in the extreme north of the subtropical zone, between the Black and Caspian Seas and by the specific complexity of the relief. The Likhi mountain

Figure 1: Hypsometry of Georgia. Source: http://drm.cenn.org
ridge conditions the climatic contrast between east and west Georgia.

The climate of west Georgia is diverse and it changes from humid subtropical to the zone of glaciers. The Black Sea coast is characterized by a humid subtropical climate. The average yearly temperature is the highest on the Black Sea coast and it equals to 14-15°C, while the average yearly precipitation varies within the limits of 1200-2500 mm. In the vicinity of the Mt Mtrala (Adjarian Autonomous Republic) the maximum annual precipitation, up to 4000 mm, is observed. In the mountainous and high mountain zones of west Georgia the average annual air temperature varies within 6-10°C and 2-4°C, while the overall annual precipitation equals to 1200-1600mm and 2000 mm, correspondingly. In east Georgia the climate is drier. In the plains the climate is dry subtropical, while in mountainous regions it is Alpine. The annual average air temperature in the plain is 11-13°C, while in the mountains it is 2-7°C. In east Georgia, in its high mountain part of the Caucasus, almost the same quantity of precipitation falls that comes in west Georgia. In the average height mountains of the Caucasus and in the northern folds of Trialeti mountain ridge the average annual rate of precipitation equals to 800-1200 mm. The minimum precipitation of 375 mm come on Eldari valley.

Georgia is especially rich in water resources, although they are not equally spread across the territory of the country. More than 26,000 rivers are on the territory of Georgia (total length – 54,768 km). Some of these rivers join the Black Sea and the others the Caspian Sea, through Azerbaijan. In west Georgia the river flow (alongside with transitional) equals to 49.8 km³, while in east Georgia it is 16.5 km³. Rivers are fed at the expense of glaciers, precipitates and underground waters. There are 850 lakes in Georgia. Most of them are very small, therefore the total area of the lakes doesn't exceed 170 km² (0.24% of the territory of the country). The biggest lakes of the country are located in mountainous region of the South Georgia and on the Javakheti plateau.

The complexity of the relief and substantially different climatic conditions cause a diversity of landscapes and ecosystems of Georgia. There are forests, swamps, seaside ecosystems, semi-deserts, steppe, sub-alpine and alpine meadows and glaciers. 40% of the territory of Georgia is covered by woods.
The overall area of various categories of protected territories (14 preserves, 10 national parks, 32 natural monuments, 18 banned and 2 protected landscapes) is 521 735.7 ha, which covers 7.5% of the country territory.

1.1.2 Demographic characteristics
Over the last two decades, economic changes, intense urbanization, low level of life expectancy, a great number of displaced persons and many other additional factors adversely affected the demographic development of the country. Today the overall population is rather stable after a multiyear negative demographic tendency. The number of the population reaches 4.4838 million (according to the data of January 2013). According to the data of 2013, 46.2% of the population lives in rural places.

The average life expectancy in Georgia is 74.5 years. The total index of childbirth in Georgia compared to that of other countries of the region is rather low. From 2005 to 2009, the childbirth index per 1000 population varied from 10.7 to 14.4, while in 2012 childbirth index fell to 11.7.

69.14% of the population consists of the age group from 15 to 64 years. The share of 65 years or older persons in the whole population remained more or less stable after 2005 and by 2013 it equals to 13.8%. In distinct from this, the share of the population younger than 15 years has decreased gradually from 22.0% (2000) to 17% (2013) and the share of able-bodied persons (from 15 to 64 years) suffered a slight increase. The demographic aging of the population will become an increasing economic burden for the able-bodied population in future.

The average population density is 71 people per km². The average density differs greatly according to the regions. The most heavily populated is the capital of Georgia, Tbilisi, where, according to official data 1.17 million persons reside.

1.1.3 Economic indicators
By income, Georgia lags behind average income countries. GDP per capita in 2012 equalled 3523.4 USD.

In recent years, significant economic reforms have been realized in Georgia. These reforms were focused on the formation of an attractive business environment, which formed the basis for an inflow of foreign investments, the creation of new working places, an increase of economic activity in all branches of economics and raising the quality of life of the population. According to the UN Development Program 2013 Report, Georgia, according to the human development index (0.745) occupies the 72nd place among 187 countries leading significant political and economic modernization of the country.

According to data from 2012, the GDP of the country equals to 15,846.8 million US Dollars, while the real growth of GDP is 6.2%. Between 2008-2012, the increase of GDP per capita reached 602.3 USD, and gross national income by 2012 equalled 15700.5 million USD, while GNI per capita was 3490.9 USD.

Irrespective of the fact that the conflict of 2008 with Russia and global economic crisis hampered economic growth, the national economy managed to overcome the dead-end and in 2010 and 2011 indices of growth managed to go back to the pre-crisis level. In 2010 and 2011 indices of economic growth were increased by 6.3% and 7.0%, correspondingly.

According to the structural point of view, the structure of the economy has changed over the last 20 years. The agriculture, industry and service sectors contributed almost equally to GDP in 1990. Today the service sector (68.4%) and industry (23.2%) have become the main economic sectors (World Bank, 2009 a) irrespective of the fact that the greater part
of the employed persons are occupied in agrarian sector (UNECE, 2012).

Figure 6: GDP components 2012. Source: Ministry of Economy and Sustainable Development

Irrespective of the significant economic achievements of the last year, the great part of the Georgian population lives in poverty. According to the assessments, the index of extreme poverty is 10%; if we use a less conservative limit, 45% of the population lives below the poverty line. Poverty indices differ according to the regions and groups of the population. Imbalance in revenues is high; according to assessments in 2011 the Gini index equaled to 0.42.

1.2 NATURAL HAZARDS AND DISASTERS

In Georgia, frequent natural disasters include landslides, floods, flash-flooding, mudflows, droughts, avalanches, heavy winds and storms. These result in significant economic loss to the country, damage to agricultural lands, infrastructure and human casualties. The risk of natural calamities and catastrophes is the result of the complex mountainous relief and climatic peculiarities of Georgia.

The large-scale occurrence of natural disasters over recent years in Georgia and frequency of their recurrence is caused by the intensification of extreme meteorological phenomena, as well as by the high impact of human activity on nature: through inadequate and unsustainable application of natural resources, including the cutting of woods, extraction of inert material, excess pasturing, and uncontrolled urban development in high-risk zones.

According to the National Environment Agency, losses incurred between 1995-2013 as a result of natural disasters (landslides, floods, drought, storms, avalanches, hail) were 2708.25 million GEL. 20776 houses are built in geological hazard zones, and 42781.7 ha of arable lands were damaged. Various type natural disasters claimed the lives of 179 people.

The most vulnerable groups of the population are refugees as a result of military actions of 90s which occurred in Abkhazia and South Ossetia, and the Russia-Georgia conflicts of 2008 (258 595 persons), indigent persons (according to the data there are 129 599 indigent persons in Georgia); and the population of high mountainous regions, the greater part of which relies on agriculture, a branch of economy that is characterized by low productivity and low income, but that satisfies mainly their personal needs.

Official unemployment data from 2012 shows a rate of 0 15.0% (SakStat); according to public interviews carried out in 2012, employment for the local population remains the main state problem, which precedes territorial integrity and poverty problems (Navarro & Woodward, 2010, 2012; CRRC, 2010).

According to the database of the Ministry of Displaced Persons, as of June 1 2012, 35,300 families from the occupied territories of Georgia and other refugees were registered as having suffered losses as a result of natural disasters. According to the data of the same Ministry, by 2012, 4,957 houses were damaged as a result of natural disasters, including 190 destroyed, and 481 which could not be reconstructed.

1 Views from the Frontline, Country Report: Georgia, 2013

According to the data of National Environment Agency, landslides result in the greatest losses. More than 70% of the territory of Georgia and up to 3000 settlements are located in geological risk zones. Landslide phenomena are especially intense in mountainous regions and it is a main cause for economic migration of the population. In 1995-2010, losses from landslides totalled 915.1 million GEL. Geological hazards were especially active in 2004-2005 when 1036 were damaged;
3070 dwelling houses suffered deformation, 2674 ha arable lands were flooded and affected by landslide. Mudflow phenomena were fixed in up to 3000 eroded water ducts. In 1995-2012, losses as a result of mudflows totalled 358 million GEL and 35 people died. Settlements located at the foot of the Caucasus Mountain Ridge in Kakheti, and primarily the town of Kvareli, are under constant threat of mudflows, together with settlements in Racha and Upper Svaneti. Within the last 100 years, more than 150 persons died as a result of mudflows in the gorge of the river Duruji and the population of the town Kvareli suffered tremendous losses. In May 2012, as a result of heavy precipitation that caused mudflows, 5 people died in Tbilisi and several houses were destroyed. Losses exceeded 20 million US Dollars.

Almost all rivers of Georgia are characterized by floods and flash floods. In 1995-2012, 202 cases of floods were registered, and losses incurred by those events amounted to 502.8 million GEL. Those phenomena took lives of 38 people.

The agricultural sector suffers especially great losses as a result of hail and drought in east Georgia, the frequency and length of which has been increased in recent years. If earlier droughts occurred once in every 15-20 years, recently the frequency has increased by almost three times. The maximum length of drought was registered in 2000; it lasted six months. Drought affected 700,000 people and reduced the GDP by 5.6% which was caused by its adverse effect on agriculture and electricity generation by hydroenergy power stations. According to the quantity of losses, especially big losses were caused by heavy storms and hail in July 2012, when the disaster in east Georgia destroyed more than 20,000 ha of arable lands. It took off the roofs of more than 2000 houses. Losses caused by this disaster, exceeded 150 million GEL by approximate calculations.

More than 50% of territory of Georgia is in an avalanche risk zone. The population of Svaneti, mountainous Adjara, Tusheti, Kazbegi and Dusheti regions suffer most from avalanches. Losses caused in 1995-2012 by avalanches totalled 55.4 million GEL with 22 deaths.

The heavy impacts of natural disasters are mainly caused by lack a lack of knowledge in the planning and implementation of cost-efficient prevention measures; a lack of experience...
and low knowledge of the population and local management about the issues of disaster risk management; and the non-priority distribution of limited resources. In addition, the modern system of early warning of catastrophes does not yet work perfectly in Georgia.

1.3 CLIMATE CHANGE IN GEORGIA

1.3.1 Current climate change

Signs of climate change in Georgia have been observed since the 1960s. Pictures differ according to the regions of the country. According to the Second National Communication to the UNFCCC (2009) there have been changes in climatic parameters between 1955-1970 and 1990-2005. In west Georgia, from the first to the second period, the average temperature increased by 0.2°C, while yearly total precipitation decreased by 27 mm; in east Georgia the average annual temperature increased by 0.3°C, and an overall increase of annual precipitation by 41 mm was also observed.

Changes in climate parameters for the whole Georgia do not always coincide with the locally obtained picture in individual regions. Thus, the averaged overall index of annual precipitation in west Georgia shows a tendency of decrease, while in individual regions of West Georgia (e.g. Lentekhi), on the contrary, shows an increasing trend.

Simultaneously, the increase in the rate of change in air temperature and atmospheric precipitation was especially high during 1985-2005.

In the Second National Communication, simultaneously the tendency of changes of average air temperature, average overall annual precipitation and the humidity regime were estimated for the periods 1955-1970 and 1990-2005 in three priority regions of Georgia (the regions most vulnerable to climate change): The Black Sea coast, Dedoplisitako municipality (in the far south-east of Georgia, a semi-arid zone) and Lentekhi municipality (a high-mountainous region in west Georgia).

Statistical analysis showed tendency of increase of average annual temperature and average annual precipitation from the first period (1955-1970) to the second one (1990-2006) in all three priority regions. Additionally, changes in absolute minimum and maximum air temperatures were studied. Statistical analysis showed a warming of winter as well as summer periods in these regions.

In the process of developing the Third National Communication to the UNFCCC, current climate changes for the Adjara Autonomous Republic have already been assessed. The changes of climate parameters are not homogeneous: in Batumi and Kobuleti an increase of average annual temperature by 0.2°C and 0.4°C respectively have been noted. The temperature increase is identified against the background of autumn and summer warming, while spring and winter are cool everywhere. In the coastal zone the number of hot days and

![Figure 9: Economic losses from natural disasters by year (million GEL). Source: National Environmental Agency](image-url)
warm nights has increased, which affects human health and the tourism industry. In Keda (in high mountainous Adjara) the average annual temperature has increased by 0.5°C. The average maximum as well as average minimum have increased significantly too. In high mountainous Adjara precipitation has increased in Keda by 16%, while in Khulo it has increased by 11%. At the same time, the maximum index of precipitation in 24 hours has increased too, which may have serious effect on floods and landslides, which will be a real problem for this region.
Changes of air temperature in the South Caucasus

This figure shows the changes of average annual maximum and minimum temperature in the South Caucasus. Studies were carried out in 2010-2011 with the support of the Environment and Security Initiative (ENVSEC) regional project “Assessment of Regional Results of Climatic Changes in the South Caucasus Countries” (Armenia, Azerbaijan, Georgia) implemented by UNDP.

Within the framework of the study the data of 21 meteorological stations were analyzed in Georgia for the period of 1936-2005. In the greater part of the region the average temperature increased by 0-1.5°C, while in some regions of Georgia and Azerbaijan, change exceeds by 1.5 °C. According to the indices of climatic extremes it was observed that the number of days when 24 hour maximum exceeds 25°C had increased in Georgia.

(Source: Climate Change in the South Caucasus; A Visual Synthesis Based on official country information from the communications to the UNFCCC, scientific papers and news reports., ENVSEC/ Zoï Environment Network 2011)
1.3.2 Future projections

The IPCC Fourth Assessment Report on Climate Change (2007)\(^9\), which sums up the projections of temperature and precipitation and the changes based on various global climatic models for the whole world, forecasts a warmer and drier climate for the South Caucasus. Changes in climate parameters may be expressed differently at the local level, in various parts of the region of the South Caucasus.

The final scenario of the future climatic changes for the territory of Georgia prepared within the Second National Communication to the UNFCCC is presented in Diagram 11.

As is seen in figures 16 and 17, by the end of the century in west Georgia, a temperature increase of 3.5 °C and a decrease of precipitation by 6% is anticipated; in east Georgia the forecasted changes of temperature are an increase of 4.1 °C and a precipitation decrease by 14.5 %. The process is extremely acute in summer, when the tendency of temperature increase and precipitation decrease is higher than in other seasons.

Projected climate change in Georgia

The images below show the forecasted changes in annual air temperature and annual precipitation in the South Caucasus. According to the prognosis for 2070-2100, the highest increase of temperature within the region is expected in west Georgia, in summer. For the same period a decrease in precipitation of 15% is forecast.

<table>
<thead>
<tr>
<th>Year Period</th>
<th>Forecasted Changes in Annual Air Temperature (°C)</th>
<th>Forecasted Changes in Annual Precipitation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011–2040</td>
<td>1.5</td>
<td>5%</td>
</tr>
<tr>
<td>2041–2070</td>
<td>3</td>
<td>0%</td>
</tr>
<tr>
<td>2071–2100</td>
<td>5</td>
<td>-5%</td>
</tr>
</tbody>
</table>

(Sources: UNDP/ENVSEC Study on Climate Change for the South Caucasus, 2011.)
Within the framework of the assessment of the program “Reducing the Vulnerability of Georgia’s Agricultural Systems to Climate Change, Adaptation and Impact Assessment Options” of the World Bank implemented in 2012-2013 (World Bank’s Europe and Central Asia (ECA) Regional Analytical and Advisory Activities (AAA) Program on Reducing Vulnerability to Climate Change in ECA Agricultural Systems, 2013) changes were forecast in average annual temperature and average annual precipitation for four agricultural zones of Georgia. (1. Lowlands of West Georgia, 2. Mountainous part of West Georgia, 4. Mountainous part of East Georgia and 4. Lowlands of East Georgia. These zones were selected according to the altitude, temperature and precipitation. On the basis of an analysis of the climate moisture index (CMI), prognoses were developed for all those four zones up to 2050 for minimum, maximum and average impact scenarios/options.

As is seen from the picture given below, according to all options the average annual temperature increases up to 2050 in all four agricultural zones by approximately 2.3°C, which is far higher than the 0.2°C change fixed for the recent 50 years in west Georgia and the 0.6°C change fixed in east Georgia. The average prognosis forecasts that the precipitation will be increased most in the agrarian regions of the west lowlands. However, the range of the results in the minimum and maximum impact scenarios is rather wide, starting from tendency to grow, according to the minimum impact option, and ending by 24% increase in precipitation, according to maximum impact option.

Climate change impact on average annual temperature in 2010-2050 according to minimum, average and maximum impact options

Climate change impact in average annual precipitations in 2010-2050 according to minimum, average and maximum impact options (mm/year)

Source: Reducing the Vulnerability of Georgia’s Agricultural Systems to Climate Change, Impact Assessment and Adaptation Options, Industrial Economics, Incorporated, 2013

* Minimum impact: Base for global circulation model for the option – National Center for Atmosphere Assessment, Parallel Climate Model (USA); corresponding IPCC SRES option - A2;

Maximum impact: Base for global circulation model for the option – Space Assessment Godard’s Institute, model IER (USA), corresponding IPCC SRES option - A1b;

Average impact: Base for global circulation model for the option – Climate modeling and Analysis Center, Coupled GCM 3.1 (Canada); corresponding IPCC SRES option - A1b.
During the preparation of the Second and Third National Communications, as well as within the framework of the programs implemented by Regional Environment Protection Caucasus Center (RECC)\textsuperscript{10} and Caucasus Environment Non-governmental Organizations Network (CENN)\textsuperscript{11}, projections were made for various climate parameters changes for municipalities vulnerable to climate change (Dedoplistskaro, Sagarejo, Gardabani, Gori, Kareli, Akhaltsikhe, Borjomi, Khelvachauri, Keda).

Computations performed for the Second National Communication showed that by 2050 in the Black Sea coastal zone (in the vicinity of the town of Poti), an increase in air temperature of 1.2°C is expected, with a decrease in precipitation of 8-10%. In Dedoplistskaro municipality, by 2100 the average air temperature is expected to increase by 4.6°C to 15.4 °C, while the annual precipitation quantity is expected to decrease in summer and increase in winter, but will remain unchanged overall (although other global models for the periods after 2050 showed total decrease of precipitation). In Lentekhi municipality by 2100, an increase of temperature by as much as 4.1°C was projected, while annual overall precipitation is expected to decrease by 60 mm.

According to the computations carried out for the Third National Communication, by 2050, in the whole territory of Adjara the increase in average annual temperature by approximately 1.5°C is expected/forecasted compared to 1961-1990. This increase is fixed in every season, although it is felt particularly in summer (approximately 2.2°C increase). For 2070-2099 climate change will be intensified and average temperature excess compared to 1961-1990 will equal to 4.2°C. Annual overall precipitation by 2021-2050 will remain factually unchanged, but the seasonal distribution of precipitation is expected to change; in particular, summer precipitation will decrease significantly (by 6-8%) and winter precipitation will increase (by 6-7%). In 2070-2099 an overall decrease in precipitation by 7-10% is forecast.

1.3.2 Climate change and natural disasters

In recent years the intensification and increase of frequency of extreme meteorological phenomena in Georgia has resulted a rising number of natural disasters. In the future, according to the climate change prognosis we should expect further intensification of extreme weather, which will probably result in increased occurrence of landslides, floods, avalanches, and mudflows.

As a result of climate change, droughts and spring winds have become frequent in the semi-arid regions of Georgia; in the Black Sea coastal zone the coastal erosion process has become more active. In the high mountainous regions flash floods, landslides and mudflows have become more frequent which to a definite extent is a result of the recession of the Caucasus glaciers; heavy river flows as a result of fossil glaciers melting result in intense mudflows in high mountain regions; landslide processes are intensified, which was observed in Georgia in April-May 2005 when rapid warming and snow melting resulted in initiation of mudflows and landslides in mountainous regions, as well as in heavy floods all over the country.

In 2010 major economic losses were suffered by the high mountainous region of Racha because of downpours in the river Brdghviora gorge. Up to a million cubic metres of stone and mud flow destroyed and damaged houses, it swept across arable and agricultural land plots, and mudflow alluvium covered tourist base (120,000 m² of territory); overall the the greater part of Glola community faced devastation. As a result of an assessment it was considered that the causes of the catastrophic mudflow stream were the melting of fossil glacier layers at the sources of the river Brdghviora, which resulted in the increase of moisture capacity of mudflow forming material to its critical limit. Therefore, abundant precipitation and heavy rains in June and August resulted in extreme mudflow transformation. Today there still is a high risk of development of mudflows in the river Brdghviora gorge if abundant precipitation falls.

Likewise, a significant increase was observed in disasters caused by heavy precipitation in Svaneti over the past 15-20 years, which have resulted in great losses and encouraged the tendency of migration of the population. In Mestia municipality, up to 30 communities are in geological risk zones. These communities include Latali, Mulakhi, Becho, Jabeshi, Lakhamula, Eceri, and Mestia. In Becho community at the source of the small river Kheldra, mudflow centers of gravitation, old-glacier, landslide and erosion processes are fixed, from where the mudflow streams take origin. The outlet of a mudflow stream was observed in May 2012 too, when the volume of solid alluvium reached some thousand cubic meter and covered more than 2 ha of territory.

In Lentekhi municipality an increase of overall annual average precipitation in heavy precipitation months by 12% was observed over the period 1955-2005. As a result of heavy precipitation, landslide
In the Black Sea coastal zone between 1956 and 2007 the frequency of storms increased by 50-60%, while the elevation of the sea level by 0.7 m (due mainly to eustatic phenomena) sharply increased the risk of damages from storms and coastal flooding. The most vulnerable area to climate change in the Black Sea coastal zone is the mouth of the river Rioni. The town of Poti which is located here is seriously threatened during storms, when sea water enters the river and sections of the town are flooded. In the near future in case of the expected increase of number of storms and relative and further sea level rise by 0.2-0.3 m, storms will have already a catastrophic significance.

Adjara region is one of the most complex regions of the country according to the catastrophic geological processes and negative results. It is proved by the data of disasters of the last 30 years that specific extremes of disasters were observed in: 1967-68; 1974-75; 1982; 1985; 1987-89, 1991-92, 1995-96. 1998, 2000-02, 2004-05, 2008. During these periods disasters took life of more than 170 persons; more than 10,000 residents were shifted to safe territories, while the economic losses reached some million dollars. The activation of dangerous geological processes in high mountainous regions of Adjara, alongside with geological and geomorphological conditions and the impact due to economic activity is the result of anomalous atmospheric precipitation deviated from the multiyear norm. Within the last half century the recurrence of heavy (Khulo) and extremely heavy (Batumi) precipitation increased in Adjara, which resulted in the activation of landslides and mudflows, avalanches and erosion risk processes as well as the intensification of flash floods and riverine floods. Starting from the 1970s and until the present number of magnitude 5 storms on the coastal zone of Adjara doubled, and a magnitude 7 storm was observed too. The intensification of heavy storms causes erosion in the Black Sea coastal zone.

Observations carried out in the semi-arid zone of Georgia (Dedoplistskaro municipality) proved that the average length of drought in 1980-2007 increased by 22% compared to that of 1952-1979, and the occurrence of drought increased from 0.7 to 0.9 year -1 year. This tendency was most apparent in the last decade (1998-2007), when during 10 years 19 drought periods were observed, with an average length period increase of 72 days. In the semi-arid zone the frequency of heavy winds significantly increased too. In 1963-2006 the occurrence of heavy winds increased by five times.

1.3.3 Vulnerability to climate change and natural disasters

The Second National Communication defines the three most vulnerable regions to climate change in the country as (i) the Black Sea coast, (ii) Dedoplistskaro municipality (far south-east Georgia, semi-arid zone) and (iii) Lentekhi municipality (high-mountainous region in west Georgia).

The dense infrastructure, traffic and rail mains of the Black Sea coastal zone, the important sea ports located in Poti and Batumi, and dense settlements and industrial zones play a significant role in the economy of the region, but simultaneously
make it especially vulnerable to climate change and its impacts, including sea level rise, increasing maximum speed of winds and intensifying of powerful storms. A comparison of separate segments of the coastal zone (the river Rioni mouth, the river Chorokhi mouth, the lower bed of the river Rioni and the coastal town of Sukhumi) showed that the most vulnerable area in the Black Sea coastal zone is the mouth of the river Rioni, which is under the significant threat from sea level rise and storms.

An assessment of vulnerability to climate change in municipalities located in the semi-arid zones of Georgia (Dedoplistskaro, Sagarejo, Gardabani, Gori and Kareli) revealed that the most arid zone in Georgia is Gardabani and this will remain so in the future (aridity index 0.365). Gori (Shida Kartli) will become still more arid in future (aridity index will decrease by 0.078), and the southern territory of Sagarejo, which up until the 1990s was more dry sub-tropical, in future will become semi-arid (aridity index 0.474). According to the results of the analysis, from the municipalities located in the semi-arid zone the most vulnerable to current and forecasted climate changes is Gardabani, then comes central part of Kareli and the south of Sagarejo (Project “Development of measures for adaptation to climate change and their realization for conservation and sustainable application of agro-bio-diversity of arid and semi-arid ecosystems of the South Caucasus”, RECC, EU, 2011).

Climate change in the semi-arid zones of Georgia

Vulnerability of municipalities located in semi-arid zones to climate change
As a result of assessments carried out for the Third National Communication, the vulnerability of various sectors of the Adjara Autonomous Republic were assessed in detail (forestry, agriculture, health care, tourism), as well as the vulnerability of coastal zone of Adjara, and its land and water resources. The implemented assessments proved that the most vulnerable sector to climate change in the Adjara Autonomous Republic is the land resources of the region, which in inhabited places suffer the impacts of landslides, mudflows and flash floods; in pastures and arable lands the intensification of erosion processes and loss of fertility has been observed, while in the coastal zone the process of intense coastal erosion by sea water. An increase of temperature and precipitation on the territory of Adjara will result in a rise in plant diseases, the disappearance of forests in the sub-alpine zone and the lowering of upper limit of forests because of soil erosion. The appearance of diseases which are connected with pathogens spreading and activation in the area (such as leprospirosa and boreliosa) are also associated with a warming climate, and are connected with the development of climatic conditions necessary for the propagation and existence of these diseases. The vulnerability of tourism sector to climate changes is a result of extreme hot weather (extension of the length of heat waves), an increase in the frequency of powerful storms, and an increase number of days with heavy precipitation in summer, which cause an increase in the risk of flash floods and mudflows.

In Dedoplistskaro municipality, which faces the danger of desertification, prolonged droughts and strong winds have a significant impact on agriculture; 94% of the population of the municipality is occupied in this sphere of the economy. Against a background of increase of drought periods and powerful winds, cutting of wind shield bands in the 1990s

significantly decreased soil fertility. In 1983-2006 the composition of humus in Shiraki black soil decreased from 7.5% to 3.2%.

The population of Lentekhi municipality has decreased by 40% since 1986 due largely to the increase in landslides and flash floods over this period\textsuperscript{15}. In the forests which cover more than 60% of the region and form one of the main sources of natural wealth of Lower Svaneti, increased spreading of pests and diseases has been observed. Lately against the background of temperature rise the number of damaged and dry plants increased. By the end of the century, the forecasted rise of temperature and decrease of precipitation is expected to further increase the vulnerability of forests of the region.

\textsuperscript{15} Georgia’s Second National Communication to the UNFCCC, 2009
2. Climate change impacts on water resources

2.1 OVERVIEW OF WATER RESOURCES

Georgia is rich in freshwater resources thanks to the mountainous relief of the territory and abundant atmospheric precipitation. The overall annual flow rate of rivers equals to 61.5 billion m³, with 52.77 billion m³ formed on the territory of Georgia. The annual water intake, inclusive for hydro power generation is far less and in 2012 it equalled 29.210 million m³. Water resources are not distributed equally throughout the country and are accumulated mostly in the western part of Georgia, while the eastern regions often suffer a lack of water.

![Figure 19: Overall water consumption (million m3/sec). Source: National Statistics Office](image)

Irrespective of the above, today only a small part of the population of Georgia is provided with a permanent supply of pure potable water. This is a result of the disorder of the water supply systems (losses in various towns of Georgia equals to 20-50%). In rural places the provision of the population is realized through their own wells and holes.

![Figure 20: Water consumption by sector (million m3/sec). Source: National Statistics Office](image)

In future, alongside with the development of the economy, the processes of management of water resources will probably be activated with the view of water intake, as well as of water discharge. In particular, the planned expansion a network of hydropower plants, increased tourism industry, improvement of water supply networks and irrigation systems will result in increase of demand for water and impact on water resources.
2.2 IMPACT OF CLIMATE CHANGE ON WATER RESOURCES

In accordance with assessments implemented by UNDP/ENVSEC based on temperature rise and precipitations decrease by the end of the century, a fall of flow rate by 26-35% and 45-65% respectively should be expected in the basins of trans-border rivers Alazani and Khrami-Debed\(^{16}\).

In the basin of the River Alazani, in case of an increase of demand minimum by 10% for water for agriculture, and expected growth of number of population, the water deficit in summer (August) will be already felt by 2050. In the trans-border basins of the rivers Alazani and Khrami-Debed the intensification of land degradation and desertification is expected along with the forecasted changes in climate extremes.

The results of this assessment refer to the necessity of application of adaptation measures in order to avoid economic losses in future, especially in the agriculture sector, as the water in the Khrami-Debeda and Alazani Rivers is used mainly for irrigation.

The annual river flow is unevenly distributed throughout the year. The distribution of the interannual streamflow generally depends on climatic factors. Due to global warming, changes are expected also in the annual distribution of river flow. For example, the average annual flow of the River Acharistskali in 2021-2050 in fact will not change in comparison with the average rates of 1961-1990, but it is expected that the volume of winter and autumn flows will increase and the summer and spring flows will decrease. Such change may have a positive influence upon hydropower generation since the capacity of power generation in winter will increase; however it will have a negative influence upon agriculture since the volume of irrigation water available in the summer will decrease. In spite of decreased flow in spring, precipitation in the form of snow during the winter period will cause the risk of floods in spring.\(^{17}\).

2.3 RECOMMENDATIONS FOR THE WATER SECTOR

Water resources in the basins of the above listed rivers are mainly used for agricultural purposes. Therefore, the application of modern efficient technologies for irrigation in agriculture would be the most important adaptation measure with the background of forecasted changes in river flow rates.

Due to damage to the irrigation system, today only 2% of the agricultural lands are provided with irrigation water. In this case, it is necessary to restore the irrigation systems and canals.

In particular, it is very important to restore irrigation canals and irrigation systems in Alazani and Khrami and Debeda Rivers in order to minimize water losses. There are other important adaptation measures as well: investment in drought-resistant and higher-yield crops/cultures, as well as rural agricultural crop diversification and introduction of modern technologies for soil tillage.

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\(^{17}\) Achara Climate Change Strategy, UNDP Georgia, 2013

Figure 21: Forecasted changes in average annual flow rate of the Khrami-Debed and Alazani Rivers for various regions compared to the period 1961-1990. Source: ENVSEC
In municipal and industrial sectors a more efficient water use system should be introduced, along with water conservation techniques and secondary wastewater technologies. With the help of water supply rehabilitation and expansion of existing systems, losses from the water supply system should be minimised.

The development of strategies and plans in transboundary water resources and their implementation can significantly increase the effectiveness of adaptation measures.

**Developing effective watershed management for adaptation**

The efficient management of water resources will be significantly increased by the application of pond/basin control. With this in view, in September 2010 the USAID Agency began the four year program “Integrated Management of Water Resources in Water Collector Basins of Georgia”– (INRMW) which is implemented within the framework of the “Global Water Sustainability” (GLoWS) program. The goal of the program is to develop innovative approaches and practical models of integrated water resources management in pilot basins of the rivers Alazani, Iori and Rioni. With the support of the program the vulnerability to climate change and natural disasters of the River Alazani and River Rioni basins was assessed, and adaptation measures were developed.

The program supports inculcation of management plans through the realization of small grants programs. It was with the support of the program that a water infrastructure rehabilitation project was realized in 20 communities, including the projects for improvement of the drinking water supply, rehabilitation of irrigation system, prevention of floods, and improvement of drainage systems (http://www.globalwaters.net/projects/current-projects/inrmw/).
3. Climate change impacts on health

3.1 HEALTH

Climate change has a definite impact on the healthcare sector and on human health more generally. This section will consider the impact of one of the climate change-associated extreme atmospheric phenomenon – “heat waves” on the healthcare sector and generally on human health, specifically at the level of the capital city, Tbilisi.

To assess the vulnerability of the healthcare sector to climate change we assess some components: the first is the capacity of the sector as such, that is how correctly it works and to what extent it is able to face the challenges of climate change (in this case heat waves); the second urgent component for the assessment of vulnerability is the assessment of health status of the population, which covers the assessment of indices of spreading of diseases generally as well as the statistical review of spreading of climate-related diseases in particular. Our report will consider only diseases of the systems which are most sensitive to high temperature and extreme changes of temperature. These are cardiovascular and respiratory diseases.

The present report will offer the information about spreading of heat waves in Tbilisi (both the existing tendency and future prognosis) and it will assess the issue as to what extent heat waves affect the health of the population of Tbilisi. At the end of the report we will offer recommendations which should be necessarily implemented for better adaptation of the health care sector to overcome the challenges of climate change such as heat waves.

The present report was developed on the basis of the country’s (national) reports, international publications, and the data of Medicinal Statistics Department of the National Center ofDiseases Control and Public Health.

3.1.1 Overview of the healthcare sector

One of the characteristic indices of the healthcare sector is its economic index. According to the data of 2010, irrespective of the significant increase of state resources allocated for healthcare which are expressed in absolute numbers, its share with respect to GDP (2.4%) and state budget (6.5%) is rather low and is similar to the poorest countries of Europe18.

In recent years the structure of state expenditures for medical services has suffered particular changes according to the forms of medicinal services. The share of resources spent on stationary hospital services in the state healthcare expenditures suffered a gradual decrease, while the share of costs made for ambulatory services has suffered insignificant changes. Preservation of high costs for hospital services refers to the fact that shifting of emphases on the first aid healthcare sector by the state, has not brought yet the expected effect with the view of redistribution of resources. Similarly low is the share of resources spent on public health; in 2007, to reduce financial barriers for accessibility of medical services the state-funded insurance programs began, which covered vulnerable groups of the population (population below the poverty limit, teachers, children left without care, IDPs, children up to 6 years, pensioners, students etc.), for whom purchase of medical services is realized by private insurance companies.

As it was stated above, in 2013 the campaign of universal insurance coverage was launched which covered the population through non-profit insurance fund, which has to decrease the costs of the population for medicinal services and has to increase the accessibility to medical services.

In the hospital sector, by the end of 2013, the thorough restoration of 150 medical centers has been planned. This was fulfilled partially. But irrespective of this, the scarcity of multi-profile university clinics is apparent, where the medicinal personnel should be trained. It should be stated that from the beginning of 2012 because of substantial changes made in the hospital sector, which planned replacement of bed-fund and optimization of human resources, it is hard to evaluate objectively the

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18 Healthcare System Efficiency Assessment Report, 2013, Tbilisi
hospitals’ capacities according to the data of 2011. Therefore, for making real conclusions and developing recommendations it would be more appropriate just to study and analyze the currently available bed-land and utilization indices.

From 2007-2011, with the material and technical support of donor organizations, the building and rehabilitation of new ambulances and the process of advance training of family doctors and nurses began in rural areas. In 2009 village ambulances took the legal form of entrepreneurs – physical persons. From September 2012 the insurance companies fund the services of village doctors and nurses in their medicinal regions. At the regional levels, the integration of primary healthcare, ambulances and emergency medical services and infrastructure is in progress at the newly created medicinal centers, while in big towns the process of privatization of polyclinic organizations has begun.

Despite the above measures, the condition of the primary healthcare (PH) infrastructure is not homogeneous and is often inadequate. Structurally, functionally and financially the primary healthcare system is not sufficiently regulated and mechanisms of realization of referrals from the level of primary healthcare organization are vague.

With the view of assessing system efficiency, the low productivity of medical personnel should be emphasized. One physician annually renders services to approximately 42 hospital patients; the primary healthcare physician renders his services to approximately 3 patients a day, instead of the 15 patients recommended by the World Health Organization (WHO)\(^\text{3}\)

3.1.2 Overview of national health trends
The health status of the population, measured by such as life expectancy at birth and cases of mortality of mothers and infants, has tended to improve from the second half of the 1990s, which was a significant achievement for the healthcare system. Life expectancy, after its decrease in early nineties, increased from 70.3 years in 1995 to 74.5 years in 2011; at the same time the number of the population of aged persons increased too\(^\text{20}\).

Significant progress has been observed as a result of reforms implemented in economic development and the health sector of the country, with the view of reduction of number of mother and child deaths. The rate of neonatal mortality was reduced almost twice in the last ten years. The mortality rate of children under five was reduced from 24.9 to 12.0, while maternal mortality was reduced from 49.2 to 27.4\(^\text{21}\). In spite of this, still greater efforts are needed to achieve designed indices defined by Millennium Development Goals by 2015. In order to achieve these, it is necessary to further develop measures contributing to the health of mothers and children.

Among the causes of death the leading role is still occupied by non-contagious diseases, inclusive diseases of circulatory system (36%), cancer (10%) and others; ageing of the population and tendency of increase of diseases connected with it are also observed. Despite the fact that the national program for tuberculosis was successful for the increase of percent share of recovery cases, according to the World Health Organization data, Georgia is a “high burden” country for multi-drug resistant tuberculosis. Simultaneously, Georgia is one of the few countries which has reached universal accessibility to resistant tuberculosis diagnostics and treatment.

The rate of late diagnosis of HIV (54% of cases are registered at the stage of AIDS) is high and remains as one of the serious problems. In 2010 the routine and sentinel new epidemic supervision systems were launched, which will improve the detection of infection cases in early stage.

A high level of mortality from cancer remains, due mainly to low rates of diagnosis at early I and II stages (from 25% to 30%). The fact should be stated that in Georgia only a small number of women are subjected to screening for breast and cervical cancer\(^\text{22}\).

Nationwide the population is not regularly subjected to medical examination for the assessment of spreading of risk-factors such as addiction to tobacco, alcohol and drugs, excess weight, low physical activity and inadequate nutrition. Knowledge of the level of spreading of these factors and implementation of measures for their reduction, are vitally important strategies for the impact on the main causes of morbidity and mortality.

The current national health care protection strategy of 2011-2015 needs refining, proceeding from new realities; a detailed 3-5 years operation plan should be developed which will be based on the new European strategy of the World Health Organization: the Health 2020, the latest UNO resolution in connection with universal coverage of quality medicinal services, the Adelaide agreement “Health in All Politics”, the political declaration of Rio on social determinants, UNO’s global strategy for mothers and children’s health, the New York political declaration on non-contagious diseases and others\(^\text{23}\).

\(^{19}\) Healthcare System Efficiency Assessment Report, 2013, Tbilisi
\(^{20}\) Ministry of Labor, Health and Social Affairs of Georgia; National Report 2001-2011;
\(^{22}\) Ministry of Labor, Health and Social Affairs of Georgia; National Healthcare Strategy 2011-2015;
\(^{23}\) Healthcare System Efficiency Assessment Report, 2013, Tbilisi
3.1.3 Vulnerability to climate change

According to the World Health Organization (WHO), climate change has various impacts on human health through changing the social and natural environment; this can result in an increase of air and water pollution, elevation of the frequency and intensity of extreme phenomena etc. Since 1970, the index of the annual rate of mortality conditioned by global warming reached 140,000 for 2004, and the annual financial losses associated with health will reach 2-4 billion USD by 2030.\textsuperscript{24}

WHO maintains a list of diseases which show a close connection to climate change and are known as climate-associated/dependent diseases. These diseases are cardiovascular and respiratory system diseases, mental disorders, traumas, pathologies conditioned by high temperatures and others.

According to WHO data, the specific impact of climate change on human health is made by three main characteristic phenomena of climate change: heat waves, natural disasters and altered infectious environment.

Extremely high air temperatures, lasting for several days, exert a direct impact on human health: it conditions the formation of particular diseases and aggravation of already existing ones, and it can become a cause of death too. Thus, e.g., in 2003, in Europe, 70,000 people died as a result of heat waves. According to the opinion of experts, high atmospheric temperature has an adverse impact on the functioning of cardiovascular and respiratory systems, especially in aged and chronically diseased persons.

In addition to the immediate impact, extremely high temperatures exert an indirect impact on human health: at high atmospheric temperatures, concentrations of the near-earth ozone and other air polluting substances are increased, which contribute to the occurrence of cardiovascular and respiratory systems diseases.

Since the 1960s, the number of natural disasters has increased three times.\textsuperscript{25} Correspondingly, losses incurred as a result of natural disasters have also increased, including the number of injured and deceased persons, as well as frequency of disease outbreaks which are related to the impact of extreme events. Thus, for example, flood damages canalization pipes, which results in derangement of the sanitary system and outbursts of infection epidemics. The increase of a number of natural catastrophes can also result in increase of the number of displaced persons, and economic migrants, which can be a heavy social burden for the country.

Climate change is also considered as a factor contributing to a rise in cases of infectious pathologies, especially those which are spread through water and vectors (pathogens). Thus, for example, air temperature and humidity makes great impact on the infection; e.g. on the life cycle of the mosquito that carries malaria. If the climate becomes more favourable for the vector (high temperature and humidity for the malaria vector) it will contribute to the increase in outbreaks of certain diseases.

Groups especially vulnerable to climate change are children, old persons and chronically diseased persons. Societies where the above-stated risk groups are present in high numbers are very vulnerable to climate change, and the healthcare sector will need more efforts to face and overcome the negative impacts of climate change and to adapt to climate changes efficiently.

3.1.4 Climate-related diseases in Georgia

Proceeding from the fact that the present report will consider only the peculiarities of impact of heat waves on health and the healthcare system within the city of Tbilisi, we will consider only those diseases which are affected by heat waves. Such diseases are first of all cardiovascular and then respiratory system diseases.

Generally the most rapid medicinal outcome, which is caused by heat waves is heat diseases (heat stroke, heat exhaustion and others) and death, but the report will not deal with the information about the relation between the heat waves and heat diseases, as well as lethal end, since there are no statistics on heat disease and how many people died as a result of extremely high temperature available in the country. Also more important is the consideration of cardiovascular and respiratory systems diseases, which are one of the most important climate-related diseases, because they are the most widely spread diseases in Georgia and are already a heavy economic burden on healthcare system.

Cardiovascular diseases

Among cardiovascular diseases, hypertension is considered as a disease that is most sensitive to climate change, in particular, to changes in atmospheric temperature.

Generally cardiovascular diseases, and in particular hypertension, are one of the most widespread pathologies in Georgia. According to the data of 2010, by the prevalence\textsuperscript{26} index hypertension occupied the first place among the most widespread diseases, while by the index of incidence – the second\textsuperscript{27} (the

\textsuperscript{24} A Human Health Perspective on Climate Change, National Institute of Environmental Health, April 2011
\textsuperscript{25} A Human Health Perspective on Climate Change, National Institute of Environmental Health, April 2011
\textsuperscript{26} incidence – primary morbidity; prevalence – general morbidity;
\textsuperscript{27} Healthcare, Statistic reference book, 2010.
first place was occupied by acute respiratory infections of upper respiratory tracts. Together with the fact that cardiovascular diseases occupy the first place according to frequency (incidence and prevalence)\textsuperscript{28}, a trend of increase of their frequency is observed within the scales of all Georgia (Fig. 22).

![Figure 22: Cases of cardiovascular diseases. Light blue – total cases; dark blue – new cases. Source: Health Statistics of Georgia, 2011](image)

We can draw similar conclusions about hypertension (Fig. 23). It forms half of the cases of cardiovascular diseases and is the leading cause of morbidity and mortality in Georgia. The index of prevalence of hypertension in 2011 compared to that of 2010 increased by 9.2\%, while that of incidence by 7.2\%.

![Figure 23: Cases of hypertension. Light blue – total cases; dark blue – new cases. Source: Health Statistics of Georgia, 2011](image)

A strong relationship is observed between climate change and cardiovascular diseases. On the basis of the data of WHO and international organizations\textsuperscript{29}, climate has an immediate and indirect impact on functioning of cardiovascular system. According to the USA National Institute of Environmental Health Science and Center for Disease Control (CDC) in extremely hot and cold weather, the number of ambulatory and hospital referrals and visits because of heart diseases increases twofold. According to the data of the WHO there is a direct link between high and low temperatures and heartbeat and arterial tension. Likewise, high heat results in the aggravation of pathological processes in persons suffering from chronic cardiovascular diseases. Especially high is the number of elderly persons who are affected by hypertension associated with climate: temperature change results in dilatation and stenosis of blood vessels, which in its turn becomes a reason for changes in arterial pressure. In elderly people, whose adaptation capacity is decreased, the regulation of pressure does not proceed smoothly, which contributes to hypertension.

According to the data of the IPCC Third Assessment Report, the frequency of cardiovascular diseases and mortality rate depend greatly on the duration and intensity of heat. Similarly, the rise of concentration of solid suspended particles increases significantly the number of referrals to hospitals and mortality because of cardiovascular diseases\textsuperscript{30}.

Thus, it can be stated that in a region where climate change, and in particular rise of temperature is sharply expressed, a further increase of a number of cases of cardiovascular diseases should not be surprising.

**Respiratory system diseases**

At higher air temperature the concentration of ozone and suspended solid particles in the atmosphere increases, which has a negative effect on functioning of cardiovascular as well as respiratory system. Such negative changes of atmospheric air quality increases the charge on heart functioning, and it complicates air-exchange in the lungs, which can be considered as a trigger mechanism for the formation of various diseases\textsuperscript{31}.

Respiratory tracts diseases are fairly widespread in Georgia. According to the data of 2011\textsuperscript{32} respiratory system pathologies and in particular acute respiratory infections of the upper respiratory paths occupy the first place among the 10 most widespread diseases according to incidence (index 7168.1), as well as according to prevalence (index 7600.2) indices.

Especially high is the index of respiratory tracts diseases in children: in 2011 63.7\% of morbidity in the under-15 population of the country was diseases of respiratory bodies. 55.2\% of diagnoses fixed for the first time in life come upon children. According to diagnoses of patients suffering respiratory diseases in 2011, 63.4\% of patients which left hospitals were children\textsuperscript{33}.

In 2010 there was an insignificant decrease of general morbidity in respiratory systems diseases, in 2011 its index was again increased by 6.4\% (Fig. 3).

\textsuperscript{28} Incidence – primary morbidity; prevalence – general morbidity.

\textsuperscript{29} A Human Health Perspective on Climate Change: A Report Outlining the Research Needs on the Human Health Effects of Climate Change; April 22, 2010; www.niehs.nih.gov/climatereport


\textsuperscript{32} Healthcare, Statistical reference, 2011.

The group of respiratory system (RS) chronic diseases (asthma, allergic diseases of respiratory system, Chronic Obstructive Pulmonary Disease (COPD), pulmonary professional diseases, pulmonary hypertension) covers the main part of diseases of respiratory system and also can be associated with climate change: according to the opinion of scientists extremely high temperature can result in an increase of ground level ozone concentration, which in its turn will negatively affect the functioning of respiratory system organs, as ozone injures pulmonary tissue as a result of which respiratory infections, asthma and other chronic diseases can develop more easily. Among chronic diseases of respiratory system the most sensitive to climate are COPD and asthma.

\(^{34}\) [http://www.epa.gov/climatechange/impacts-adaptation/health.html](http://www.epa.gov/climatechange/impacts-adaptation/health.html)

In 2011, 44.9% of respiratory tract chronic diseases came on (in children – 55.1%) as pulmonary chronic obstruction diseases. The greater part of COPD (95.4%) was not-fixed bronchitis (in children - 99.4%). Compared to the previous year these data are significantly increased.\(^ {35}\)

In 2011, compared to 2010, the index of asthma and the asthmatic status prevalence index in the overall population has almost not been changed, while at the same time incidence of new cases decreased insignificantly, by 18.5%; in children incidence index decreased by 14.6% (Fig. 4). The share of asthma in respiratory system diseases formed 2.9%, while in the group of chronic diseases of lower respiratory tracts it equalled 35.9%.


### 3.2 HEAT WAVES AND HEALTH RISK IN TBILISI

#### 3.2.1 Cardiovascular diseases in Tbilisi

According to the index of spreading of cardiovascular diseases, Tbilisi occupies the first place compared to the regions. According to the latest medicinal statistics drawn in 2011, the prevalence index of cardiovascular diseases in Tbilisi is higher than in other places of Georgia and it equals to 13,577. The incidence index is lower compared to that of the regions (2,422.1), but since the computation of incidence index, as well as that of prevalence is carried out per 100,000 population and the number of Tbilisi population exceeds greatly the index of the population of the regions, incidence index here is low. In spite of this, according to the absolute value of new cases of cardiovascular diseases, Tbilisi is still a leader: 28,281. According to the spreading of hypertension diseases Tbilisi is also a leader. According to prevalence index it is a leader: 6530.9, according to incidence index it is on the 5\(^{th}\) place, although according to the absolute index of new cases it is still on the first place: 14,137.\(^ {36}\)

Tbilisi is a leader according to stationary and hospital services of cardiovascular diseases: the number of patients discharged from hospitals equals to 22,293, inclusive those deceased (1,162). The percentage value of lethality is relatively low and it equals to 5.2%. This analysis of trends of annual spreading of cardiovascular diseases was made on the basis of the data which were received from the Medicinal Statistics Department of the National Center for Diseases Control and Public Health and the data of Tbilisi ambulatory-policlinic organizations, which show numbers of the primarily exposed (in the life) cardiovascular diseases and respiratory diseases for 2003-2012.

\(^{36}\) Healthcare Statistics Department, National Center for Disease Control and Public Health, www.ncdc.ge
On the basis of these data it was shown that the highest index of cardiovascular diseases was fixed in 2003-2008. Arterial hypertension incidence was the highest in 2003. In other years the data are similar. In 2003-2006 compared to the data of other years, the number of heart attacks and myocardium infarctions is high too (see Annex 1).

As to the monthly trend of spreading of cardiovascular diseases, the highest index is fixed in 2003, when the highest number of cardiovascular diseases was fixed and 2010, when incidence compared to other years is the least (see: Figure 5). As is shown from the graph, cardiovascular diseases are fixed more frequently in March-May, and incidence is the lowest in August.

As is seen from the graph the highest index of hypertension was fixed in 2003, while in 2010 in January; the least index in both years was fixed in August.

To visualize heart attack and infarction monthly trend we chose 2003, when the incidence index was high (see: Figures 28 and 29).

As is seen from figures 28 and 29, the spread of heart attack episodes and myocardial infarction is not homogeneous throughout the year, although in August and September the least index is fixed.

Analysis of data shows that it is hard to reveal a monthly relationship between cardiovascular diseases and high temperature, since a high occurrence of cardiovascular diseases is not revealed in hot season period when the attacks of heat waves...
are expected. Possibly a closer connection would have been revealed if we compared the daily number of extremely hot days and visits and referrals to hospitals or urgent medical aid services because of cardiovascular diseases, but such statistical research is rather time-consuming and labour-intensive, and not very justified when an annual rise in frequency of cardiovascular diseases, as well as increase of number of extremely hot days (see chapter 2.3.4) is fixed even without it.

3.2.2 Respiratory system diseases in Tbilisi

According to the data from 2011, by the prevalence of respiratory system diseases, Tbilisi is a leader and the index equals to 14911.3, while by the incidence it is on the second place after Shida Kartli (13103.2). The frequency of spreading of asthma is high. The prevalence is not the highest, but according to absolute data, Tbilisi is a leader: the number of cases registered by the end of the year equalled 4,047, while the number of new cases is 704, which compared to the number fixed in regions is the highest index.

In 2011 in Tbilisi the majority of people who were hospitalized and were discharged from hospitals suffered from respiratory system diseases: 19,863. Similarly high was the mortality rate conditioned by respiratory system diseases, which equalled 2.2%.

An analysis of the trends of the annual spreading of respiratory system diseases was carried out on the basis of the data which was provided by the Medicinal Statistics Department of Diseases Control and Public Health National Center. This is the data of Tbilisi ambulatory-polyclinic organizations, which show numbers of primarily revealed cardiovascular and respiratory system diseases for 2003-2012.

According to the analysis, the incidence of respiratory system diseases in Tbilisi was the highest in 2003, then the index decreases, although in 2011 it again increases. For better demonstration of monthly data we gave preference to these two years 2003 and 2011. (see: Figure 30).

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<td>39</td>
<td>41</td>
<td>43</td>
</tr>
</tbody>
</table>

Note: Heat index is defined when a person is in shade, with a slight wind. Direct sun or dry hot wind can change the value of heat index by more than 10°C.

Figure 30: Incidence of respiratory diseases in Tbilisi by month in 2003 and 2011. Source: NCDC

The index of spreading of respiratory system diseases as well as that of cardiovascular diseases is low in hot season of the year, which shows that for the assessment of impact of climate change and in particular extremely high temperature...
on human health it is better to take long-term periods and to observe over the dynamic of several years.

3.2.3 Heat waves and human health

There is no official definition of a heat wave in Georgia, but according to the opinion of a number of experts it is a period of extremely high temperature that persists for a long period. Definitions vary according to countries and it depends on temperature maximum, humidity and other atmospheric factors, as well as on the length of extremely hot days. Thus, for example, if for one country it is sufficient to exceed the average temperature by 5°C for 2 days, for other countries the temperature can exceed the average value by as much as 10°C and such change can last up to one week.

High temperature has various effects on health. It can result in the formation of various diseases and it can aggravate already existing chronic pathologies and even can cause death. Among the most rapid results of impact are: heat stroke, heat exhaustion, heat cramps (muscle spasms), and skin rash. Additionally, periods of high temperature can aggravate chronic diseases including cardiovascular and respiratory system diseases. High temperature is able to exert a direct impact on health (as described above) and to affect it indirectly: e.g. during periods of high temperature the concentration of surface ozone increases in atmosphere, which results in increase of frequency of damage of lungs (asthma and obstructive pulmonary diseases) and respiratory diseases and contributes to their aggravation.

High temperatures can become a cause of fatalities too. In 2003, 70,000 people died because of heat waves in Europe, inclusive up to 15,000 in France alone. The main cause of such fatalities is lack of preparedness for extremely high temperature and low awareness of the risks among the population. Among those victims of European heat waves were particularly elderly and homeless people.

3.2.4 Impact assessment by Heat Index

Individuals perceive one and the same atmospheric temperature differently, which is conditioned by the quality of air humidity. Such perception of temperature was called by meteorologists Heat Index (HI). HI data used in the present research are taken from the studies of R.G. Steadman and are accurate data when relative humidity (RH) is added to factual air temperature. The values of heat indices are offered in Table 1, which are taken from the server of the US National Weather Service.

The definition of heat waves is closely related to the HI. In a general sense a heat wave can be defined as a prolonged period of excessive heat. We consider not only the values of heat indexes, but also the absolute numbers.

Table 2 shows the classification of HI into risk levels, and the possible health risks.

In the last column of Table 1, just for simplicity, we offer our estimates. It should also be stated that the days when heat indices were not computed because their air temperatures and relative humidity indices are below 22.2°C and 10% correspondingly, we marked as “normal” and gave in white color, and “warm”-in green color, the values for which heat index formula was computed, but their values don’t belong to heat index risk group, that is, heat indices of which are less than 26.6°C.

Current values of heat indices on the territory of Tbilisi

In the tables given below we show changes of heat indices according to two periods (the first period 1961-1985 and the second period 1986-2010). Not only were the number of annual average extreme days calculated (Table 3 a), b), c)), but also their average significances were computed (Table 4 a), b), c)).

To make the picture clear we consider not only the average air temperature, because daily average air temperature cannot

<table>
<thead>
<tr>
<th>Risk level</th>
<th>HI</th>
<th>Possible health risks</th>
<th>Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caution</td>
<td>27–32°C</td>
<td>tiredness at long stay at high temperature or at physical activity</td>
<td>very warm</td>
</tr>
<tr>
<td>Extreme caution</td>
<td>32–41°C</td>
<td>Sun stroke, muscle cramp and/or thermal exhaustion, which can develop at long stay at high temperature or at physical activity</td>
<td>hot</td>
</tr>
<tr>
<td>Danger</td>
<td>41–54 ºC</td>
<td>Mostly sun stroke, muscle cramp and/or thermal exhaustion. Thermal stroke is developed at long stay at high temperature or at physical activity</td>
<td>very hot</td>
</tr>
<tr>
<td>Extreme danger</td>
<td>54 ºC or more</td>
<td>Sun or thermal stroke</td>
<td>Extremely Hot</td>
</tr>
</tbody>
</table>
show the whole picture (in some cases it is enough to have just two hours with very high HI values that affect people), but also maximum and minimum air temperature, and of these were calculated the average, maximum and minimum values of heat indexes correspondingly.

Table 3. Average number of extremely hot days:

<table>
<thead>
<tr>
<th>Average-daily Tbilisi</th>
<th>1961-1985</th>
<th>1986-2010</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>87.36</td>
<td>75.76</td>
<td>-11.6</td>
</tr>
<tr>
<td>Warm</td>
<td>47.52</td>
<td>45.08</td>
<td>-2.44</td>
</tr>
<tr>
<td>Very Warm</td>
<td>17.92</td>
<td>31.28</td>
<td>13.36</td>
</tr>
<tr>
<td>Hot</td>
<td>0.2</td>
<td>0.88</td>
<td>0.68</td>
</tr>
<tr>
<td>Very Hot</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Extremely Hot</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total number of</td>
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<td>32</td>
<td>14</td>
</tr>
<tr>
<td>dangerous days per year</td>
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</table>

b) Maximum daily heat index

<table>
<thead>
<tr>
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<tr>
<td>Normal</td>
<td>19.32</td>
<td>19</td>
<td>-0.32</td>
</tr>
<tr>
<td>Warm</td>
<td>27.36</td>
<td>20.72</td>
<td>-6.64</td>
</tr>
<tr>
<td>Very Warm</td>
<td>51.8</td>
<td>43.92</td>
<td>-7.88</td>
</tr>
<tr>
<td>Hot</td>
<td>45.24</td>
<td>46.84</td>
<td>1.6</td>
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<tr>
<td>Very Hot</td>
<td>9.12</td>
<td>22.2</td>
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</tr>
<tr>
<td>Extremely Hot</td>
<td>0.16</td>
<td>0.32</td>
<td>0.16</td>
</tr>
<tr>
<td>Total number of</td>
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<td>113</td>
<td>7</td>
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<tr>
<td>dangerous days per year</td>
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</table>

c) Minimum daily heat index

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Normal</td>
<td>149</td>
<td>144.6</td>
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<tr>
<td>Warm</td>
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<td>8.32</td>
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<tr>
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<tr>
<td>Hot</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Very Hot</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Extremely Hot</td>
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<td>0</td>
</tr>
<tr>
<td>Total number of</td>
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<tr>
<td>dangerous days per year</td>
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</table>

Table 4. Average values of extremely hot days (°C):

These tables show the average values of daily average, maximum and minimum heat indexes per year of two time periods and also their differences, or how the maximum and minimum heat indexes values accordingly grow per year for each group of heat indexes.

a) Average daily heat index

<table>
<thead>
<tr>
<th>Average-daily</th>
<th>Tbilisi</th>
<th>1961-1985</th>
<th>1986-2010</th>
<th>Difference</th>
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<tbody>
<tr>
<td>Normal</td>
<td>18.64</td>
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<td>-0.24</td>
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<tr>
<td>Warm</td>
<td>25.35</td>
<td>25.43</td>
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<tr>
<td>Very Warm</td>
<td>27.99</td>
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<td>0.32</td>
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<tr>
<td>Hot</td>
<td>33.34</td>
<td>33.10</td>
<td>-0.24</td>
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<tr>
<td>Very Hot</td>
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</tr>
<tr>
<td>Extremely Hot</td>
<td></td>
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</tr>
<tr>
<td>Average value of dangerous days per year</td>
<td>30.66</td>
<td>30.70</td>
<td>0.04</td>
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</tbody>
</table>

b) Maximum daily heat index

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</thead>
<tbody>
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<td>Normal</td>
<td>19.64</td>
<td>19.25</td>
<td>-0.39</td>
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<tr>
<td>Warm</td>
<td>25.53</td>
<td>25.53</td>
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<tr>
<td>Very Warm</td>
<td>29.21</td>
<td>29.37</td>
<td>0.17</td>
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<tr>
<td>Hot</td>
<td>35.72</td>
<td>36.00</td>
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<tr>
<td>Very Hot</td>
<td>43.88</td>
<td>44.63</td>
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<td>Extremely Hot</td>
<td>57.87</td>
<td>57.05</td>
<td>-0.82</td>
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<tr>
<td>Average value of dangerous days per year</td>
<td>41.67</td>
<td>41.76</td>
<td>0.09</td>
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</table>

c) Minimum daily heat index

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<td>24.96</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Hot</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very Hot</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely Hot</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average value of dangerous days per year</td>
<td>-</td>
<td>27.15</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Temperature indices are grouped according to risk groups and their annual mean values, and the mean values are calculated for the first and second time periods. In the last columns the differences are given between the average annual HI of the first period and average annual HI of the second period. Analysis of the offered tables enables us to see that the mean-daily (Table
3 a) and maximum daily (Table 3 b) HIs in the second period increase by 14 and 7 days, correspondingly compared to those of the first period. As to the number of extremely high temperature days of minimum-daily (Table 3 c) HI, this changed slightly, although there is a tendency of increase: e.g., in the first period the number of extreme days was not fixed at all, and in the second period the days were fixed in the the HIs which belong to “very warm” group.

The values of average daily and maximum daily extreme heat indices 2010, as is seen from the tables (Tables 4 a, b, c) increase approximately by 0.04°C and 0.09°C respectively. Most obviously this increase is expressed in average daily HIs (Table 4 a) in the values of the group “very warm” (increased by 0.32°C) and the values of maximum daily (Table 4 b) HIs increased by 0.17°C, 0.28°C and 0.75°C in the following groups: “very warm”, “hot” and “very hot”, respectively. As to the minimum-daily (Table 4 c) HIs, as it was stated, extreme indices were not fixed above in the first period and in the second period indices of “very warm” group were fixed, by average 27.15°C values. Therefore, we could not state as to by how many degrees the relevant group of HIs were increased, although the increase was apparent. Similarly values of “normal” days and “warm” days were increased by 0.4°C and 0.16°C respectively.

As is seen, the increase of number of extremely hot days and temperatures in the two periods taken for comparison (1961-1985 and 1986-2010) is apparent, which can be associated with the increase of number of climate-related diseases. Because of the absence of corresponding medicinal statistics it is impossible to assess changes in climate-related diseases incidents and prevalence in the time intervals taken here. We can make definite conclusions only on the basis of superficial data: if an annual increase of number of extremely hot days will be fixed, together with the increase of temperature values of those days, and if simultaneously we have the conclusions of scientists that extremely high temperatures contribute to formation of series of pathologies, we can suppose that a sharp increase of incidence and prevalence of climate-related diseases may be connected with temperature factor and if HI values will continue a still more sharp increase, the number of climate-related diseases, which in Georgia and particularly in Tbilisi are very high, may grow still more.

**Future values of heat indices on the territory of Tbilisi**

The tables below show changes in the HIs in to two periods (the first period 1986-2010 and the second period 2025-2049). Not only the number of annual-average extreme days, but also their mean temperature values were computed (Tables 5 and 6). If for the computation of heat indices for present day we took maximum temperature values, for future we used only mean temperature values.

<table>
<thead>
<tr>
<th>Average-daily</th>
<th>Tbilisi</th>
<th>1986-2010</th>
<th>2025-2049</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>1894</td>
<td>1253</td>
<td>-641</td>
<td></td>
</tr>
<tr>
<td>Warm</td>
<td>1127</td>
<td>990</td>
<td>-137</td>
<td></td>
</tr>
<tr>
<td>Very Warm</td>
<td>782</td>
<td>1262</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Hot</td>
<td>22</td>
<td>245</td>
<td>223</td>
<td></td>
</tr>
<tr>
<td>Very Hot</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Extremely Hot</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total number of dangerous days for whole period</td>
<td>804</td>
<td>1507</td>
<td>703</td>
<td></td>
</tr>
</tbody>
</table>

**Analysis of the tables enables us to make the following conclusions:**

The average daily (Table 5 a) HIs absolute number in the second period may increase by 703 days, while according to
average annual number by 28 days (Table 5 b). The value of average annual days may increase in future by 0.68 (Table 6).

If we compare HI changes of 25-years long intervals in the future (1986-2010 and 2025-2049) with the data of the present period (1961-1985 and 1986-2010), we can see that in the future HI values will suffer greater changes than at present.

In 1961-1985 and 1986-2010 the alteration of the average daily HI (number of days) equals to 14, that is, at the calculation with respect to average annual values, the average number of HIs of 1986-2010 compared to 1961-1985 has increased by 14. In the future a twofold increase is expected: the number of HIs in 2025-2049 is 28 times more than in 1986-2010. The values of the HI sharply increase in future: in 1961-1985 and 1986-2010 the difference equals to 0.04°C, while in future, the values of HIs in 2025-2049, increase by 0.68°C compared to that of 1986-2010.

Such changes enable us to make the following conclusion: an increase of extremely high temperature values in the future may be accompanied by still further increase of those climate-associated diseases, which are more sensitive to temperature changes and which show a trend of increase of incidence and prevalence indices today. In addition to the increase of frequency of non-contagious diseases, which for Georgia and Tbilisi is a problem, the number of cases of infectious diseases might be increased too, in particular those initiated by infections through vectors (e.g. malaria) and there really is a threat of their appearance and spreading (in neighbouring countries frequency of their spreading is high).

3.2.5 Recommendations for sustainability/resistance of health care sector to climate change

The following recommendations have been developed for the healthcare sector in Georgia to improve adaptation to climate change, and particularly to respond to the challenges of increased heat waves in Tbilisi.

- Contribute to the inclusion of a climate change component in the National Environment Health Strategy document; strengthen a strategy of management of climate-related diseases during heat waves; initiate the expansion of a “green policy” – supporting greening of urban spaces, the presence of water bodies as well as considering increased heat wave risk in new building constructions with particular focus on vulnerable groups (e.g. school buildings, homes for elderly, hospitals).

- Raise the awareness of Tbilisi municipality about climate-related diseases through the organization of a media campaign: TV programs, preparation of information material on the topic “Impact of heat waves on human health and prevention measures”; involvement of local NGOs in the awareness-raising campaign to reach vulnerable groups of society.

- Raise the awareness of primary health care health professionals of Tbilisi (ambulatory doctors and personnel of emergency service department) on the risks of climate change and health through trainings on climate-related disease managemen. The guideline for health care professionals on climate change ("The Boomerang Principle") was published in 2008 which may need additional revision.

- Elaborate and implement a citywide heat action plan (HAP) based on the best international practices and WHO recommendations. The formation of an Early Warning System (EWS) is an important part of the HAP with the active involvement of following links: meteorological station, which will timely notify the National Center for Diseases Control and Public Health about approach of heat waves, which will in turn notify Tbilisi Primary Healthcare services for mobilization; One of the main component of the system must be local NGOs, specifically including the Georgian Red Cross Society which will be obliged to reach the most vulnerable groups in a timely manner.

- Conduct further research on the impact of climate change, in particular, the impact of high temperature on the concentration of particulate matters (PM) in the atmosphere and the effect of PM on distribution of cardiovascular and respiratory diseases, and if the research will show that concentration of PM is high, the development of a strategy for concentration management will be needed.
4. Responding to climate change

4.1 Public Awareness

The informing of concerned parties, target groups and wider society of and raising their awareness about climate change and its impacts is one of the main components of all projects and programs related to climate change in the country. In recent years, activities have especially intensified in this direction. Campaigns focused on various target groups of the society have been implemented, involving mass media; thematic trainings have been organized for target groups, practical instructions, information and educational materials targeted at local population, farmers, school teachers and pupils have been published. As a result, gradually a potential is being formed in the country for planning and implementing climate change adaptation and mitigation measures at the country and local levels.

In spite of this, there remains a low level of awareness about issues of climate change at the national and local levels, and insufficient integration of these issues in the plans for development of various sectors which greatly hampers designing and implementation of efficient ways for problem resolution.

People who are authorized and responsible to make decisions at the national level have not enough information about current and forecasted impacts of climate change on various sectors, as well as about modern adaptation methods, modern means and facilities for technical provision. With this in view it would be very important to develop corresponding practical methodological instruction documents.

Within the framework of the EU-funded project “Strengthening of local facilities/opportunities and regional cooperation for adaptation to climatic change and conservation of biodiversity in Georgia and the South Caucasus” implemented by Mercy Corps Georgia and CENN, an educational information manual was prepared for school children titled “Global Climate Change and Georgia”. Simultaneously, trainings were organized in the project target regions (Sagarejo, Dmanisi, Ninotsminda, Mameuli and Bolnis) for school teachers. In their turn teachers organized open lessons in selected schools. The selection of interactive and creative teaching methods incited great interest among school children and active discussions during lessons. In all up to 1300 pupils from the selected regions took part in those trainings. In 2014, within the framework of the same project it is planned to prepare a manual dealing with the issues of disaster risk management and to organize analogous trainings for school children and teachers.
The level of awareness about climate change at the local level differs according to municipalities, although as a whole, the awareness level is very poor. Municipalities where projects about adaptation to climate change have been implemented and awareness-raising campaigns have been organized know more about the issue. The risks connected with climate change are considered by them to be important but in reality the potential impacts connected with climate change and its impact on local economy and welfare of the population is not considered in the process of planning at the local level, and most of municipalities are not ready for adaptation to climate change.  

Let’s Jointly Create a Sustainable Future  
A week dedicated to climate change in Georgia

The NGO “Ekokhedva” (EcoVision) implements projects, which are directed towards climate change mitigation through the inculcation of energy saving and energy efficiency principles. Within the framework of these projects, energy-efficient measures for the warming of classrooms have been organized at schools. Energy-efficient furnaces were distributed to schools with the result that the quantity of wood previously used at schools for heating classrooms has now been reduced twice. Lamps were replaced by eco-lamps, and thus electric energy consumption was reduced by 40%. Children register reduction of carbon dioxide emission as a result of implemented measures. 300 public schools are engaged in this project. Manuals were issued such as “Energy Economy” and “Our Energy” and trainings were organized for more than 600 school teachers. The organization also prepared cognitive special programs for children dedicated to climate change, within the framework of the children’s program “Ecovision” (http://www.youtube.com/watch?v=CgJqtq-58dM). The projects is implemented with the support of Ministry of Foreign Affairs of Norway, the Association of Nature Protection of Norway (Norges Naturvernforbund) and the German International Society (GIZ).

Energy efficient schools

For five years at the initiative of the Georgia Green Movement and Friends of the Earth, an annual week has been arranged in Georgia dedicated to climate change. The event aims to mobilize society and to engage people actively in the processes of mitigating of problems resulting from climate change. In the measures planned within the framework of the event, NGOs, social groups, school students, universities, and representatives of the Ministry of Environment and Natural Resources take part in organized activities together. In 2013 a march of bicyclists, a flashmob and the “Yes to renewable energies” campaign were organized within the frames of the week. Climate change weeks are organized in Georgia with the financial support of the European Commission delegation.

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4.2 NATIONAL POLICY AND LEGISLATION FOR REDUCTION OF CLIMATE CHANGE AND DISASTER RISKS

4.2.1 Policy for adaptation to climate change and responsible authorities

In the field of climate change, Georgia is a party of the following significant diverse international treaties:
- United Nations Framework Convention on Climate Change (UNFCCC)\(^{43}\)
- UNO Climate Change frame convention Kyoto protocol \(^{44}\)

The first (1997-1999) and second National Communications (2006-2009) to the UNFCCC of Georgia are the main political documents, which depict impact of climate change and define adaptation possibilities.

During preparation of the Second National Communication to UNFCCC, scenarios of projected climate change were developed and the vulnerability of three priority regions of Georgia – Black Sea coastal zone of Georgia, Dedoplistskaro municipality (Kakheti semi-arid zone) and Lentekhi municipality (Svaneti, high mountainous zone) to climate change were assessed; an adaptation strategy was developed for those three selected/priority regions and adaptation options were developed.

Recommendations developed within the framework of the Second National Communication in connection with reducing the impact of climate change on the Black Sea coastal zone was integrated in the state strategy of Georgia for regional development for 2010-2017 \(^{45}\). According to the above referred document, plans for regional development should take into consideration the forecasted results of climate change impact on coastal zone and in the mouths of rivers (especially in the River Rioni mouth), and the systems for monitoring and early notification of floods and flash floods should be arranged.

In 2012 the process of the preparation of the Third National Communication to the UNFCCC (TNC) was started, which will be continued till December 2014. Target territories for the vulnerability assessments within the preparation of TNC are Adjara, Kakheti and Upper Svaneti. During the preparation of the Third National Comunication, an electronic database has already been prepared for making an inventory of greenhouse emission gases (GHGs) and the national inventory for greenhouse gas emissions was carried out (2006-2010) for the following sectors: energy (excluding transport), industry, waste management, land tenure, land use change and forest-utilization (LULUCF), and the process of preparation of strategy for climate change for Adjara Autonomous Republic was completed.

In 2012 government of Georgia approved the National Program (2012-2016)\(^{46}\) for Environment Protection measures (NEAP). According to the Program the long-term (20 years and more) goals planned for the sphere of climate change are as follows:
- Provision of security of the population of Georgia through adaptation measures to climatic change;
- Reduction of effect of greenhouse gas emissions.

To achieve the long-term goals the following short-term (5 years) tasks have been planned:
- Task 1: Realization of adaptation measures in the regions vulnerable to climate change;
- Task 2: Determination of the impact of climate change on other regions and sectors
- Task 3: Creation of an environment contributing towards the reduction of greenhouse gasses emission;

The NEAP offers also operational plans to achieve these short-term objectives. Designed adaptation measures are focused on priority regions (Black Sea coastal zone, Dedoplistskaro and Lentekhi municipalities); simultaneously the measures are designed for assessment of impact of climate change in high mountainous and semi-arid regions and preparation of a package of corresponding adaptation measures, which, as it was stated above, is in the process of development within the framework of the preparation of the Third National Communication.

The document of the Government of Georgia “National data and trends for 2014-2017” (BDD)\(^{47}\) plans to prepare the country’s plan for adaptation of branches of economic and ecosystems to climate change and preparation of national strategy for low-emission development.

In 2010 Tbilisi joined “Covenant of Mayors”, according to which Tbilisi and Rustavi undertook to reduce CO\(_2\) emission by a minimum 20% compared to 2002. This agreement also provides

\(^{43}\) Is in force in Georgia on the basis of the resolution of the Cabinet of Ministers of Georgia #302, May 16, 1994

\(^{44}\) Is in force in Georgia on the basis of Resolution of the Parliament of Georgia dated 28 May, 1999.

\(^{45}\) Was approved by the Government of Georgia by the resolution of June 25, 2010 #172, “On regional development of Georgia for 2010-2017 yy. About approval of the state strategy and creation of governmental commission for regional development”

\(^{46}\) Was adopted at the order # 127 of the Government of Georgia, dated January 24, 2012

\(^{47}\) The document for main data and trends of the country is the average-term plan for development of Georgia, to be developed by the government of Georgia
for the implementation of an operational plan contributing to sustainable power generation.

The authority that is responsible for the implementation of obligations undertaken by the UNFCCC and correspondingly responsible for development and planning of policy and legislation for this sphere is the Ministry of Environment and Natural Resources of Georgia. The Service for Climate Change within the Ministry is responsible for the assessment of impacts and risks of climate change, and coordinates the preparation of adaptation strategies and action plans and their implementation, as well as preparation of the National Communications to the UNFCCC, implementation of the national inventory for greenhouse emissions and submittal of a report to the UNFCCC.

The role of departmental ministries is key (Ministries of Energy, Agriculture, Labor, Health and Social Affairs) for the assessment of the vulnerability of various sectors to climate change for the process of preparation of adaptation measures. The integration of issues of climate change in educational programs is within the competence of the Ministry of Education and Science.

4.2.2 Policy for the reduction of disaster risk and responsible authorities

In 2005 the government of Georgia ratified the Hyogo Framework for Action (HFA) 2005-2015 Building the Resilience of Nations and Communities to Disasters. Through this step the government demonstrated that disaster risk reduction has become one of the country’s priorities.

In the Concept for National Security of Georgia48 specific attention is paid to prevention and preparedness for natural and man-made disasters (such as floods, landslide, avalanche, as well as prevention of industrial accidents). The importance of regional cooperation to increase ecological security is underlined.

The short terms objectives defined by the NEAP are as following: modernization of the early warning system, reduction of the impacts of floods, restoration of artificial impact mitigation works for certain types of natural disasters (hail, droughts, snow avalanche) and reduction of industrial accident risks49.

The development of the industrial accidents prevention policy, as well as improvement of risk assessments and early warning systems are planned through the “Main data and trends of the country for 2014-2017” (BDD)50, which provides for realization of the following measures in the sphere of management of the catastrophe risk:

- Development of policy of prevention of industrial accidents according to European Union approaches;
- Improvement of mechanisms of assessment of natural catastrophes;
- Development and improvement of disaster forecasting and the system for early warning of the population;

Several state organizations take part in the management of disaster risks:

The main authority that determines the policy of the sphere of disaster management is the National Security Council. The governmental commission for the management of force majeure situations coordinates (at the central level) the management and prevention of force majeure situations, and the activity of all authorities integrated in the united system for the mitigation of their results.

The Ministry of Environmental Protection and Natural Resources of Georgia is the coordinator of the execution of the Hyogo Framework for Action at the country level. Functions of the National Agency for Environment of the Ministry of Environmental Protection and Natural Resources of Georgia include implementation of hydro-meteorological and geo-dynamic observations; development of projections and forecasts, preparation of special warnings about expected/forecasted hydro meteorological and geological hazards and about extremely high environment contamination, notification, the assessment of threatening risks, and planning of prevention measures.

The Ministry of Regional Development and Infrastructure participates in the activity for the mitigation of disaster impacts; it coordinates the building and rehabilitation of hard infrastructural measures for disaster prevention.

The Technical and Building Inspection of the Ministry of Economics and Sustainable Development of Georgia provides

48 Approved by Decree NS89-RS dated 23 December 2011 of the Parliament of Georgia “On approval of the national security concept of Georgia” It is a fundamental document, which defines the fundamental national values and interests, establishes the vision of safe development of the country, and determines existing dangers, risks and challenges and general directions of security policy.


50 Document for the main data and trends of the country is the plan of the basic average-term development, which is to be developed by the government of Georgia http://www.mof.ge/BDD
state supervision and control over the objects of excess technical danger.

The Competency of the Ministry of Accommodation of Displaced Persons and Refugees from Occupied Places covers the issues of accommodation of those affected by disasters.

Currently the Ministry of Environmental Protection and Natural Resources of Georgia considers the issue of reduction of disaster risk as one of its main priorities. Consequently, in 2013, a special structural entity was created at the Ministry: the Service for Management of Natural and Anthropogenic Risks, the main functions of which are: development and coordination of the DRR strategy and policy, as well as programs and projects, realization of the measures for DRR, cooperation with stakeholders and facilitation of formation of the national platform on DRR.

Recently the main focus in Georgia was shifted to creation of facilities for quick and efficient response to natural disasters and technical disasters while financial resources were mainly directed for reducing the impacts of natural disasters and only small amounts to the realization of prevention measures.

The activities of local management authorities in the management of disaster risks are mainly directed for reduction of the impacts of natural disasters, such as support to the population in the restoration of their houses. Very insignificant is their role in planning and realization of prevention measures. Bodies of local powers occupy a very passive position in the sphere of adaptation to climate change and disaster risk management. In some municipalities there are projects focused on reduction of climate change and disaster risks, which are realized by international or local non-governmental organizations which are in progress or have already been completed. In spite of this, the institutional facilities of local management bodies are limited. They do not possess facilities fit to overcome challenges connected with climate change at local level and to plan and realize adaptation measures.

The system of management of reduction of disaster risks covers also international and local non-governmental organizations, universities and research institutes. Despite the available multi-branch and sector composition there is no efficient coordination among participants. As a whole, at the central level, the current institutional potential is not sufficient for the provision of application of inter-departmental approaches in the process of preparation of documents determining the policy for integration of issues connected with adaptation to climate change and reduction of disaster risks, and for efficient inter-departmental coordination in this sphere.

In the creation of thorough and efficient national platform for reduction of catastrophe risk, which is stipulated by the Hyogo Framework for Action (2005-2015) and which will efficiently coordinate the activity of the above referred organizations, the government of Georgia receives technical support from the UNDP through the project “Perfection of system for reduction of catastrophe risks”. It was with the support of the project that a DRR think tank, was created which holds regular meetings of representatives of decision-making persons, researchers and scientists, and non-governmental organizations for mobilization of knowledge, experience and resources for integration of DRR issues into sectoral development policies; it also contributes to and strengthens the coordination of current programs. One of the first initiatives of the project was the development of profiles of organizations working in the DRR sphere, which is given on the web-site: http://www.undp.org.ge/files/24_853_170970_3W-201003.pdf

4.2.3 Legislation for the sphere of management of climate changes and disaster risks

There are several key pieces of legislation outlining the national response to climate change, disaster risk management and environmental protection, which are outlined below. According to the law “On Environmental Protection” (1996), people carrying out activities climate change mitigation are obliged to observe norms fixed for emission of greenhouse gases and to implement measures for their reduction (Article 51).

The law of Georgia “On Protection of Atmospheric Air” (1999) defines the minimum permissible norms of harmful substances emitted from polluting sources to atmospheric air. For the activities which are subject to ecological examination, permitted minimum norms for emission are to be determined in the process of assessment of the environment impact and approved at the moment of issuance of a permit, for a term of five years. For the activities which are not subject to ecological examination technical report of inventory of stationary sources of air pollution and harmful components emitted by them is developed. For such activity there are technical regulations approved by the Minister of Environmental Protection and Natural Resources, which fixes maximum values for emitted harmful substances.

The law “About Atmosphere Air Protection” fixes the coordination of the country’s program for climate change and for the development of the action plan for the fulfilment of obligations undertaken by Georgia under the UNFCCC, which should be realized by the Ministry of Environmental Protection and Natural Resources, while the observation over climate change, its analyses and scientific-research works should be
implemented by the National Agency for Environment of the system of the same Ministry.

The law “About protection of the population and territories from force majeure circumstances of natural and anthropogenic character” (2007), is the main legal act for the sphere of management of natural disaster risk; it defines the rights and responsibilities of central and local managerial bodies in reaction to force majeure situations, sources of funding, it defines publicity of information about force majeure circumstances, as well as obligation to prepare the population and carry out educational propaganda.

For the activation of a united system for prevention of force majeure circumstances in the country and for the mitigation of disaster impacts, in August 2008 at the order of the president of Georgia (№415) the “National Plan for Reaction/Response to natural and anthropogenic character force majeure situations” was approved. The document defines in detail how emergency rescue and restoration works should be organized and coordinated in force majeure situations, as well as the responsibilities of definite ministries, other state institutions and local management bodies.

4.2.4 Monitoring of climate change and management of disaster risks, study and early notification

Observations of climate change, analysis, forecasting and research works are carried out by the National Agency for Environment (Legal Entity of Public Law of the Ministry of Environment Protection and Natural Resources)\(^\text{51}\).

There is no modern system for early warning in Georgia yet. The stationary network for observation over standard hydro-meteorological parameters is weak. From 148 hydro-meteorological and 180 meteorological stations which were functioning in 1990, only 35 and 58 respectively are functioning today. No distance observations over specialized hydro-meteorological parameters are carried out; modern models of hydrological forecasting and modern technologies for statistical treatment of multiyear hydro-meteorological and geological threats are not duly calculated. Because of insufficient resources geological studies are performed only in high-risk areas and it makes annual forecasting of dangerous geological phenomena risks (landslides, mudflows) treated by the National Agency for Environment not wholly reliable (not of whole value).

Only 7 posts for observation of air pollution are functioning in Georgia: 3 in Tbilisi, 1 in Rustavi, 1 in Kutaisi, 1 in Zestafoni and 1 in Batumi. Existing stations, the methodologies for pollution rate measurement, and data treatment systems all need renovation and updating.

Actions for the introduction of a modern early warning system are being undertaken by the National Environmental Agency with the support of the UNDP, the Czech Development Agency and the Slovakia Development Agency.

\(^\text{51}\) http://www.meteo.gov.ge/

4.3 REGIONAL INITIATIVES FOR REDUCTION OF CLIMATE CHANGE AND DISASTER RISKS

In 2010-2011 the “Environment and Security Initiative” (ENVSEC) carried out a study of regional impacts of climate change in the Caucasus countries (Armenia, Azerbaijan, Georgia). The project aimed to improve knowledge about the impacts of climate change and cooperation at the regional level. The study was implemented in the following aspects: (i) current climate change and future projections; (ii) the impact of climate change on trans-border river basins; (iii) the impact of climate change on water provision for agricultural crops and on water demand in rural economies and in agriculture; (iv) the impact of climate change on heat waves in some cities of the region. The project contributed to the improvement of collaboration of experts in the sphere of climate change at the regional level, to the exchange of data and information, and exposure of issues which can be resolved only through cooperation at the regional level.

With the support of the EU thematic program “Environment and Sustainable Management of Natural Resources, including Energy” (ENRTP) in the countries of the South Caucasus (Armenia, Azerbaijan, Georgia) currently some regional initiatives are in progress for the development of joint approaches to adaptation to climate change, with the purpose of forming a cross-border network of local communities and non-governmental organizations, for accessibility of information and experience sharing. These initiatives are implemented within the framework of the ENRTP fifth priority – biodiversity and climate change in ENPI countries. Detailed information is given in the chapter 3.4.1.

With the support of the EU, the Clima East project is currently under implementation, with the aim of helping Eastern Partnership countries to mitigate and adapt to climate change.
The project includes two components: the first component, which is implemented by the UNDP, consists of pilot projects oriented at development of ecosystem approaches of climate changes adaptation. The second component of Clima East involves the development of the policy, strategy and market mechanisms in the field of climate change by improvement of regional cooperation and availability of information. The project will continue up to 2016. (http://www.climaeast.eu/)

4.4 ROLE OF CIVIL SOCIETY AND RED CROSS

4.4.1 Role of civil society in climate change and disaster risk management

A number of international and local non-governmental organizations functioning in Georgia are implementing various scale initiatives which are directed towards institutional strengthening of the sphere of adaptation to climate change and disaster risk management, the elevation of facilities of state structures and local communities, the provision of the society with information and strengthening of engagement of all concerned parties in decision-making. Below we offer a brief overview of major projects and about non-governmental organizations which take an active role in this sphere.

The Association of national local self-managements of Georgia, with the support of USAID, began this program through creation of institutional and organizational facilities in local self-management authorities for adaptation to climate change and softening its impact, in 2012. The Program provides actualization of issues of environment protection, climate change and agriculture at the self-management level and creation of special units – commissions working on the above stated issues. The existing practice in adaptation to climate change and mitigation of impacts of climate change was assessed at the local level as part of the program. On the basis of this research a guidebook was prepared about climate change at the local level; for the purposes of inclusion into “State Strategy for Regional Development of Georgia for 2010-2017” a special chapter will be prepared about climate change. The program contributes to the inclusion of local powers in discussions and decision-making about climate change. With this in view trainings have been organized for officers of local self-management. Trainings and media tours are organized for journalists, which are dedicated to the issues of climate change in the regions vulnerable to climate change.

The “Caucasus Environment Protection non-governmental network” (CENN) implements projects for contribution to raising the awareness of society, formation of communities resistant to climate change in rural places, analyses of local self-managements, natural disaster risks and vulnerability and drawing risk maps, for elevation of facilities of local communities and NGOs, for contribution to inclusion of issues of adaptation to climate change and catastrophe risks in local development plans. The project is implemented with the support of USAID, the EU, MATRA and other donors and is mainly focused on regions vulnerable to climate change (Kakheti, Adjara Autonomous Republic, Samtskhe-Javakheti). CENN, with the support of Netherlands Central and East Europe Social Transformation Program (MATRA) prepared an atlas of natural disaster risks in Georgia (http://drm.cenn.org), instructions for risk assessment and thus contributed to developing the skills and qualification of officers of state institutions working with the issues of management of disaster risks, for the assimilation of modern technologies for risk management.

Mercy Corps Georgia in collaboration with CENN and with the support of the EU implements a regional project, which is focused on raising the awareness of local governments and NGOs and strengthening of their facilities, on the formation of a cross-border network, in which local communities and NGOs will be united, as well deepening regional cooperation through the development of cross-border plans for adaptation to climate change. The project is implemented in Georgia (Samtskhe-Javakheti, Kvemo Kartli and Kakheti), Azerbaijan (Ganji-Gazakh region) and in Armenia (Lori-Martsi region) and it helps the pilot municipalities in the development of DRR and

52  Within the framework of Clima East, as a pilot project in Georgia, the project: “Sustainable management of pastures in Georgia to demonstrate climate change mitigation and adaptation benefits and dividends for local communities” is being implemented. The project objective is to rehabilitate 8,700 ha of degraded pastures (including pastures in Vashlovani Protected Areas and adjacent alternative pastures) and introduce/implement sustainable pasture management practices in the area among the farmers/sheep breeders in the Dedoplistskaro region.

53  http://nala.ge/

54  Approved by the resolution of the Government of Georgia, of June 25 2010 #172 “About adoption of state strategy for regional development of Georgia for 2010-2017 and creation of governmental commission for regional development of Georgia”

55  www.cenn.org

56  http://mercycorps.ge/
CCA integrated operation plans. For various target groups of the project, information and awareness-raising materials were prepared; trainings and information campaigns are organized for school teachers and students dealing with reduction of natural disaster risks, readiness and reaction, protection of biodiversity and adaptation to climate change. Pilot adaptation projects are implemented in selected municipalities of Georgia.

The Regional Environmental Center for the Caucasus (REC Caucasus)\(^{57}\) jointly with the country’s decision-makers and local communities carries out measures for raising awareness about the problems connected with climate change, its impact on the socioeconomic environment and food security through the demonstration of adaptation measures and the integration of issues of climate change in the process of planning and strengthening of facilities at the local level. With the support of the EU, the RECC realizes regional project for contribution to conservation of agro-diversity in semi-arid zones of Georgia, Armenia and Azerbaijan, under the effects of climate change. With the support of the project, priority local breeds spread in arid and semi-arid zones (according to their resistance to climate change, conservation value and demand on the market) were revealed. Simultaneously pilot projects were implemented for the popularization of those breeds and for the demonstration of agricultural technologies, the introduction of which is recommended for their adaptation to climate change in arid and semi-arid zones. At the national level, the project contributed to revelation of flaws in the policy and legislation and to development of recommendations for adaptation to climatic changes and to integration of issues of conservation of agro-biodiversity in the conditions of climate change.

WWF Caucasus \(^{58}\) are directed towards strengthening the resistance of the forest ecosystem to climate change in the South Caucasus countries. With this in view, the WWF-Caucasus within the framework of the EU ENRTP program renders support to country’s forestry administrations in the development of forestry strategies and in their introduction, which are focused on the transformation of monoculture groves into ecosystems similar to natural ones. The project contributes to raising the awareness of local communities and forestry economy personnel about impact of climate change on forest ecosystem and provides the target groups with corresponding knowledge and practical skills, as well as in demonstration of practical measures as a result of which 150 ha forest artificial groves will be transformed into ecosystems resistant to climate change approximated to natural ecosystems.

Oxfam\(^{59}\) helps local communities in strengthening preparedness for disasters and in reduction of the impact of disasters; it supports local communities in preparation of plans for reaction to disaster situations and in implementing small projects focused on risk reduction; it organizes trainings on the issues of drawing operation plans for community unions and on the issues of advocacy. Through a partnership with local non-governmental organizations Oxfam helps local communities in leading lobby campaigns for mobilization of resources with the purpose of reduction of disaster risks; it also contributes to the activation of community unions in order to have a more efficient impact on the distribution of resources. At the national level Oxfam actively cooperates with governmental structures and develops instruments for assessment of vulnerability to disasters. In collaboration with RECC, Oxfam coordinates the studies “Views from the Frontline”\(^{60}\) in Georgia and Armenia, according to which the progress achieved at the local level in realization of the Hyogo Framework for Action is estimated.

Non-governmental organizations interested in disaster risk management and reduction are part of the national DRR Think Tank, which was created on the initiative of UNDP, which enables them to share regularly information about current activities and acquired experience with governmental structures and international organizations, and to provide them with ideas and recommendations about improvement of the policy for catastrophe risk management.

4.4.2 Role of the Georgia Red Cross Society

The mission of the Red Cross Society of Georgia is to assist vulnerable people in coping with the effects of emergencies and socio-economic crisis by mobilizing the power of humanity and ensuring appropriate means and services to protect human life and dignity.

The four year strategic plan of the Georgia Red Cross Society (GRCS) defines the following priority areas of activity and corresponding to these priorities the GRCS implements the projects:

- **Priority 1**: Care for the health and social welfare of the unprotected layer of society, and providing information about a healthy mode of life.
- **Priority 2**: Disaster Management (Disaster Risk reduction, Disaster Preparedness, Response and recovery).
- **Priority 3**: Public Relations and Communication-dissemination of the Fundamental Principles of the International Red Cross

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57 \(^{57}\) www.rec-caucasus.org

58 \(^{58}\) http://wwf.panda.org/what_we_do/where_we_work/black_sea_basin/caucasus/projects/eu_enrtp_caucasus/

59 \(^{59}\) http://www.oxfam.org/en/georgia

60 \(^{60}\) “Views from the Frontline” is public monitoring for implementation of HYOGO operation plan which is realized from 2009 at the initiative of “Global Network of NGOs for Reduction of Catastrophe Risks” (GNDR)
Georgia Red Cross Society was officially recognized by the State of Georgia via adopting the Law ,,on Georgia Red Cross Society” on October 16, 1997 and Law of Georgia ,,on the Emblem and Name of the Red Cross and Red Crescent Societies”.

In the sphere of Disaster Management the Georgia Red Cross Society (GRCS) is the only non-state institution included in the state National Response Plan for Natural and Manmade Emergency Situations according to Presidential Decree N415, August 26, 2008. According to this plan the GRCS is responsible for organizing the activities of non-governmental organizations participating in disaster response situations, participation in search and rescue activities, provision of medical first aid, and delivery of food to temporary settlements. Through the wide network of branches of the GRCS, the organization has vast possibilities to deliver information to at-risk communities, to provide them with relevant knowledge and skills for minimization of disaster impacts, and to participate efficiently in disaster response.

The GRCS has deepened its cooperation with central government and local authorities as well as with non-governmental organizations working in Disaster Management area in order to ensure institutional readiness for disasters and effective coordination. Regular meetings are held with representatives of state agencies and civic sector for the purpose of reducing disaster hazards, exchanging knowledge and experience related to disaster readiness and response and developing effective coordination tools.

The Georgia Red Cross Society implements the following projects in Disaster Risk Reduction (DRR) and climate change spheres:

**Regional Programme for Building Safer Local Communities in South Caucasus** funded by the European Commission and co-funded by Danish Red Cross, Austrian Red Cross, and Icelandic Red Cross in a consortium with IFRC. Program activity in Georgia was focused on high mountain regions (Ambrolauri, Oni, Tsageri, Lentekhi, Sachkhere and Tkibuli municipalities) that were especially vulnerable to natural disasters (earthquakes, landslides, floods). During the project in those six municipalities 11 rescue groups consisting of volunteers, 20 persons per group, were mobilized for readiness and reaction to disasters. Those groups are able to react till the damaged area will receive further support. Trainings were organized for volunteer teams in disaster risk reduction, psychosocial first aid, rescue and fire prevention activity and they received appropriate equipment, simulation exercises were conducted.

As part of the program, the municipality vulnerability and facilities were assessed, the main priorities became apparent and with the participation of local governmental bodies, rescue teams and community representatives the plans for reaction to disasters were developed for vulnerable communities. Trainings were organized for school teachers and pupils where they learned what to do at home and at school for more safety. Information and educational material was issued. The innovative DRR Model; establishing Community Volunteer teams; raising public awareness of risk; conducting Family Emergency Plans; supporting school evacuation exercises; conducting simulation exercises and supporting community-based mitigation projects has been well integrated into National Society Strategic Plans.
Building Safe and Resilient Communities: From 2012 to 2015 the GRCS is implementing this project, funded by the Austrian Red Cross and the Austrian Development Agency. The aim of this project is to develop the resilience to natural disasters of communities in the South Caucasus, and in Georgia the project operates in rural and urban communities in the Kakheti region in the south east of the country. Working closely with local authorities, the GRCS is training local disaster management teams, raising awareness of communities about disaster risk reduction, disaster response and climate change, and undertaking small-scale disaster mitigation projects to help protect communities from the effects of disasters and extreme weather.

Emergency Preparedness and Response (EPR) project was supported by ICRC. Within the framework of the project Reception (Operational) centres have been established. Main purpose of these centres is to assist affected population within the 72 hours after disaster (e.g. First Aid, Psychosocial Support, Restoring Family Links, etc.).

Climate Forum East: Since 1 January 2013, the GRCS has with the co-funding of the EU, Austrian Red Cross and Austrian Development Agency been implementing this project. The project is in progress in six countries and partner organizations in this region are: Armenia Red Cross Society, Azerbaijan Red Crescent, Belarus Red Cross, the National Ecological Center of Ukraine, and Ecospectru (Moldova). The project contributes to development of a civil society network in the EU Eastern Partnership countries and to the strengthening of their capacities at the national and regional level in assessment of vulnerability to climate change, advocacy, communications and educational activities in the area of climate change and environmental governance. One of the objectives of the project is the mobilization of a regional platform of non-governmental organizations for establishing relations with national governments, the EU and international organizations.
5. Recommendations

5.1 RECOMMENDATIONS FOR DECISION-MAKERS

• Certain climate change adaptation strategies are included in the National Environmental Action Program of Georgia (NEAP). Simultaneously, as part of the development of the Third National Communication to the UNFCCC climate change adaptation strategies are being developed for more vulnerable regions of the country (Adjara AE, Kakheti and Upper Svaneti). However, climate change issues are not adequately addressed in the “State Strategy for Regional Development of Georgia for 2010-2017”, and in the development strategies of individual regions (e.g. Kakheti), and in the development strategies of some sectors. Therefore, in the process of preparation of development strategies for individual regions (especially for regions vulnerable to climate change) as well as for sectors the current and projected changes in climate parameters should be considered, together with their possible impacts and should be integrated in measures for adaptation to climate change and mitigation of its impacts.

• Studies connected with climate change are mostly concentrated on priority regions. It is expedient to carry out an assessment of the vulnerability of other regions of Georgia to current and projected changes, to plan and implement relevant adaptation measures, as well to attract finances for implementation of definite programs and projects.

• The integration of climate change adaptation issues into plans for development of regions and various sectors is complicated by insufficient awareness and lack of knowledge of decision-makers about the impact of current and expected climate change and lack of adaptation facilities. Therefore, it is important to prepare planning instructions (methodological directions) according to sectors, which will offer technical-economic character reference material together with practical examples of planning.

• Considering the fact that at the local level the issues of projected climate changes and potential impact are not defined accurately yet, specific emphasis should be made on planning and realization of the so called “no regret” adaptation measures, which will be useful with the environment protection and social point of view, despite climate change impact scales.

• A number of international and national agencies functioning in Georgia have been implementing various scale initiatives in connection with climate change, but these activities are of a fragmentary character and are not sufficient for regulation of the existing problems. To achieve more efficiency it is necessary to formulate coordination mechanisms for the sphere of adaptation to climate change, which will contribute to regular meetings of representatives of governmental, non-governmental, scientific and international organizations for sharing knowledge and experience acquired during various projects implementation and for mobilization of resources for adaptation to and softening of climate change. It is necessary to ensure the participation of representatives of local management bodies in the above referred coordination mechanism.

• The assessment of capacities and needs of decision-makers in the issues of climate change adaptation and mitigation, the development of training modules and systemic organization of corresponding trainings will significantly contribute to integration of climate change adaptation measures in development plans.

• For informing, educating and awareness raising in wider society it is most important to integrate the issues of adaptation to and mitigation of climate change in the general and higher educational programs. For the purposes of informal organization, the training of teachers in public schools as well as implementation of informational-educational measures by participation of school children and students should be continued. Special emphasis should be made to engage vulnerable communities, and provide them with informational-educational material and organization of measures which would raise their awareness.

• For the development of an efficient system of early warning for disasters, relevant authorities should be provided with adequate financial and technical resources; it is important to form a corresponding monitoring system at the local level.
In recent years significant studies connected with the assessment of impacts of current and expected climate change at the regional and local levels have been implemented in Georgia, but there is relatively little data related to the assessment of climate vulnerability at the national level. Such research would significantly contribute to consideration of issues of climate change in the planning of sectoral development. The development of a concept, indicators and methodology for monitoring climate change impact on most vulnerable sectors is needed. Similarly important is to assess the impact of climate change on the main vulnerable groups (IDPs, elderly, etc.) and the development of corresponding adaptation measures.

5.2 RECOMMENDATIONS FOR CIVIL SOCIETY

• As stated in chapter 3.4, non-governmental organizations have been implementing urgent projects in Georgia, dedicated to the assessment of vulnerability to climate change, development of adaptation measures (especially at the local level), and strengthening of facilities of local management for raising the awareness and knowledge of vulnerable communities. As a result, civil society has definite knowledge and experience in this area and its consideration would be important in the process of development of the policy at the national level. The formation of a network of non-governmental organizations will contribute significantly to sharing of available knowledge and experience. Non-governmental organizations must intensify lobbying the integration of the issues of climate change in political documents and development strategies, at the national and local levels.

• Non-governmental organizations need to intensify their efforts for improving the information available to wider society and target groups about issues of climate change, for raising their awareness and knowledge; in particular, the campaigns designed for school teachers and pupils, decision-makers and vulnerable communities should be intensified.

• Similarly, non-governmental organizations must continue and extend support to local self-management bodies in the development of local adaptation plans, and in raising, mobilizing and using resources for implementation of those plans.

• The formation of an information exchange mechanism in the form of a special web portal (clearing house mechanism) will contribute significantly to accessibility of the data obtained as a result of research implemented by various civil society projects for the assessment of climate change impact, and will contribute to information exchange.
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