National Report
AZERBAIJAN

Final report on climate change impact (including social and economic impact) to local forests of Azerbaijan, as well on relevant capacities on climate change mitigation and adaptation

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Abbreviations

AC   Adaptive Capacity
ADB  Asian Development Bank
AR   Autonomous Republic
CCCM Canadian Climatic Center Model
CDM  Clean Development Mechanism
DNA  Designated National Authority
ENVSEC Environment and Security
FAO  Food and Agricultural Organization
FLEG Forest Law Enforcement and Governance
IPCC International Panel on Climate Change
GHG  Greenhouse gases
GISS Goddard Institute of Space Surveys
GFDL Geophysical laboratory of hydrodynamics
NAMA National Appropriate Mitigation Actions
NAP  National Adaptation Plan
NGO  Non Governmental Organization
MENR Ministry of Ecology and Natural Resources
OSCE Organization for Security and Cooperation of Europe
PRECIS Regional Climates for Impact Studies
UNFCCC United Nations Framework Convention on Climate Change
UKMO United Kingdom Meteorological Office
WB   World Bank
Introduction

Forests are one of the most valuable and important natural resources of our world. The area of the world's forest cover is 4 billion ha.

There are many benefits of forests: they serve as a soil and watershed as biodiversity shelter creating specific ecosystems, forests provide significant economic benefits, and including tourism benefits and finally forests play crucial role in regulation of climate.

Forests have four major roles in climate change:

- Forests currently contribute about one-sixth of global carbon emissions when cleared, overused or degraded;
- Forests react sensitively to a changing climate;
- When managed sustainably, they produce wood fuels as a being alternative to fossil fuels;
- and forests have the potential to absorb about one-tenth of global carbon emissions projected for the first half of this century into their biomass, soils and products and store them

Forests are vulnerable to climate change impacts. Increasing temperatures and reducing precipitation level negatively impact forest resources leading to forest fires, dying of “weak heat tolerant” trees, changes in forest structures leading to forest degradation and deforestation.

In this regards, it is very important to take adaptive measures in order to cope with negative impact of climate change to forests. For this, first important step is to conduct assessment to measure the level of impact of climate change to forest areas, as well vulnerability of forests.

Forests are considered to be one of the most valuable natural resources of Azerbaijan that integrate soil, water, trees, bushes, vegetation, wildlife and microorganisms which mutually affect each other from biological viewpoint in the course of development.

For the past 200 years the forest area of Azerbaijan’s territory has become twice as less. In 8-9th century the present area of Azerbaijan was covered with 35 percent of forests. At present forests of Azerbaijan constitute 11.8% of the territory of the country.
Current assessment report describe results of assessment on climate change impact to forest areas of Azerbaijan and its vulnerability, as well its social and economic impact to local communities assessing current and potential losses. Separate part of the report is devoted to the description of the results of analysis on the capacities and knowledge of relevant stakeholders (both at national and local level), as well local communities on climate change mitigation and adaptation in regards to forest sector.

Assessment was conducted on the basis of desk study on existing literature, available reports and studies on forest resources, forest policy, institutional and legislative framework, monitored and forecasted climate change tendencies, as well analysis on vulnerability of forest areas to expected climate change, results of survey and interviews conducted with relevant national and local stakeholders.

Each part of the report has chapter on conclusion. All these conclusions are summarized and provided at the end of the report, including relevant recommendations.
Part I: Assessment of climate change impact to local forests of Azerbaijan

National circumstances

The geographical position

Azerbaijan is located at crossroads of Europe and Asia; having unique geopolitical and geographical position Azerbaijan has been maintaining its importance and role at international economic and cultural relations since very ancient times up to our days.

The Republic of Azerbaijan has a total area of 86.6 thousand km² and is situated in the Southern Caucasus being a biggest country of the region.

Population

The population of the Republic of Azerbaijan is 9 million 477 thousand according to data for the beginning of 2014. 53.2% of total population live in urban areas while 46.8% of population of Azerbaijan in villages. Azerbaijan is considered one of the counties with dense population.

The average density of population for each km land is 108 persons. The most dense population rate is observed in Absheron peninsula and the most sparse population is determined being in middle mountainous areas and in the highlands. The birth rate of population was always high from ancient times. The number of birth here was per thousand person 40R50 persons from time to time. However, the rate dropped up to 8 persons per each thousand persons due to transitional period that existed in early times of independence.

Nevertheless, an increase has been observed in the birth rate from 2013 and according to 2013 data the rate has risen up 13 persons per each thousand persons.
Relief, climate, land cover and vegetation

Mountains dominate the northern, southern, and western regions of Azerbaijan, covering roughly 57% of the country, and flatlands run throughout the centre of the country, accounting for the other 43% of Azerbaijan’s land area. Forests make up 11.8% of the total land area.

The Republic of Azerbaijan has a vast variety of relief types. There are 2 main forms of relief: lowlands and mountains. The average altitude of the country is about 400 meters.

The geographical position, landscape and the Caspian Sea has influence on the climate of Azerbaijan. Semi-desert and dry steppe climate with cold winter and dry hot climate can be observed here. 9 out of 11 existing climate types are present in Azerbaijan.

Dry subtropical climate is dominant in Kur-Araz Lowland and Absheron peninsula. Humid subtropical climate type can be observed only in the south of Talysh mountains, it is typical for foothills and Lankaran lowland. Moderate climate is mainly predominant in the scopes of Greater and Lesser Caucasus which covered with forests and it is divided into dry, mild-hot dry, mild-hot humid and mild cold types. Cold climate is observed in high mountain ranges, in the tops of Greater and Lesser Caucasus and alp and sub-alp meadows.

Precipitation falls unequally in the area. Per year, in Absheron peninsula and Nakhchivan Autonomous Republic we can observe less precipitation (200 mm). In Kur-Araz lowland the amount of precipitation is 200-300 mms, in the North-East scopes of Lesser and Greater Caucasus it is 600-800 mms, in the south scopes of Greater Caucasus that has 2000-2500 metres height approximately 1200-1300 mms precipitation has been observed and in the highest amount of precipitation is in the south of Lankaran lowland and the foothills of Talysh mountains, it reaches 1200-1700 mms.

The directs of dominant winds are north (Absheron peninsula) and South-West (Kur-Araz lowland) and West (Lankaran lowland).

The relief and climate plays an important role in the formation of land cover of Azerbaijan. As a result of the influence of these factors soil on the territory of the Republic of Azerbaijan are located in the vertical zones.

There are 25 types and 60 sub-types of soils in the republic. Chestnut soils (gray-brown) are widespread in the republic between 400-800 metres of altitudes. In mountains at 700-2000 metres of height the mountain-forest soils were formed. In lower zones, relatively dry areas brown mountain-forest soils are widespread.
The lands of the republic of Azerbaijan have rich vegetation. Roughly 4500 species of higher, spore-bearing flowering plants that grow in Azerbaijan combined in 125 groups and 920 sorts. For the total number of species of the flora Azerbaijan is much richer than any other Caucasus countries. Kinds of vegetation found in republic consist of 66% of the total amount of plant species growing in the Caucasus. Apart from prevalent plants in the Caucasus and other regions, approximately 240 endemic plants specific just to the Azerbaijani flora grow in the area.

**Economic profile**

The territory of the Republic of Azerbaijan enjoys favorable climate conditions and rich natural resources. The economy of Azerbaijan is mainly comprised of oil and gas extraction and refining, chemical and petrochemical, metallurgical, mechanical engineering, textile and food industries and by wheat, cotton, vine, fruit, tobacco, tea, vegetable growing and cattle breeding.

Azerbaijan’s economy showed clear signs of improvement for the first time since 1995 as the result of having signed petroleum exploration contracts. Subsequent years showed stable economic performance and in 2005 economic growth more than doubled compared to the previous year’s performance.

Azerbaijan’s economy is still maintaining the pace of dynamic economic growth and is one of the fastest growing economies in the world. In 2012 economic growth dynamics was observed and in 2013 GDP reached USD 57.7 with 5.8% growth indicator. In 2013, 58.4 percent of the GDP in the country was achieved in industry, 9.1 percent in agriculture, forestry and hunting, 7.6 percent in construction, 20.1 percent in trade and paid services, 0.2 percent in transport and freight transportation, 1.5 percent in the field of communication and information services.
General information on forests of Azerbaijan

**Forest of Azerbaijan**

Forests are considered as one of the most valuable and also vulnerable natural resources in Azerbaijan. Forests of Azerbaijan are state-owned, and fulfilling protection functions and they are included in the first group forests. Small part of forests are owned and managed by local municipalities.

There are 450 species of trees and shrubs in the Azerbaijani forests. The difference of this biological classification is connected with the diversity of natural conditions of Azerbaijan. Despite of the variety of forests, the main forest-forming species are broad-leaved forests. They are mainly consisted of beech, oak and hornbeam.

FAO studies has divided the various ecosystems of Azerbaijan into 5 ecological zones:

- temperate mountain;
- temperate continental forest;
- temperate desert;
- subtropical mountain and
- humid subtropical forests.

The total area of Azerbaijani forests is 1021.0 thousand ha which is 11.8 % of the country area. 49% of the forest reserve of the country falls to the share of the region of Caucasus Major, 34% to the region of Caucasus Minor, 15% to the Talysh zone, 2% to the Aran (lowland) zone (including Nakhichevan AR). The forest area per capita is 0.12 in Azerbaijan. Currently, 261 thousand ha forest fund is under occupation of Armenia.

95% of the forests of Azerbaijan are located in the mountains and foothills, while 5% in the low-lying areas. The forests perform mostly the functions of soil protection, water storage, climate control, microclimate creation, biodiversity shelter, carbon sinks and etc.

Large areas of Azerbaijani forests are in the southern and north-eastern slopes of the Greater Caucasus Range. These forests begin from the territory of Republic of Georgia, and stretch to the border with Russian Federation. The forests cover the area in the north-eastern slopes beginning from chiefly the administrative regions of Gusar, Guba, Davachi, Siyazan and Khizi in the direction of south-west.
The forest tracts gradually decrease in the direction of south-west from Khizi region, and replaced by the completely woodless area. In the southern macroslope of Great Caucasus, the forest tracts are restored, and extends to the border with the Republic of Georgia, creating a whole cover with mountain slopes without a break. Here, forests cover mainly the mountainous part of the administrative regions of Ismayilli, Gabala, Oguz, Shaki, Gakh, Zagatala and Balakan.

One of the widest forest areas is the slopes of Lesser Caucasus Range. Here, forests cover the northern, north-eastern and eastern slopes of the main mountain branches as separate tracts. One of the largest forest tracts covers the slopes of Talysh mountains. Here, the forests are spread in the area of the administrative regions of Astara, Lankaran, Lerik, Masalli, Yardimli, Jalilabad and partly Bilasuvar. The few parts of forest extend along the coasts of the rivers of Kura and Aras, and cover a belt-shaped area in the form of riparian type of forest.

**Policy and legislative framework**

As only 11.8% of the territory of Azerbaijan is covered by forests, the protection of existing forest areas and its development is utmost importance. So, government pays special attention to protection and development of forest areas.

Forest policy of Azerbaijan is integrated into the environmental policy. The Ministry of Ecology and Natural Resources carries out the forest policy through the Department of Forest Development.

The forestry policy of the country is focused on the followings:

- Improvement of the management of forestry (preparation of long-term development plans for forestry institutions, monitoring of forests);
- Improvement of the legislation and reforms in the forest sector;
- Measures of combat against illegal logging;
- Capacity building in the forest sector (raising the level of professional skills of the workers of forestry, preparation of school supplies that take the features of country forestry into account);
- Application of purposeful scientific programs, and insurance of the connection between the science and production in the forest sector;
• State registry of forests;
• Increase of the capacity of use of forest through the application of new technologies;
• Assistance to the local people in the more efficient use of forest products.

According to the national report of Azerbaijan on the global assessment of forest resources for the year of 2010 submitted to FAO, an official forest policy does not exist in the country as a separate normative document.

The following national programs and action plans related to the forest development have been adopted by the government:

• “National Program on the reforestation and expansion of forests in the Republic of Azerbaijan” (No 1152, dated 18 February 2003);

• “National Program on the efficient use of summer and winter pastures and hayfields, and prevention of desertification in the Republic of Azerbaijan”;

• “National Program on the use of alternative and renewable energy sources in the Republic of Azerbaijan” (No 462, dated 21 October 2004);

• “National Strategy and Action Plan on the protection and sustainable use of biological diversity in the Republic of Azerbaijan” (No 81368, dated 24 March 2006);

• “Integrated Action Plan on the improvement of environmental situation in the Republic of Azerbaijan for the years of 2006-2010”;

• “Order of the President of the Republic of Azerbaijan on the greening of protective belt of highways and motorways, dated 30 October 2007”;


The legal bases of regulation of forest relations, use, protection, preservation, rehabilitation, and improvement of environmental and resource potential of forests in Azerbaijan are regulated by the Forest Code of the Republic of Azerbaijan.
Institutional framework

During the Soviet period, works on forest structure in Azerbaijani forests were carried out by the Transcaucasia Forest Structure Scientific Institution operated in Georgia based on the plan applied to the Caucasian countries. At present, these works are conducted by the Forest Institute.

The main state authorities at the management, restoration, improvement and protection fields of forests are the Ministry of Ecology and Natural resources and management of state forest lands are conducted by Department of Forest Development of the Ministry of Ecology and Natural Resources (MENR). The structure of the Division is provided in the Annexes.

Other relevant organizations are State Land and Cartography Committee, Ministry of Agriculture, Ministry of Economy and Industry, Ministry of Extreme Cases, State Town-building and Architecture Committee, Azerbaijan Melioration and Water Culture Stock Committee, State Statistical Committee, National Academy of Sciences, local executive powers, as well as municipalities in Azerbaijan.

These authorities realize specific activity on the abovementioned areas at the limit defined by the legislation.

Ministry of Ecology and Natural Resources implements the following activities within frame of his authority on conservation of biodiversity, agro biodiversity, forest protection, special protected areas and rational use of them, struggling against desertification.

There are the divisions and departments within the Ministry of Ecology and Natural Resources: Ecology and Environment Protection Policy Division, Environment Protection Department, Forest Development Department, Department of Biodiversity Conservation and Development of Special Protected Areas. The ministry has more than 20 local ecology and natural resources offices, more than 40 offices on forest protection and restoration.

Forest Development Department provides the implementation of forest protection, reforestation, forest growing, growing of planting materials, purveyance of seeds of various species of trees and shrubs, state registry and cadastre of forest fund, forest service and other forestry actions. Main functions of the Forest Development Department are maintenance of water protection, water treatment, soil protection, recreation and other useful natural properties of forestry areas, valuable natural landscapes, as well as forests, carry out measures for the efficient use, reforestation and reproduction of forest resources, and further efficient increase of forestry, ensure the protection of them from fires, pests and diseases, the development of seed-growing of forest vegetation and preparation of the permits for the use of forests, determines and controls over the rules of registration, keeping filling-in, and giving to users of the documents of reforestation.
Ministry of Agriculture also implements specific activities related to forest management and protection. There are specific departments on Animal Husbandry, Erosion and Irrigation, Scientific-Investigation Institution of Plant Protection and State Phytosanitary Control Service acts under the management of Ministry.

State Land and Cartography Committee realizes the state control on the usage and protection of lands in the country. The activity scopes of Committee include land management, combat against desertification, and protection from several anthropogenic from contamination of lands.

There are Land structure Institute, Baku Cartography Institute, Baku Cartography Factory, its regional and district level divisions functioning within the State Committee.

Amelioration and Water Farms Open Stock Company is responsible for provision of functions for provision of irrigation water supply to agricultural lands, forest areas and green areas to achieve land fertility. The Company implements activities to minimize land degradation due to provided amelioration and irrigation works.

Within the structure of the Company functions Institutions of Water problems, Hydro technical and Melioration Scientific-Investigation, Production Union “Azersuteseruffatlayihe”, Hydro geological Meliorative Service Office act in the Stock Company, relevant irrigation departments and enterprises in regions.

The forest and land sector was specially emphasized at the permanent development State programs and decreasing of poverty and social-economical development of regions prepared and realized by the Ministry of Economy and Industry.

Azerbaijan National Science Academy, as scientific organization established by the State, organizes and provides development of science in the country, implements state scientific-technical policy. Activities of the Academy are financed by State budget.

The responsibilities of the local power authorities are executed by the leaders of regional (district) Executive Powers which are the state authorities due to the administrative regional division of the country and by their representatives on the administrative regional units (village, district) in region (city).

Municipalities are the local self-managing authorities selected by the people of specific region due to the Constitution of country. Municipalities participate at the limit of their responsibilities given them by the legislation on the management of greeneries that are at the general usage, of lands, forests, pastures that are at their ownership and usage in their regions. Local self-managing authorities realize the function of great communities in real.
Non-governmental organizations also give special attention on the permanent management of forests and lands, their suitable usage and deserting in their activities. There are nearly 2 thousand NGOs registered legally in the country at the present. More than 80 of them keep the usage areas of environment and natural resources at the focus of attention and express activity at the execution of projects about these areas.

Climate change tendencies in Azerbaijan

Global climate change

One of the factors of dynamic environmental changes under the ever growing anthropogenic impact is the climate change, of which scientists and experts were warning in 1950-1960s. Considerable increase of greenhouse gases (GHG) concentration in the atmosphere has affected the radiation balance of the Earth, which may result in the global increase of the temperature.

Climatic events of recent years show that the process is already underway and potentially may result in such irreversible consequences as melting of polar glaciers, world ocean level rise with flooding of vast coastal territories, change of climatic belts, redistribution of precipitation, etc. The ongoing warming process directly threatens the world environment and social-economic development of the world civilization.

In the Fifth Assessment Report of Intergovernmental Panel on Climate Change, observations on all continents and in many of the oceans showed that many natural systems, including hydrological cycle, water availability, water quality and water supply, are impacted by human-induced climate change. Air composition also changes as a result of human activities.

In Azerbaijan, during recent years it is already observed signs of climate change. It is clearly observed in the decreasing amount of precipitation (especially in summer season) and increased level of temperature. Especially, in 2014, it was observed droughts in agricultural areas of the country. This case negatively affected forest areas, as well, leading to drying of some tree species not resistant to high temperatures. Along with this, due to initial observations the area of glaciers at high mountain areas is also becoming less.

In this regards, all countries should develop a national strategy on adaptation and integration of climate change aspects into activities that engage all national stakeholders.
Climate change policy of Azerbaijan

Azerbaijan has ratified United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and its Kyoto protocol in 2000, and included to Non-Annex I Group. State Commission on Climate Change established in Azerbaijan by the Presidential Decree of 30 April 1997 is composed from representatives of 18 ministries and other governmental institutions and had been entrusted to coordinate implementation of commitments made under the UNFCCC.

Ministry of Ecology and Natural Resources of Azerbaijan Republic was appointed as Designated National Authority (DNA) for CDM mechanism of Kyoto protocol by President of Azerbaijan in 2005. The Initial National Communication (2000) and Second National Communication (2010) of Azerbaijan has been accomplished and submitted to the UNFCCC Secretariat.

Those reports has identified main emission sources and amount, emission scenarios and future climate change scenarios, as well providing assessment of vulnerability of main economic sectors and potential adaptation measures. At present, Third National Communication is under preparation and it is going to be submitted by the middle of 2015.

Azerbaijan actively participates in Clean Development Mechanism. Up to 40 CDM projects have been already registered by national DNA secretariat, 7 projects passed validation procedure and 6 of projects registered by UNFCCC secretariat.

At present, there are several NAMAs under preparation in Azerbaijan. It should be mentioned that, one of the NAMAs related to low carbon end-use oil-gas sector has been already recorded in NAMA registry system of the Convention.

Azerbaijan has already identified development priorities as part of national development strategies, poverty reduction strategies and sector policies. Climate change issues have been reflected in the most of state programs and plans related to climate change.

Some of state development programs and plans are listed below:

- “State Programme for the Development of Fuel Energy Complex (2005–2015);
- “State Programme on development of vine growing activities” (2012–2020);
- State Programme on poverty reduction and sustainable development (2008-2015);
• “State Programme on Ensuring Reliable Food Provision to Population” (2008–2015);
• “Azerbaijan-2020: “vision to future” Development Conception

In spite of the fact that, Azerbaijan is not included to Annex I group under the convention and has not taken any quantitative obligations in accordance with Kyoto protocol, the country has contributed and is continuing to contribute to the global emission reduction efforts to close emission gap by 2020.

A number of mitigation activities have been implemented in Azerbaijan. As an example, it could be to mention activities related to use of renewable energy sources such as formation of State Agency, as well adoption of State Program and preparation of National Strategy on Alternative and Renewable Energy Sources as a result of which share of Renewable Energy in total energy consumption has increased to 11% (including small hydro power stations).

As another examples, it could be mentioned use of gas instead of black oil at Thermal Power stations, application of smart cards in electricity and gas measuring devices, activities related to energy efficiency, reforestation and rehabilitation of approximately 103 thousand ha during last 10 years and so on. Implementation of such type of mitigation activities in different sectors of economy will be continued during next 7 years till 2020 which will lead to increase of national contribution to mitigation.

Along with this, there is a good mitigation potential in various sectors such as energy supply, commercial and residential sector, renewable energy, agriculture, forestry, waste management and foam sector.

At present it is developed GHG emission projections according to country development priorities. This would help the country to prepare Intended National Determined Contributions.

Regards adaptation strategy, national adaptive strategy has been reflected in different State programs related to sustainable economic development of the country. As developing country Azerbaijan is in process of development of NAP. Various adaptation measures such as application of more drought resistance crop species, water saving technologies, conservative cultivation are applied under a number of international projects implemented throughout the country. Agricultural sector, water sector, forest and other ecosystems, coastal zones, tourism sector and human health sector are considered as more vulnerable to climate change in Azerbaijan.
Climate description

Azerbaijan is on the northern edge of the subtropical zone, and has a mild continental climate. Generally speaking, most of Azerbaijan is characterized by mild winters and moisture scarcity in the summer, with continuous droughts. Beyond that, the climate varies significantly with location. Temperatures in low-lying areas, in the east and between the mountains, range from 25 to 27°C in the summer and 3 to 6°C in the winter. In general, these lowlands are considered semi-deserts. In the highlands, the temperature does not exceed 5°C in the summer and ranges from -3 to -5°C in the winter. Average precipitation is 447 millimetres per year.

Figure 1: Climate map of Azerbaijan
**Historical climate trends**

Historical climate change trends for Azerbaijan have been assessed in the framework of Initial and Second National Communications. Changes in climate manly include: increasing temperatures, shrinking glaciers, sea level rise, reduction and redistribution of river flows, decreasing snowfall, and an upward shift of the snowline. In the past ten years the region has also experienced more extreme weather events with flooding, landslides, forest fires, and coastal erosion which resulted in economic losses and human casualties.

As it is indicated in Second National Communication, since 1906, mean temperature has increased in the east and decreased in the west, including the Greater Caucasus Mountains areas for the past years compared to the 1961 to 1990 baseline, rainfall levels fell by 14.3% in Kura-Azraz Lowland, 2.6% in Guba-Khachmaz region, 6.4% in Shaki-Zagatala region, 17.7% in Ganja-Gazakh, 1.7% in Nakhchivan, and 1.2% in the Southern region, with overall reductions of 9.9% across the country. While water shortages exist in Azerbaijan during the low water seasons, inundations and flash floods are common in the high water season.

The frequency of these extreme events has been increasing in recent years. Additionally, an analysis of extreme events in Azerbaijan found an increasing trend in the number of days per annum with minimum daily temperatures over 20°C.

**Monitored climate change in Azerbaijan**

According to the analysis provided in Second National Communication, temperature data from the National Hydrometeorology Department of MENR for 1991-2000 showed that the mean temperature had risen by 0.41 °C—three times higher than that of the longer period 1961 to 1990 (+0.34 °C). This finding is consistent with the results derived from climate modelling.

Compared to the level of 1961-90, for the past 10 years, temperature anomalies in the Kura-Araz Lowland ranged from -1.12 °C to +1.91 °C. The average temperature anomaly in Kura-Araz lowland was +0.49 °C. Temperature anomalies in Guba-Khachmaz region ranged from -1.16 °C to +1.72 °C). The average annual temperature anomaly was about +0.48 °C. In Shaki-Zagatala, temperature anomalies ranged from –1.26 °C to +1.63 °C, for an average of +0.48 °C. Temperature anomalies in Ganja-Gazakh region ranged from -1.1 °C to +1.84 °C. The temperature difference from the norm level was about +0.74 °C. In the Southern region, temperature anomalies ranged from -1.08 °C to +1.37 °C.
The average was about +0.43 °C. In Nakhchivan AR anomalies ranged from –2.07 °C to +1.78 °C, for an average of +0.47 °C.

For the past 10 years the average annual rainfall level was below the norm by 14.3% in Kura-Araz Lowland, by 2.6% in Guba-Khachmaz region, by 6.4% in Shaki-Zagatala region, by 17.7% in Ganja-Gazakh, by 17.1% in Nakhchivan and by 1.2% in the Southern region. In overall, during period of 1990 to 2000 the rainfall level in the country has reduced by 9.9%.

**Forecasted climate change in Azerbaijan**

In the framework of Initial National Communication it was used models developed by Goddard Institute of Space Surveys, USA (GISS), Canadian Climatic Center (CCCM), United Kingdom Meteorological Office (UKMO), Geophysical laboratory of hydrodynamics of USA (GFDL-3 and GFDL-T). Within Second National Communication it was used PRECIS 1.4 model for projections.

According to the PRECIS model, the average annual temperature increase in 2021-2050 will amount to 1.5 °C -1.6 °C (Figure 2). In the coastal zone and the western part of Nakhchivan, the increase will be 1.7 °C.

The temperature increase in the first half of the century might be about 0.30 °C per decade. Since the actual temperature rise in Azerbaijan 1990-2000 was about 0.40, the data provided by the model are consistent with observed reality.

But, in IPCC Fourth the estimates are slightly different. The mean temperature in the country is expected to continue to rise and precipitation is expected to continue to decline as estimated by application of the PRECIS 1.4 model. The mean temperature is predicted to increase by 1.3°C by the 2020s, 2.1°C by the 2030s, and 2.5°C by the 2040s under the medium climate scenario. Additionally, precipitation is expected to decline by 1% by the 2020s, 20% by the 2030s, and 12% by the 2040s under the medium climate scenario.
Rainfall in 2021-2050 will increase by 10-20% compared to the period of 1961-1990. This includes increases of 0-10% in Nakhchivan and 20% in the eastern part of the country. No decrease in rainfall takes place in the Kura-Araz basin (Figure 2).

Figure 3: Rainfall changes in the region (2021-2050 in compare with 1961-1990)
According to the PRECIS model, temperatures simulated for 2071-2100 rise by 3°C-6°C, while in most parts of the country's area the temperature rises by 5°C compared to temperatures in 1961-1990. In Nakhchivan the rise is even higher, at 5.4°C-5.7°C.

Figure 4: Annual increase of temperature in the region (2071-2100 in compare with 1961-1990)

The level of rainfall in the country area increases from West to East by 20% to 80%. Only in Nakhchivan the level of rainfall is forecast to fall, by 20%. Model rainfall increase data on the Caspian Sea and surrounding regions raises some doubts. Therefore, other boundary conditions should necessarily be applied to the rainfall scenario.

Figure 5: Rainfall changes in the region (2071-2100 in compare with baseline period)
Forests and climate change

Role of forests in carbon sequestration

Widespread concern about global climate change has led to interest in reducing emissions of carbon dioxide (CO$_2$) and, under certain circumstances, in counting additional carbon absorbed in soils and vegetation as part of the emissions reductions. In this regard, forests are a significant part of the global carbon cycle. Forests are carbon stores, and they are carbon dioxide sinks when they are increasing in density or area.

Carbon removal feature of forests are taken into account during national inventories GHG. For example, in Second National Communication of Azerbaijan carbon removal for baseline year (1990) was reported as (-3438) Gg when it was increased to (-3739) Gg by 2005.

Expected climate change impact to local forests

It is obvious that forecasted climate change will have significant impact to forest ecosystems. These impacts could be listed as below:

- Climate change will result in ecosystem shifts and conversions that will also affect forest ecosystems;
- Climate change will result with “heat stresses” and many tree species will have insufficient resistance to cope with climate change;
- Climate change impacts on forests will impair the ability of many forested watersheds to produce reliable supplies of clean water;
- Climate change will result in a widespread decline in carbon storage in forest ecosystems;
- Climate change will amplify many existing stressors to forest ecosystems, such as invasive species, insect pests and pathogens;
- Increased temperatures will increase risk of forest fires.

Local forests of Azerbaijan play first of all environment-forming and nature-protecting roles. Because of the expected climate change this role of forests will increase. Climate change impact to local forests of Azerbaijan may be elaborated as following:

- Increasing temperatures result with “heat stresses”, especially in summer season, that negatively impacts some tree and bush species leading to “shock” cases in growing period (such cases were already observed in 2010 and 2014 for poplar, ash-tree and oak trees in semi desert forests of the country);
Increase of temperature will result in changes in vegetation period and could be also lead to some positive results;

As a result of changes in hydrologic cycles will lead to heavy rainfall and increase in flood cases that will result with erosion and land degradation at mountain-forest ecosystems. In some cases it will positively impact the floodplain forest areas;

As a result of glacier melting and reduce in the snow level will negatively impact flora and fauna in forest ecosystems;

Increased aridity due to climate change combined with anthropogenic impact (overgassing) will make highly negative impact to forest ecosystems;

Extreme high temperatures, increased number of days with high temperatures and increased evaporation will lead to increased forest fire cases which was already observed in recent years;

Increased number of “heat stresses” will lead to increase of plant diseases, mainly in floodplain forests;

Loss in biodiversity and biotic risks will increase;

On the other hand, when having sufficient humidity increased carbon concentration in ambient air will positively affect growing of some tree species and increase carbon removal.

As a result of the expected warming of climate with realization of the GISS and GFDL-3 scenarios it can be assumed that area of stiff-leaved species will decrease approximately by 2-2.5%. It is expected that the areas under oak and beech forests will reduce (by ~3-3.5% and 15% respectively), and under hornbeam forests will increase (by ~19%).

The total area under stiff-leaved species may decrease by approximately 17 thousand hectares. Decrease is expected of soft-leaved species by ~4 thousand hectares (~20%). Area of other woody species may increase approximately by 12%, and bushes - approximately by 70% or 13-14 thousand hectares. In general over the Republic territory, area of forests will decrease by 7.6 thousand hectares.

As a result of this, changes will take place in stocks and annual growth of carbon sequestered in the wood. Due to the change of the species composition on the area of 13.5 thousand hectares and reduction of the area of forests by 7.6 thousand hectares decrease of the total carbon stock in the forests will reduce as compared to baseline by 859.4 thousand tons, and annual growth of sequestered carbon will decrease by 10.3 thousand tons or approximately by 2%.
Vulnerability of forest ecosystems to climate change

Vulnerability assessment is necessary to understand the impacts of climate change on forests and identify most vulnerable areas. It helps to answer equations such as: What will be the impacts of climate change? To what extent is the system vulnerable? Who is vulnerable?

Methods and tools can help identify the impacts of climate change at the global, national, sectoral or local scale and bring useful results for policies on climate change. Other methods and tools aim at assessing local vulnerability for prioritizing policy interventions or developing and monitoring adaptation responses.

*Figure 6: The components of vulnerability*

- **Exposure** is the degree to which forests will be exposed to future climate changes and their impacts;
- **Sensitivity** is the degree to which forests are or are likely to be affected by or responsive to climate changes;
Adaptive Capacity is the ability of forests to adapt to the changing environmental conditions which is also enhanced by the measures implemented in order to mitigate the adverse impacts of climate change.

As it was stated in above chapters, forests are considered as highly vulnerable to climate change tendencies. As most forests of Azerbaijan are situated in mountain regions and at slope areas, and have differentiated specifications, it needs specific approach and fundamental scientific research to be applied for each area and even slope during analysis of vulnerability and adaptation.

Current vulnerability assessment for forestry resources is based on analysis on similar studies and expert estimations. IPCC methodology was applied during the assessment. Based on stakeholder consultations and expert judgment, it was decided to use the three major vulnerability components:

- Adaptive capacity of local forests to climate change
- Exposure of local forests to climate–hazards
- Sensitivity of local forests to climate–hazard exposures

Each of these three vulnerability components is further divided on subcomponents. For each vulnerability sub-component, a set of vulnerability indicators has been assigned.

Figure 7: Vulnerability of a coupled socio-ecological system

Based on the available data vulnerability indicators have been assessed for each vulnerability sub-component for each type of forest ecosystem zones of Azerbaijan (semi-desert and dry steppe, temperate mountain, humid subtropical forest, subtropical mountain, continental temperate forest and dry subtropical).
Table 1: Vulnerability components and sub-components

<table>
<thead>
<tr>
<th>Component</th>
<th>Sub-component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive capacity</td>
<td>Social capital</td>
</tr>
<tr>
<td></td>
<td>Human capital</td>
</tr>
<tr>
<td></td>
<td>Financial capital</td>
</tr>
<tr>
<td></td>
<td>Physical capital</td>
</tr>
<tr>
<td>Exposure</td>
<td>Climate hazards</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Ecosystems</td>
</tr>
<tr>
<td></td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>Communities</td>
</tr>
</tbody>
</table>

Then, it was identified indicators within each sub-component. Each indicator has been provided with relevant weight within the sub-components by project team based on the significance of appropriate indicator.

First of all, it was provided calculation for each vulnerability component: adaptive capacity, exposure and sensitivity.

Based on discussions provided with the key national stakeholders, it was given relevant points for each forest zones. For instance, 0.91 point (0.91 out of 1 meaning 91%) given to exposure component of semi desert and dry steppe forests means that such type of forests are have high risk of climate change impact).

Table 2: Results of calculations of vulnerability indices for each component

<table>
<thead>
<tr>
<th>#</th>
<th>Components</th>
<th>Semi-desert and dry steppe</th>
<th>Temperate mountain</th>
<th>Humid subtropic</th>
<th>Subtropical mountain</th>
<th>Continental temperate</th>
<th>Dry subtropic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exposure</td>
<td>0.91</td>
<td>0.81</td>
<td>0.67</td>
<td>0.72</td>
<td>0.85</td>
<td>0.88</td>
</tr>
<tr>
<td>2</td>
<td>Sensitivity</td>
<td>0.72</td>
<td>0.75</td>
<td>0.70</td>
<td>0.70</td>
<td>0.71</td>
<td>0.74</td>
</tr>
<tr>
<td>3</td>
<td>Adaptive capacity</td>
<td>0.65</td>
<td>0.60</td>
<td>0.68</td>
<td>0.66</td>
<td>0.65</td>
<td>0.60</td>
</tr>
</tbody>
</table>
Then, to have final value of calculation of vulnerability indices the following formula has been applied:

\[ \text{VI} = (I_{\text{exposure}}^{\frac{1}{3}} \times I_{\text{sensitivity}}^{\frac{1}{3}} \times I_{\text{adaptiv capacity}}^{\frac{1}{3}}) \]

Then, result of calculations was presented in separate table based on the risk level: none, limited, moderate, high and very high. For instance, if the point given to temperate forests for sensitivity component is less than 0.6, the risk level of negative climate change impact is limited.

**Table 3: Vulnerability risk level**

<table>
<thead>
<tr>
<th>#</th>
<th>Risk level</th>
<th>Exposure</th>
<th>Sensitivity</th>
<th>Adaptive capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>None</td>
<td>&lt;0.4</td>
<td>&lt;0.4</td>
<td>&lt;0.4</td>
</tr>
<tr>
<td>2</td>
<td>Limited</td>
<td>&gt;0.4&lt;0.6</td>
<td>&gt;0.4&lt;0.6</td>
<td>&gt;0.4&lt;0.7</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>&gt;0.6&lt;0.8</td>
<td>&gt;0.6&lt;0.8</td>
<td>&gt;0.7&lt;0.8</td>
</tr>
<tr>
<td>4</td>
<td>High</td>
<td>&gt;0.8&lt;0.9</td>
<td>&gt;0.8&lt;0.9</td>
<td>&gt;0.8&lt;0.9</td>
</tr>
<tr>
<td>5</td>
<td>Very high</td>
<td>&gt;0.9</td>
<td>&gt;0.9</td>
<td>&gt;0.9</td>
</tr>
</tbody>
</table>

The results of vulnerability assessment for different forest ecological zones are presented in below table:

**Table 4: Results of calculations of vulnerability indices for each component**

<table>
<thead>
<tr>
<th>#</th>
<th>Components</th>
<th>Semi-desert and dry steppe</th>
<th>Temperate mountain</th>
<th>Humid subtropic</th>
<th>Subtropic mountain</th>
<th>Continental temperate</th>
<th>Dry subtropic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exposure</td>
<td>very high</td>
<td>high</td>
<td>moderate</td>
<td>moderate</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>2</td>
<td>Sensitivity</td>
<td>moderate</td>
<td>moderate</td>
<td>moderate</td>
<td>moderate</td>
<td>moderate</td>
<td>moderate</td>
</tr>
<tr>
<td>3</td>
<td>Adaptive capacity</td>
<td>limited</td>
<td>limited</td>
<td>limited</td>
<td>limited</td>
<td>limited</td>
<td>limited</td>
</tr>
</tbody>
</table>

As it seen from above table, semi-desert and dry steppe forests are considered as high exposure risk to climate change. Temperate mountain, continental mountain and dry subtropical forests are considered as high risk to climate change tendencies.

Regards sensitivity and adaptation capacity, almost all forest zones have typical features showing moderate sensitivity and limited adaptive capacity.
Climate change mitigation scenario in forest sector

According to the GHG inventory carried out within the framework of this report, in 2010, in the forestry sector carbon removal level has reached -3942 tons of CO$_2$.

It should be mentioned that within the framework of the National Programme on Rehabilitation and Expansion of Forests in the Republic of Azerbaijan (2003-2010), the Ministry of Environment and Natural Resources has carried out forest rehabilitation activities in more than 103 thousand hectares of land. The main advantages of this National Programme was restoration of degraded forests, improving tree composition quality in forests, and expanding the share of forests in the country in accordance with international norms.

The policies that have been carried out in the forestry sector in the Republic of Azerbaijan indicate that carbon removal capacity of the forests in the country will keep increasing during the upcoming years as well. According to information provided by experts from the Forestry Development Department, forests will be expanded as described in the following Table, which will contribute to a total carbon removal of 840 thousand tons.

<table>
<thead>
<tr>
<th>Years</th>
<th>Planned expansion, ha</th>
<th>Expected emission removal, Gg</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>30.000</td>
<td>0.09</td>
</tr>
<tr>
<td>2030</td>
<td>90.000</td>
<td>0.25</td>
</tr>
<tr>
<td>2040</td>
<td>90.000</td>
<td>0.25</td>
</tr>
<tr>
<td>2050</td>
<td>90.000</td>
<td>0.25</td>
</tr>
<tr>
<td>Total</td>
<td>300.000</td>
<td>0.84</td>
</tr>
</tbody>
</table>

According to the provided numbers, GHG emission removal from forest sector could be illustrated as in below figure:

**Figure 8. Projected level of GHG emission removal in forestry sector for 2020-2050, Gg CO$_2$ eq.**
Conclusions

Azerbaijan has limited forest resources. Thus, protection and development of forest areas in light of climate change tendencies are of utmost importance.

Government of Azerbaijan has strict policy on forest protection and development. It has been reflected in different state programmes and action plans, including legislative basis for proper regulation of forest protection and development.

Recent climate change scenario studies show that forests are very vulnerable for forecasted climate changes. Increasing temperatures will result with “heat stresses”, especially in summer season, that will negatively impact some tree and bush species leading to “shock” cases in growing period (such cases mostly forecasted in realization of GISS va GFDL-3 scenario models), and will result in changes in vegetation period. As a result of changes in hydrologic cycles will lead to heavy rainfall and increase in flood cases that will result with erosion and land degradation at mountain-forest ecosystems. Along with this, as a result of glacier melting and reduce in the snow level will negatively impact flora and fauna in forest ecosystems. Besides, increased aridity due to climate change combined with anthropogenic impact will make highly negative impact to forest ecosystems. increased forest fire cases, increased number of “heat stresses” will lead to increase of plant diseases, loss in biodiversity and biotic risks could be mentioned as other negative impact of climate change.

On the other hand, changes in climate may lead to positive results such as having sufficient humidity increased carbon concentration in ambient air will positively affect growing of some tree species and increase carbon removal.

Results of vulnerability assessments conducted on the basis of available studies and expert judgement, show that most forests of Azerbaijan are at a high risks to exposure. It is already observed negative impact of climate change to local forests. It was mainly observed in 2010 and 2014 (mainly ash-tree, poplar and oak trees). Along with this, negative impact is observe in new planted areas. Results also show that sensitivity and adaptivity capacity level of forests are pretty low.

Here it should be mentioned that municipal forests are also at high exposure risk for climate change, mainly because of poor management practices and adaptive capacity. One of the major shortcomings emerged during the assessment process is weak awareness and low capacity of local decision-makers and local communities on possible negative impact of climate change to forest ecosystems.
Poor capacity of local decision-makers and local communities, researches on conduciton of vulnerability assessment and adequate adaptation of forest ecosystems in light of climate change and designing appropriate adaptation strategy could be also mentioned as major weaknesses emerged during assessment process.

Adaptation to climate change requires to:

- **determine the vulnerability** of forest ecosystems
  
  *Up-to-date it was not provided the detailed vulnerability of forest ecosystems to climate change. The capacity of forest managers to implement such assessment is not enough.*

- **establish objectives** for the future forests
  
  *At present, there is a new forest program under preparation under which there are specific objectives and targets specified. Adaptation to climate change at forest should be a main part of this program.*

- **develop present and future cost-effective adaptive actions**
  
  *The capacity of forest managers to implement such assessment is not enough and there is a need for additional capacity building activities. At least, it can be implemented pilot projects under which there can be developed and implemented adaptive actions.*

- **manage** the forest to reduce vulnerability
  
  *At present, it is implemented activities to reduce vulnerability of forest to climate change, but such actions are the very limited level.*

- **monitor** to determine the state of the forest

- **increase awareness** and **education** within the forestry community mostly focusing on vulnerability assessment and adaptation

As a conclusion, it is especially impotant to note that development of impact assessment, vulnerability and adaptation strategy of forest ecosystems has strategic importance taking into account environmental and ecosystem balance functions of forest resources.
Part II: Assessment of social and economic impact of climate change

Forests of Azerbaijan: ecological, economic and social benefits

Forests are considered as one of the most valuable and also vulnerable natural resources in Azerbaijan. Forests of Azerbaijan are state-owned, and fulfilling protection functions and they are included in the first group forests. Small part of forests are owned and managed by local municipalities.

There are 450 species of trees and shrubs in the Azerbaijani forests. The difference of this biological classification is connected with the diversity of natural conditions of Azerbaijan. Despite of the variety of forests, the main forest-forming species are broad-leaved forests.

The total area of Azerbaijani forests is 1021.0 thousand ha which is 11.8 % of the country area. 49% of the forest reserve of the country falls to the share of the region of Caucasus Major, 34% to the region of Caucasus Minor, 15% to the Talysh zone, 2% to the Aran (lowland) zone (including Nakhichevan AR). The forest area per capita is 0.12 in Azerbaijan. Currently, 261 thousand ha forest fund is under occupation of Armenia.

Ecological benefits of local forests

Forests stabilize the climate in general. The plants enrich the soil by recycling the nutrients through the shedding of leaves and seeds. They also regulate the water cycle by absorbing and redistributing rainwater quite equally to every species living within its range, which is known as the economy of water. Overall, forests provide perfect habitats for life to flourish on land. Plants also play a crucial role in the purification of the air. When breathing, they absorb carbon dioxide and release oxygen.

Finally, forests provide with a huge amount of different medicine material. Important amounts of the drugs we use are extracted from tropical plants and animals and the majority of drugs used to fight cancer are coming from there as well. Forests contain a potential source of an amazing amount of cures, but most of it hasn’t been discovered yet.

There are a number of components to the broad range of ecological services that forests provide. Some of them are listed in below:

- the regulation of water regimes by intercepting rainfall and regulating its flow through the hydrological system;
- the maintenance of soil quality and the provision of organic materials through leaf and branch fall;
• the limiting of erosion and protection of soil from the direct impact of rainfall;
• modulating climate; and
• being key components of biodiversity both in themselves and as a habitat for other species.

It should be mentioned that, in Azerbaijan, forests are only considered as value of ecological importance. There is no commercial cutting of trees. Despite of that forest provides economic values to rural communities in means of wild fruits or medical plants etc.

_Economic and social benefits_

Traditionally, forests played an important role in socio-economic life of local communities. Local population were benefitting from resources provided by the forests: timber, fruits, berries, medical plants etc. Besides, local population were benefitting from wild animals living the forests. Most communities were settled close to forest in order to have source for wood in winter season.

During former Soviet Union period, it was observed some development in rural areas of the country and some of villages were provided with gas supply leading to reduce in pressure to local forests. But, still forests were considered as a source for economical benefit.

After getting independence, forest resources in Azerbaijan were in a great pressure. It was due to hard economic conditions in the country at the first years of independence.

At present, forests in Azerbaijan are not a subject for forest industry. Only very small amount of cutting is allowed (sanitary cutting) which is used for provision of wood to social facilities in remote areas. But, rural communities still benefit from forests benefitting from collection of wild fruits, medical plants, using areas for grazing animals and so on. Thus, climate change will negatively affect those economic benefits, as well.

Notwithstanding with that forest still remain as valuable social importance. Especially, in regards to development of tourism services in the forest areas, it has very important value.
Climate change impact to ecological, social and economic benefits of local forests

Assessment of climate change impact to ecological, social and economic benefits of local forests has been organized in close stakeholder consultation process.

Assessment was conducted at 3 stages:

- Situation analysis (desk study of available literature and reports on current level of knowledge and capacities in the field of forest management);
- Interview process (meetings and interviews with respondents at local and national level);
- Analysis of results and preparation of assessment report.

During the assessment process, it was provided desk study on available literature (both national and international) and reports related to forest benefits management in Azerbaijan.

During September-October months, it was conducted interviews with pre-identified respondents, both at local and national level (list of respondents is attached as annex) in Shamakhi, Ismayilly and Barda regions.

During the interview process, main attention was directed to get hand-in-hand information on the current information and knowledge on ecological, social and economic benefits of forests, as well current and potential losses.

**Current and potential losses**

During the assessment process, it was held meetings with representatives of stakeholders dealing with forest management (both at national and local level) and conducted interviews to get picture of their understanding on ecological, social and economic benefits of local forests, as well current and potential losses.

As it seen in figure 9, most of respondents at national level have indicated that they have understanding of the problem of negative impact of climate change to ecological, social and economic benefits of forests. For about 85% of respondents have responded that, currently, losses due to climate change impact to forests could be already observed at local forests.

However, stakeholders at local level have lower level of understanding on the same problem.
In figure 9, it is demonstrated results on questions given to respondents on current and potential losses of forest due to climate change impact. As it seen from the figure, the overall understanding on losses is not at desired level.

**Ecological impact**

Regards ecological impact of climate change to local forests of Azerbaijan, it could be mentioned that main risk is related to possible deforestation in some arid areas as some trees are not addicted to droughts. Negative impact of climate change is already observed in most forest areas. Especially in summer times, due to droughts some trees are affected negatively by “heat stresses”. For instance, during the summer season of this year, in some of semi desert and dry steppe forests it was observed that poplar, ash-tree and oak trees impacted with “heat stresses” and starting to dry. Another important danger is increasing risk for forest fires. During 2014, the risk of forest fires in summer season was highly increased. Of course, forest fires will also affects local biodiversity at the local forests leading to another ecological loss.

Some aspects of ecological impact of climate change to local forests are provided in below table:
Table 6: Various aspects of ecological impact of climate change to forests

<table>
<thead>
<tr>
<th>Negative impacts</th>
<th>Possible actions to mitigate impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deforestation in arid areas</td>
<td>Planting of more drought resilience tree species</td>
</tr>
<tr>
<td>Loss of local biodiversity</td>
<td>-</td>
</tr>
<tr>
<td>More frequent extreme weather events</td>
<td>-</td>
</tr>
<tr>
<td>More frequent and more prolonged droughts</td>
<td>Develop adaptation measures such as improve irrigation system</td>
</tr>
<tr>
<td>More frequent and more devastating fires</td>
<td>Good management planning in fire management</td>
</tr>
<tr>
<td>Decrease in carbon removal potential of forests</td>
<td>-</td>
</tr>
<tr>
<td>More frequent and more severe outbreaks of pests and diseases</td>
<td>Develop adaptation measures such as more frequent observations</td>
</tr>
</tbody>
</table>

Social and economic impact

Potential losses in forest resources may result with significant socio-economic tragedies. It may result with decrease in the level of income of local population, change in their type of economical activity; increase in unemployment and at the end with out-migration from the local communities (traditionally settled areas) to other more suitable places.

In overall, significant measures should be implemented in order to minimize potential risk of losses relate to socio-economic benefits of local forests. Some of them could be summarized as in below table 8:

Table 7: Various aspects of social and economic impact of climate change to forests

<table>
<thead>
<tr>
<th>Negative impacts</th>
<th>Possible actions to mitigate impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decrease in the level of income of local population</td>
<td>Search for alternative income sources such as apiculture (increase capacities and skills)</td>
</tr>
<tr>
<td>Change in type of economical activity of local population</td>
<td>Search for alternative economic activity (increase capacities and skills)</td>
</tr>
<tr>
<td>Increase in unemployment</td>
<td>Search for alternative economic activity (increase capacities and skills)</td>
</tr>
<tr>
<td>Increase in out-migration</td>
<td>Search for alternative income sources (increase capacities and skills)</td>
</tr>
<tr>
<td>Possible risk in resettlement</td>
<td>Search for alternative economic activity (increase capacities and skills) Increase rural investments to develop local economy or provide low interest credits to local farmers</td>
</tr>
</tbody>
</table>
In this regards, the national and local government should undertake responsibility in supporting local communities to overcome possible problems related to climate change impact. Rural investments should be considered during preparation of local socio-economic development plans taking into account possible negative socio-economic impact of climate change to local forests.

Conclusions

Despite of fact that local forests in Azerbaijan are not subject to forest industry and all forest tree cuttings (except some sanitary cuttings) are illegal, forests play important role in socio-economic life of rural communities. However, there are huge potential of losses due to negative impact of climate change to local forests in Azerbaijan.

Major conclusion and findings of the assessment could be summarized as following:

- There is potential risk for deforestation in arid areas due to negative impact of climate change to local forests;
- There is potential risk for loss of local biodiversity due to negative impact of climate change to local forests;
- More frequent extreme weather events are expected due to negative impact of climate change to local forests;
- More frequent and more prolonged droughts are expected due to negative impact of climate change to local forests;
- More frequent and more devastating fires are expected due to negative impact of climate change to local forests;
- More frequent and more severe outbreaks of pests and diseases are expected due to negative impact of climate change to local forests;
- There is a risk for decrease in the level of income of local population due to negative impact of climate change to local forests;
- There is a risk for decrease in change in type of economical activity of local population due to negative impact of climate change to local forests;
- There is a risk for increase in unemployment due to negative impact of climate change to local forests;
- There is a risk for increase in out-migration and possible risk in resettlement due to negative impact of climate change to local forests;

In order to minimize all those potential risks, the both national and local governments should take the issue as an urgent important issue and include local investment as priority in local development plans.
Part III: Assessment of capacities on climate change mitigation and adaptation of local forests

Approach and methodology

Assessment of capacities of related stakeholders is a structured and analytical process, whereby the various dimensions of capacity are assessed within various aspects, as well are evaluated for specific organizations, communities and individuals.

In current assessment, since the beginning, the process has been organized in close stakeholder consultation process. As assessment was focused on specific topic – capacities on adaptation of forests to climate change, the number of respondents and questions to be included to the questionnaire was quite limited.

Assessment was conducted at 4 stages:

- Initial preparation works (preparation of questionnaires, list of respondents);
- Situation analysis (desk study of available literature and reports on current level of knowledge and capacities in the field of forest management);
- Interview process (meetings and interviews with respondents at local and national level);
- Analysis of results and preparation of assessment report.

Draft questionnaires (it was prepared questionnaire forms for interview at national and local level) have been submitted to project coordinator during progress reporting and revised after comments and feedback. In addition, list of potential respondents was also consulted with project coordinator.

During the assessment process, it was provided desk study on available literature (both national and international) and reports related to forest management in Azerbaijan. Mai idea of this was to learn from any effective experience in similar assessments.

In July-August months, it was conducted interviews with pre-identified respondents, both at local and national level (list of respondents is attached as annex) in Shamakhi, Ismayilly and Barda regions.
During the interview process, main attention was directed to get hand-in-hand information on the current capacities related to adaptation of forests to climate change, existing gaps and needs for improvement.

Capacities and needs have been assessed in 3 directions:

- Capacities and needs at individual level;
- Capacities and needs at institutional level;
- Systematic capacities

Capacities at **individual level** are defined by capabilities of different persons responsible for SFM and SLM issues. Their capacity is interrelated with their education, managerial skills and professionalism, as well as the ability to apply these skills. The level of capacity at individual level depends on environmental education system, training and scientific centers.

Capacities at **institutional level** depend on common disposition of organization’s activities and a set of human, administrative, financial and technical resources listed as follows:

- **Human capacity**, is actually defined by the total of individual qualities in organizations engaged in forest management;
- **Administrative resources** are defined by results of activities of relevant special structures, which depend on the perfection of management mechanism;
- **Financial resources** for the implementation of responsibilities and commitments;
- **Technical resources** are special equipment, computers, technical devices, intended for the fulfilment of responsibilities and commitments.

Depending on organization’s scope of activities, the level of capacity for different aspects and needs for their further improvement could be different. For that reason, analyze responsibilities and capacity of each stakeholder is analyzed and only after that certain aspects of the capacity that need to be improved can be identified.
Regards **systematic** capacities, it is mainly related to capacities beyond individual and institutional aspects, mainly addressing policy and regulative framework. It also includes capacities of communities addressing forest management related issues at community level. Essential questions to be answered here is the level of corporate activities in issues related to sustainable forest management, as well any traditional knowledge and skills of the community in dealing with problems related to climate impacts to forestry.

All results of analysis have been described in current assessment report mainly focusing on description of main findings and recommendations to fill existing gaps in capacities.

**Assessment of capacities at institutional, individual and systematic level**

**Institutional capacities**

During the assessment process, it was held meetings with representatives of stakeholders dealing with forest management (both at national and local level) and conducted interviews to get picture of their understanding of the problem and issues related to climate change adaptation of local forests.

As it seen in figure 10, most of respondents at national level have indicated that they have understanding of the problem of negative impact to forests. For about 80% of respondents have responded that climate change impact to forests is already observed at local forests. However, stakeholders at local level have lower level of understanding of the climate change problem.

**Figure 10: Level of knowledge on climate change impact to forest**

![Figure 10: Level of knowledge on climate change impact to forest](image)
In figure 11, it is demonstrated results on questions given to respondents on adaptation of forest to climate change. As it seen from the figure, the overall understanding of adaptation issues is not at desired level. Based on the results of survey, it could be mentioned that there are very limited initiatives regards adaptation of local forests to climate change.

**Figure 11: Level of knowledge on adaptation of forests to climate change**

Strengths and weaknesses related to institutional capacities are described in below table:

**Table 8: Institutional capacities: strengths and weaknesses**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant units, including research institutions are in place</td>
<td>1. Poor financial and technical capacities</td>
</tr>
<tr>
<td></td>
<td>2. Weak infrastructure and equipment</td>
</tr>
<tr>
<td></td>
<td>3. Non-adequate number and capacity of staff</td>
</tr>
<tr>
<td></td>
<td>4. Poor knowledge on climate change impact to forests</td>
</tr>
<tr>
<td></td>
<td>5. Poor knowledge on climate change adaptation issues of forests</td>
</tr>
<tr>
<td></td>
<td>5. Lack of training courses on climate change adaptation and poor involvement of specialists to regional and international trainings and study tours</td>
</tr>
</tbody>
</table>
Individual capacities

Regards individual capacities of staff of forest management units related to climate change and climate change adaptation issues, it should be noted that mostly local staff are lack of knowledge of climate change to forest. However, negative impact of climate change is already observed in most forest areas. Especially in summer times, due to droughts some trees are affected negatively by “heat stresses”.

Strengths and weaknesses related to individual capacities are described in below table:

**Table 9: Individual capacities: strengths and weaknesses**

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Forestry officers having higher education</td>
<td>1. Low level of knowledge on climate change and climate change adaptation and on best international practice of sustainable forest management</td>
</tr>
<tr>
<td>2. Forestry officers have good knowledge on existing policy and legislative framework related to forest management</td>
<td>2. Low level of knowledge on negative impacts of climate change to forest resources and on possible adaptation measures</td>
</tr>
<tr>
<td>3. Forestry officers are interested in improving knowledge and capacities according to effective international practice</td>
<td>3. Lack of capacities on carbon monitoring tools and adaptation of forest to climate change</td>
</tr>
</tbody>
</table>

Systematic capacities

Regards systematic capacities, it should be mentioned that local communities surrounding the local forests are lack of understanding and knowledge of negative impact of climate change to forests. Besides, there is almost no single attempt towards climate change adaptation of local forests.

To sum up, current gaps related to institutional, individual and systematic capacities of relevant stakeholders involved to forest management could be summarized as in below table 10:
Table 10: Identified gaps related to institutional, individual and systematic capacities

<table>
<thead>
<tr>
<th>Identified gaps</th>
<th>Individual</th>
<th>Institutional</th>
<th>Systematic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gaps related to capacities on climate change adaptation</strong></td>
<td>1. Low level of understanding on climate change and climate change adaptation, as well best international project related climate change adaptation of forests (mainly for local stakeholders)</td>
<td>1. Non-adequate financial and technical capacities of national and local institutions dealing with forest management</td>
<td>1. Low level of capacities in local management planning, including local forest management planning in regards to climate change impact</td>
</tr>
<tr>
<td></td>
<td>2. Poor knowledge on negative impacts of climate change to forest resources (both for national and local level stakeholders)</td>
<td>2. Lack of training courses and poor involvement of specialists to national, regional and international trainings and study tours</td>
<td>2. Almost no practice on application of community forests</td>
</tr>
<tr>
<td></td>
<td>3. Poor level of knowledge on vulnerability of forests to climate change tendencies</td>
<td>3. Non-existence of plans on adaptation of forests to climate change</td>
<td>3. Non-existence of policy, regulatory and legislative framework on community forests</td>
</tr>
<tr>
<td></td>
<td>4. Poor level of capacities on possible adaptation measures related to forestry (both for national and local level stakeholders)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Low level of capacities on management planning related to adaptation measures of local forests to climate change (both for national and local level stakeholders)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Regards the main reasons of existing gaps and capacities, it should be mentioned that lack of financial resources and technical means could be mentioned as main reason for institutional gaps. In case of individual gaps, lack of financial incentives and weak career making possibilities makes forestry sector not attractive for young specialists. Along with this current staff dealing with forest management issues do not motivated to gain new skills and knowledge. Gaps related to systematic capacities are mainly related to weak access to information.
Conclusions

Current assessment was conducted in close stakeholder consultation. All relevant stakeholders (both at national and local level) related to forest management were involved to assessment process. Besides, additional consultations were held with international projects involved in similar sector.

Major conclusion and findings of the assessment could be summarized as following:

- Low level of capacities of almost all stakeholders (mainly local stakeholders) on existing state policy and programs, as well best international project related climate change and climate change adaptation;
- Poor knowledge on negative impacts of climate change to forest resources (both for national and local level stakeholders);
- Poor level of knowledge on vulnerability of forests to climate change tendencies (both for national and local level stakeholders);
- Poor level of capacities on possible adaptation measures related to forestry (both for national and local level stakeholders);
- Low level of capacities on forest and pasture management planning and use of best technologies (both for national and local level stakeholders);
- Very poor level of capacities of relevant stakeholders on role of forests in carbon sequestration (both for local and national stakeholders);
- Lack of financial and technical capacities of relevant institutions dealing with forest management issues;
- Lack of training courses and poor involvement of specialists to national, regional and international trainings and study tours;
- Low level of capacities of local communicates and municipalities in forest management planning;
- Almost non-existence of initiatives related to climate change adaptation of forests.
As it was mentioned in the first chapters of the report, current report is aimed to produce recommendations on how to improve current capacities on climate change adaptation of forests. Main recommendations are listed in below:

**Findings on improvement of capacities at national level:**

- First of all, there was a deficiency found that pointed to low or poor administrative, technical and financial capacity of national level institutions dealing with forest management issues;
- It is important to improve current level of capacities of national stakeholders on climate change impact to forests areas, as well adapting to climate-change impacts;
- It is also recommended to improve knowledge and capacities of national level stakeholders on adaptation of forests to climate change and application of relevant adaptation strategies;
- It is important to improve on knowledge on best international experience in forest pasture management, as well in application of community forest concepts;
- It should be considered interventions to improve knowledge on role of forests in climate regulation, role of pastures and forests in carbon sequestration;

**Findings on improvement of capacities at local level:**

- It is very important to improve local knowledge on climate change impact to forests, as well adaptation measures in order to increase preparedness of target communities to any possible negative impact of climate change;
- It is recommended to improve capacities on forest management tools;
- It is also recommended to increase knowledge on benefits of forests and pastures (including environmental benefits) in order to aware local population for need to protect and efficiently use current natural resources (forests and pastures);
- There should be conducted capacity building activities (local workshops, trainings etc) for local stakeholders on negative impacts of climate change to forests and necessity of adaptation measures;
- It is important to improve capacities and skills of local stakeholders on participatory forest management;
Along with above mentioned recommendations, it is also recommended to make close coordination of planned capacity building activities with other similar projects implemented in the same region.
Summary of conclusions and recommendations

As it was indicated at the beginning chapter of the current assessment report aims to describe results of assessments on climate change impact to forest areas of Azerbaijan and its vulnerability, its social and economic impact to local communities assessing current and potential losses, as well of the results of analysis on the capacities and knowledge of relevant stakeholders (both at national and local level), as well local communities on climate change mitigation and adaptation in regards to forest sector.

In overall, the followings could be mentioned as the main conclusion of the analysis:

- According to recent climate change scenario studies, local forests of Azerbaijan are considered as very vulnerable for forecasted climate changes;
- Some of negative impacts to forest ecosystems could be listed as increased forest fire cases, increased number of “heat stresses” that will lead to increase of plant diseases, loss in biodiversity and biotic risks;
- There might be some positive results such as having sufficient humidity increased carbon concentration in ambient air will positively affect growing of some tree species and increase carbon removal;
- There is potential risk for deforestation in arid areas, risk for loss of local biodiversity, risk for more frequent extreme weather events, risk for more frequent and more prolonged droughts, risk for more frequent and more devastating fires, and also risk for more frequent and more severe outbreaks of pests and diseases due to negative impact of climate change to local forests;
- There is a risk for decrease in the level of income of local, a risk for decrease in change in type of economical activity of local population, risk for decrease in increase in unemployment, out-migration and possible risk in resettlement due to negative impact of climate change to local forests;
- It is observed low level of capacities of almost all stakeholders (mainly local stakeholders) on existing state policy and programs, as well best international project related climate change and climate change adaptation;
- It is also observed poor knowledge on negative impacts of climate change to forest resources (both for national and local level stakeholders);
- The level of knowledge on vulnerability of forests to climate change tendencies (both for national and local level stakeholders) are very poor;
- It is observed **poor level of capacities on possible adaptation measures** related to forestry (both for national and local level stakeholders);

- **Lack of financial and technical capacities** of relevant institutions dealing with forest management issues are one of the main problems;

- It is observed also **lack of training courses** and poor involvement of specialists to national, regional and international trainings and study tours;

- Another emerging problem is the low level of capacities of local communicates and municipalities in **forest management planning**;

It should be mentioned that, forest managers must learn how to incorporate uncertainty and the increased probability of extreme events into their planning; they must become adaptive managers, setting objectives, deciding strategies and scheduling actions using the best available information, continuously monitoring and comparing the evolving reality against their assumptions, and revising their targets and strategies in the light of new information. The main strategy should sustainable forest management taking into account adaptive strategy.

There is a need for research to be funded to improve knowledge and capacity on the impacts of climate change on different forest classes in different parts of the region, on the tree species and other biological components associated with those forest classes; species need to be tested for their suitability to different conditions and tree breeding programs started; protected areas and protected area networks may need to be redesigned and management policies changed; civil society needs to be informed about the possible impacts and the available mitigation and adaptation options; and governments need to facilitate the dialogue that must take place to ensure that the complete range of attitude and opinion is taken into account in the development of national forest adaptation strategies and programmes.
References

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2. Climate change and agriculture country note, World Bank Regional Program on Reducing Vulnerability to Climate Change in Southern Caucasus Agricultural Systems

3. Interim report, Economics of Climate Change in Azerbaijan, Kazakhstan, and Uzbekistan—Mitigation Consultants, ADB funded project

4. Baseline study of floodplain forests in Azerbaijan, UNDP/GEF study within “Reducing Transboundary Degradation in Kura Aras River basin” project implemented Azerbaijan Branch office of RECC


6. Overview of the Mitigation/Adaptation Policy Instruments in Azerbaijan, PROMOTEAS project


10. www.azerbaijans.az

11. www.enpi-fleg.az


14. Methods and tools to assessing vulnerability of forests and people to climate change, working paper
Annexes

Questionnaire form

1. Organizational information

- Is your organization involved in climate change-related issues or forest management? If yes, how?
- Could you please describe the structure of management of climate change-related issues or forest management within your organization?
- How many staff do you have?

2. Understanding of the problem

- Do you have any information on climate change and its impact on different sectors of the economy, as well as forest areas?
- Could you please describe existing problems related to climate change negative impact on forests?
- Are there any activities implemented or planned related to climate change mitigation and adaptation of forests?
- What are the main types of forests most vulnerable to climate change tendencies?

3. Current capacity and knowledge

- How can you evaluate knowledge and capacity on climate change impact to forests?
- What is the reason of weak capacity and knowledge?
- How could it be increased?
- Does your organization organize any capacity building activity on climate change adaptation of forests?
- Does your staff participate at any capacity building activity related to climate change organized in the framework of national or international projects?
- Do you think that international practice in climate change adaptation of forests could be applied in our country?
- What are the main obstacles? Institutional structure or legislative basis? Or low level of awareness?
4. Capacity needs

- Could you please list main topics that are in need to be considered within capacity building activities?
- What are main expectations after getting improved capacity of staff on above-mentioned topics?
# Laws and normative acts related to forest management

<table>
<thead>
<tr>
<th>S/s</th>
<th>Names of legislative documents</th>
<th>Date of entry into force</th>
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<tbody>
<tr>
<td><strong>Laws</strong></td>
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<tr>
<td>1</td>
<td>Forest Code</td>
<td>1998</td>
</tr>
<tr>
<td>2</td>
<td>Law on especially protected nature areas and objects</td>
<td>2000</td>
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<tr>
<td>3</td>
<td>Law on environmental protection</td>
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<tr>
<td>4</td>
<td>Law on plant protection</td>
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<td>Water Code</td>
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<td>6</td>
<td>Law on pesticides and agrochemicals</td>
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<td>7</td>
<td>Law on obtaining information on the environment</td>
<td>2002</td>
</tr>
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<td>8</td>
<td>Law on land reform</td>
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<td>9</td>
<td>Law on industrial and domestic wastes</td>
<td>1998</td>
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<td>10</td>
<td>Law on environmental safety</td>
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<td>11</td>
<td>Land Code</td>
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<td>12</td>
<td>Law on protection of ambient air</td>
<td>2001</td>
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<td>13</td>
<td>Law on melioration and irrigation</td>
<td>1996</td>
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<td>14</td>
<td>Law on subsoil</td>
<td>1998</td>
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<td>15</td>
<td>Law on soil fertility</td>
<td>2000</td>
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<tr>
<td>16</td>
<td>Law on hydrometeorological activities</td>
<td>1998</td>
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<td>17</td>
<td>Law on water supply and waste waters</td>
<td>2000</td>
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<tr>
<td>18</td>
<td>Law on mandatory environmental insurance</td>
<td>2002</td>
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<td>19</td>
<td>Law on environmental education and awareness of population</td>
<td>2003</td>
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</table>

**Normative legal acts approved by the Orders of the Cabinet of Ministers**

<table>
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<tr>
<th>S/s</th>
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<tbody>
<tr>
<td>1</td>
<td>Act on some normative legal acts on the forestry</td>
<td>1999</td>
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<tr>
<td>2</td>
<td>Rules of lease of lands of forest fund</td>
<td>1998</td>
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<td>3</td>
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<td>4</td>
<td>Rules of implementation of forests monitoring</td>
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<td>5</td>
<td>Rules of use of the areas of forest fund for scientific-research, cultural-sanitary, tourism</td>
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<td></td>
<td>and sport purposes, and needs of forestry</td>
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<td>6</td>
<td>Rule of forest structure works</td>
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<td>7</td>
<td>On the phytosanitary rules of protection of forest fund from pests and diseases</td>
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<td>Rules of wood output in the forests of the Azerbaijan Republic</td>
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<td>9</td>
<td>Rules of inclusion of forests in protection categories, transfer of forests from one</td>
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<td>protection category to another</td>
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<td>10</td>
<td>Rules of logging</td>
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<tr>
<td>11</td>
<td>List of state registry indicators of forest fund</td>
<td>1999</td>
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<tr>
<td>12</td>
<td>Rules of the fund of maintenance and reproduction of forests</td>
<td>1999</td>
</tr>
<tr>
<td>13</td>
<td>Fire Safety in the forests of the Azerbaijan Republic</td>
<td>2004</td>
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Structure of Forest Development Department