

ARMENIA

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Summary of climate change dimensions

Currently humanity is facing climate change challenges that require urgent action at national, regional and global levels. Recognizing the importance of addressing human-induced climate change and its possible negative consequences worldwide, the United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992, and its Kyoto Protocol in 1997. Armenia ratified the UNFCCC in May 1993, and the Kyoto Protocol in December 2002. According to Articles 4.1 and 12.1 of the UNFCCC, Armenia regularly follows its commitments, as defined for the Non-Annex I Parties to the Convention, and participates in international cooperation and regional programmes related to climate change.

First National Communication to the UNFCCC

In order to fulfil the basic provisions of the Convention, Armenia has implemented the project "Armenia – Country Study on Climate Change", which was funded by the Global Environment Facility (GEF). Within the scope of its First National Communication (FNC), Armenia has carried out the following activities (Ministry of Nature Protection/UNDP Armenia/GEF, 1998):

- Inventory of anthropogenic emissions and sinks of GHGs according to the IPCC 1995 Guidelines.
- Identification at national level of the regions, natural ecosystems and spheres of activity that are most vulnerable as a result of expected climatic changes.
- Development of education, training of specialists, raising awareness of climate change-related issues, and enhancement of public opinion to these problems.
- International cooperation and information exchange on issues of relevance to fulfilment of commitments to UNFCCC.
- Submitting information to the Conference of Parties of UNFCCC on national measures for the fulfilment of the Convention and their results.
- Cooperation directed to reduction of anthropogenic emissions of GHGs in all sectors of the economy, especially in the energy sector, together with transport, industry, agriculture, forestry and waste removal.

The National Greenhouse Gas Inventory of Armenia considered five of the six main modules of the IPCC Guidelines. These were energy, industrial processes, agriculture, land use change and forestry and waste. In the GHG emissions and removals calculations both the IPCC defaults and local factors were used, with regard to the specific conditions of Armenia. The activity data were applied according to the data provided by the national and sectoral statistics.

For the land use change and forestry sector of the national GHG inventory it was estimated that CO₂ emissions and removals were caused mostly by the forestry sector. Based on estimations for 1990, CO₂ emissions from the forest sector were 80 Gg while absorption was 697 Gg, resulting in a net absorption equal to 617 Gg. Forest and grassland conversion was assumed to be insignificant, and abandoned managed lands continued to degrade and not accumulate carbon, thus they were not included in the calculations.

According to the FNC, some shift was expected of existent landscape zones in the country. In particular, the lower border of the forest belt was envisaged to move upward by 100–200 m, with vulnerability of forests expected to increase as a result of insect infestations. It was noted that the change in the lower forest border could be expected to take place over the next 50–100 years, while some upper forest expansion would be possible by slow natural forest regeneration.

To reduce adverse consequences of climate change in natural ecosystems of Armenia, the following adaptation measures were outlined: creation of optimum forest cover, up to 20.1% of the territory of the Republic, by 2050; allocation of reserves and specially protected natural territories for the reduction of general anthropogenic pressure on vulnerable ecosystems; introduction of endangered species into similar habitats, promoting survival in case of climate change; preservation of the genetic stock of the most vulnerable and valuable species by keeping and cultivating *ex situ*, preservation of genetic resources in seed banks, etc.; and monitoring of vulnerable ecosystems.

It was calculated that with annual planting of 5 300 ha of forest it might be possible to expand forest cover from the current 11.2% to 20.1% by 2050, increasing the forest area by 266 500 ha. The study of historical, archaeological and paleobotanical data on past forest cover of the country has also revealed that it was three times bigger than today, comprising about 35% of the total territory in the first millennium B.C.

Capacity building in Armenia for technology needs assessment and technology transfer for addressing climate change problems

The objective of the second phase of the Armenia – Country Study on Climate Change project was capacity building in Armenia for solution of climate change problems in the following main directions:

- Identification of the priority technological needs of Armenia’s economic sectors in the areas of reduction of GHG emissions, development of proposals for key technologies and assessment of possibilities for their practical application, development and assessment of specific technological projects.
- Development of proposals for adaptation measures and technologies for mitigation of the consequences of climate change for the environment and economic sectors.
- Determination of the technological needs for the development of the monitoring system and strengthening of the national monitoring network for participation in the Global System of Climate Monitoring (GSCM).

The report (Ministry of Nature Protection/UNDP Armenia/GEF, 2003) incorporated the results of activities, including analyses of GHG emissions, technological needs and technologies for reduction of GHG emissions. A fair amount of attention was paid to the assessment of the potential and use of alternative sources of energy. In addition, the report presented the results of vulnerability assessments for water resources, agriculture, environment and population health, as well as the technological needs and adaptation technologies for mitigation of climate change impacts in the areas mentioned, as well as incorporating information on the activities of the national hydrometeorological service and conditions of the monitoring network, analysis of the trends of climatic anomalies and assessment of their impact on the economy. Priority needs for strengthening the environmental observation and monitoring networks and wider participation in the GSCM were identified.

Finally, it discussed the conditions for technology transfer to the country (investment environment, financial market, legal framework, etc.), and presented the results of activities for developing and strengthening national capacity (organizational, informational, human) for assessment of technological needs and transfer of technologies, as well as activities for increasing public and stakeholder awareness and interagency coordination in climate change-related issues.

National capacity self assessment for global environmental management – UNDP project

First, the national capacity needs were assessed for implementation of UN Conventions on Biodiversity, on Climate Change and to Combat Desertification (thematic assessment). The

activities implemented and existing capacity was assessed from the viewpoint of ongoing processes and sectoral development plans of the country, as well as relevance for implementation of Convention decisions (UNDP/GEF, 2004). The second stage covered capacity assessment in seven cross-cutting areas:

- Organizational activities.
- Approximation of legislation to the requirements of Convention.
- Taxonomy and monitoring.
- Database development.
- Submission of national reports to the Convention Secretariat.
- Staff training and awareness projects development and implementation.
- Internal and international cooperation.

The selection was based on two considerations:

- all the seven areas were considered to be common relative to the three conventions, enabling application of synergistic possibilities of conventions for capacity needs assessment, and to correspond to the national development priorities and peculiarities; and
- all seven areas are tools for environmental policy: their improvement and harmonization will contribute to the development and implementation of a unified environmental protection policy at national and global levels.

Capacity building for improving the quality of GHG inventories (Europe/CIS region) – UNDP project

The goal of this regional project was to build on the inventory work undertaken for FNC in preparation for Second National Communications. Technical and institutional capacity would be sustained. As a result of the regional project, GHG inventories prepared under enabling activities for subsequent National Communications should be of a higher quality than those prepared for the initial national communications. Immediate objectives of the Project were the following:

- Strengthened national arrangements for compiling, archiving, updating and managing GHG inventories.
- Sustainable institutional process created.
- Enhanced technical capacity for preparing national inventories.
- Improved emission factors and methods.

A programmatic approach to building capacity was developed. The approach, while regional in design, was flexible enough to meet national needs. Aside from certain common activities, countries were free to choose to participate in some or all of the remaining project activities, consistent with national priorities. This gave countries the opportunity to focus allocation of resources on national arrangements or emission factors, as appropriate. After conducting the key source analysis, the countries reviewed the regional summary table at the project finalization workshop in Croatia (Zagreb, March 2002) and agreed upon a key-source inventory that will include up to four IPCC subcategories:

- Fugitive CH₄ emissions from oil and gas (Energy Sector).
- CH₄ emissions from solid waste (Waste Sector).
- CO₂ from transport (Energy Sector).
- CH₄ emissions from enteric fermentation (Agriculture Sector).

Although the LULUCF sector was not included as a priority sector in the frame of a regional project, further application of the IPCC Good Practice Guidance (GPG) for LULUCF, 2003, allowed the inclusion of the LULUCF sector in key source and sink analyses for GHG inventories. Recognizing the importance of the LULUCF sector within the overall GHG inventory, the project team focused on building the appropriate competence for the sector

consistent to GPG LULUCF, 2003, requirements. It promoted improving the available expertise in the sector from the level recorded at the beginning of the Regional Project (www.nature-ic.am/ccarmenia/download.php?fid=842765244), which applied the IPCC95 Guidelines. In addition, expertise for the LULUCF sector was not available at the beginning of the project in the country. However, in spite of the short time available and resources allocated to the sector, following recruitment of a National Expert on LULUCF, it was possible to gain significant achievements, namely:

- Review and apply to the extent possible, the IPCC 96 Guidelines, and GPG LULUCF, 2003.
- Improve a number of Activity Data resources thanks to application of complete territorial coverage of broad Land Use Categories, including Forest Land, Cropland, Grassland, Wetland, Settlement and Other Land, consistent with GPG LULUCF, 2003.
- Improve around 30 Removal Factors for Average Annual Timber Increment by species and forest categories for baseline year 1990, as well as about 15 local Basic Wood Density factors and 14 Conversion Factors for Carbon Fraction of Dry Matter.
- Develop the National Inventory Manual chapter for LULUCF, etc.

Technical assistance to Armenia, Azerbaijan, Georgia and Moldova with respect to their global climate change commitments – TACIS project

This regional project had the objective of building capacity for hosting CDM projects in the beneficiary countries, including assistance in forming the institutional infrastructure required to support CDM projects, and development of a portfolio of CDM projects, which would fit into the sustainable development strategy of the beneficiary country. Also covered were awareness raising among key policy-makers, the business community and the general public on issues related to UNFCCC and the Kyoto protocol, and on development opportunities and issues with respect to CDM and GHG mitigation, as well as local capacity development in GHG emission forecast modelling and assessment of sectoral GHG mitigation potentials and options and assistance to the beneficiary countries in developing their national climate change strategies, including mitigation and adaptation measures. The project outcomes include (EC, 2006):

- organization of a series of local and international awareness raising seminars on Kyoto Protocol and CDM for representatives of key ministries, project partners, private companies and NGOs;
- development and update of the CDM project pipeline;
- development of CDM Manual for Armenia;
- development and maintenance of the project website (www.cdm.nature-ic.am) which serves as a channel for dissemination of project materials and CDM-related information;
- development of a draft procedure for CDM project submission and approval; and
- development of a baseline study for grid-connected small renewable projects and three CDM project design documents.

In addition, within the scope of the TACIS project, Fichtner GmbH & Co. KG in co-operation with the Armenian Office of the Regional Project successfully prepared the Project Design Document (PDD) for a Community Small-Scale Afforestation/Reforestation CDM Project in the Lori region of Armenia. The proposed project has been designed in a way to have clear community based-orientation, focusing on Lori: one of the largest, but poorest, administrative regions of the country. Other important aspects related to the favourable nature and climatic conditions were also taken into account for the identification of the proposed A/R project activity location.

Together with tackling various technical issues related to development of the first carbon forestry project in Armenia, open and voluntary project participation has been ensured, raising awareness among the rural communities and Lori Territorial Administration (Marzpetaran) level. To facilitate this, a number of community meetings and field visits were undertaken to promote community

involvement and to identify eligible A/R sites. As a result, 25 rural communities of RA Lori marz signed Memoranda of Cooperation with Fichtner for joint implementation of the project.

The proposed project was planned as a group of relatively small areas located in different low income communities in Lori region, covering ca 1000 ha. The project area limitation was based on methodology applied for small-scale projects, since the project was expected to result in net anthropogenic GHG removals by sinks of less than 8 kilotonne of CO₂ per year. Although during project development there was no requirement for inclusion of forest adaptation objectives, they were nevertheless integrated in the project development process (Gevorgyan, 2008) to the extent possible to ensure efficiency of forest mitigation measures. However, it was not possible to proceed further for finalization of the project PDD, mainly due to lack of time and available funds, as well as there being no potential project donor identified.

The socio-economic impact of climate change in Armenia – UNDP project

The project findings prepared by Stockholm Environmental Institute (USA) stressed the following social impacts: an increased incidence of illness from heat waves as temperatures rise; a shortage of water and an increase in electricity tariffs as competing needs collide; food shortages or increased food prices as agricultural productivity falters; and an increased incidence of dangerous and damaging landslides, mudflows and floods as dry soil and deforestation coincide with extreme storms. The project report suggested very serious economic impacts, with business revenues, jobs, household income and consumption all falling as agricultural production declines and electricity tariffs grow. Smaller-scale economic losses in electricity generation and damage to forests are expected.

Changes to temperature and precipitation on this scale over the half century were forecast to have far-reaching effects on many aspects of social and economic life in Armenia. The scale of climate change damages will depend on individual, business and—most importantly—state responses through adaptive policies in the country. Social and economic impacts from climate change (high temperatures and heat waves, water shortages, reduced agricultural production, reduced electricity production and price increases, damage to forests, and natural disasters) were described in detail and subjected to socio-economic analyses, including potential adaptation measures to address each type of damage.

Mitigating impacts of climate change through forest protection, management and restoration in southern Caucasus – BMU/WWF project

The regional BMU/WWF project embraced three Southern Caucasus countries and consisted of four modules: two on forest carbon sequestration (A/R CDM projects, including one in a mountain area in Lori, Armenia; one addressing climate adaptation in mountain forests in Georgia; and one for developing a regional climate forest adaptation plan for southern Caucasus (Anon. 2008)). An investment of € 4.8 million has been envisaged in support of a project on climate mitigation through forest protection, management and restoration in three countries. Besides mitigating climate change, the project was also expected to generate new economic opportunities for the rural population in the three pilot areas, introduce alternative energy options, reduce economic losses due to unsustainable land use practices, and enhance the local biodiversity.

Project partners in Armenia were the Climate Change Centre of the Ministry of Nature Protection, “Hayantar SNCO” of the Ministry of Agriculture and the “Armenia Tree Project” NGO. The chosen project area included sites in two communities in the Lori Region: Margahovit and Spitak. Additional benefits included were the creation of local job opportunities for communities, and enhanced biodiversity values. To disseminate the results, national workshops were scheduled at the end of the project, involving representatives from other ministries, local and regional authorities, and the international donor community.

The total country project budget was €1 460 000, with the biggest allocation to local investments (71%), followed by CDM registration, local labour costs and project management. According to the logistics of the regional project, the Project Design Document should be developed in Armenia and submitted for validation. According to the timetable of the project, it was expected that the CDM project would be registered and operational by the end of 2009. Although some forest planting activities were implemented, unfortunately, it could not lead to A/R activities under the CDM framework. In fact, despite availability of funds, the project developers could go no further than the outcome obtained during the TACIS initiative on development of PDD for “Community small-scale afforestation/reforestation project in Lori, Armenia” in 2006.

Second National Communication to the UNFCCC

The Second National Communication was prepared in accordance with the guidelines for national communications of Non-Annex I parties (2003) by the Ministry of Nature Protection of Armenia, with financial support from GEF and the support of the UNDP in Armenia. The Second National Communication had a larger scope related to climate change problems, considering the developments in the country, as well as new developments under the convention after the submission of the First National Communication. Activities identified in Second National Communication included:

- Improve and expand the database of the national GHG inventory and analyse the emission trends for 1990–2006.
- Assess the potential for reducing GHG emissions in various sectors of the economy.
- Develop climate change scenarios for Armenia.
- Assess the vulnerability of ecosystems and climate-dependent sectors of the economy and define priority adaptation actions for mitigating the consequences of climate change.
- Assess the impact of the expected intensification of dangerous hydrometeorological phenomena and the related early warning needs
- Assess the improvement needs of national systems for systematic observation and climate monitoring.
- Enhance knowledge and public awareness concerning climate change issues, and contribute to improving the qualifications of climate change specialists.

The application of the IPCC GPG for LULUCF, 2003, has enabled not only the recalculation of the national GHG inventory results for 1990, but also revealed that rapid changes in the emission/removal balance had taken place in the LULUCF sector (from -36.0 Gg in 1990 to +1563.6 Gg in 2000), which is mainly attributed to unsustainable forest management and agricultural land use practices. In fact, the forest sector itself has become a large source of GHG emissions, instead of normally being a carbon sink. Table 1 below presents the data by broad land use categories for the baseline (1990) and inventory (2000) years. It should also be stressed that a number of difficulties related to the lack of a national forest carbon accounting and reporting framework, institutional arrangements, as well as scarcity of forestry and land use data, made it a challenge to meet IPCC GPG for LULUCF, 2003, requirements. Therefore, taking into account the importance of LULUCF as a key sector for the GHG inventory, there is a strong need for the further capacity building in this sector. The SNC has also outlined the climate change impact in relation to forest cover of the country. In particular, more than 17 000 ha of forest (5–5.5%) is expected to disappear because of unfavourable forest growth conditions. In addition, areas highlighted were worsening phytosanitary conditions, mass outbreaks of diseases and pests, and greater risk of forest fires, all of which will lead to negative impacts on forest ecosystems. The idea of optimal forest cover suggested by the FNC has not been further supported by SNC. Within the scope of the “Enabling activities for the preparation of the Armenian’s Second National Communication to the UNFCCC” a UNDP/GEF project, the “Implementation of the Kyoto Protocol’s Clean Development Mechanism in Armenia” was published.

Table 1. Land use, land use change and forestry (LULUCF) sector GHG inventory results for 1990 and 2000.

Land Use, Land Use Change and Forestry sector	Net GHG fluxes (Gg CO ₂ e.)	
	1990	2000
LULUCF, Total	-736.0	1 563.6
5A Forest Land	-837.1	441.0
5B Cropland	-134.0	501.8
5C Grassland	173.4	598.4
5D Wetland	71.2	27.7
5E Settlement	-9.4	-5.2
5F Other Land	0.0	0.0

Adaptation to climate change impacts in mountain forest ecosystems of Armenia – UNDP/GEF project

The Ministry of Nature Protection of Armenia has requested technical assistance from UNDP and GEF to address impacts of climate change on mountain forest ecosystems in the south-eastern, Syunik region of the country. It is expected also to bring in its own resources in addition to those of the GEF to achieve the project main goal in Syunik, namely to adapt forest ecosystems to climate change. This has involved reducing or removing anthropogenic pressures, and adopting policies and practices that will directly assist species in forest ecosystems to adjust to climate change. The project is going to operate at multiple levels:

- to integrate climate change risks into the critical decision-making points of forest conservation and management at national and sectoral levels;
- to develop institutional capacities for planned adaptation by improving climate risk monitoring, data management, knowledge and skill-set development for scenario-based decisions; and
- to demonstrate effectiveness of adaptation measures that are designed and implemented by the local stakeholders at sub-national level.

The project will therefore focus on strengthening the enabling environment for mainstreaming climate change risks in forest and protected area management planning, developing associated technical capacities, as well as piloting on-the-ground adaptation measures at target sites.

The following three main outcomes of the project are expected:

- The enabling environment for integrating climate change risks into management of forest ecosystems is in place.
- Forest and protected area management in the Syunik region integrates pilot adaptation measures to enhance adaptive capacity of mountain forest ecosystems.
- Capacities for adaptive management, monitoring and evaluation, learning, and replication of project lessons are developed.

Response measures focused on reducing the effects of the three main climate-induced threats to forest ecosystems: pest outbreaks; forest fires; and increased fragmentation. Lessons learned are expected to be replicated in other mountain forest ecosystems in central and northern Armenia. Within the scope of the project the publication on “Forest Biodiversity of Armenia's Syunik Marz and Global Climate Change” (Anon. 2008b) was prepared in Armenian with a short English summary, aiming to present the rich forest biodiversity of the region, covering current and expected vulnerability to global climate change impacts, as well as a brief introduction to the adaptation measures for climate change impacts.

Status of assessment and research on climate change

Systematic climate observations

The main institution responsible for systematic hydrometeorological and climate observations in Armenia is the State Hydro-Meteorological and Monitoring Service (Armstatehydromet SNCO) of the Ministry of Emergency Situations of RA. It operates in accordance with the provisions of the Law on Hydro-Meteorological Activities (2001) and provides actual hydrometeorological data to relevant authorities and the general public.

Hydrometeorological observations have been conducted in Armenia since 1881; however, initially they were not done systematically. The establishment of a proper network of observations dates from the 1920s. At present, there are 42 meteorological and 3 special stations (Figure 1) in the country. In addition, 79 hydrometeorological observation points, a hydro-meteorological observatory, and seven hydrological stations with 92 water gauge observation points operate within the system.

Yerevan, Sevan and Amasya meteorological and one aerological (Yerevan) stations are part of the global communications system (GCS). In addition, 20 stations are included in the intergovernmental hydrometeorological network of CIS countries. During 2000–2007, Armstatehydromet, as a result of cooperation with the World Meteorological Organization (WMO), was able to introduce a number of new systems and equipment. Technologies relevant to new international standards assist in obtaining and sharing data. The WAREP code for communicating rapid notifications on dangerous hydro-meteorological phenomena is being introduced. Since 2007, efforts have been under way for transition from the traditional letter-digit codes to the Binary Universal Form for the representation of meteorological data (BUFR), which is widely used worldwide. The “TV-inform” system installed in Armstatehydromet in 2002 was replaced by the “Mitra” system in 2004, which was integrated with UniMAS and RETIM2000 systems.



Figure 1. Meteorological monitoring network in Armenia

Data from observations at all the meteorological stations are collected and stored in the Armstatehydromet central database, using the CLICOM system. A few years ago, following IPCC recommendations, RClimDex software was introduced for data quality control. Sinop software is already being used and new software has also been introduced. Additionally, the KH-01 software for decoding and binary representation of meteorological data has been developed and introduced.

Governmental and public organizations, as well as the general public are consumers of the hydro-meteorological information provided by Armstatehydromet. Many important climate parameters are available free of charge, including:

- maximum and minimum temperatures of the previous day; quantity of precipitation; meteorological phenomena; clouds; depths of snow cover on the national territory;
- weather forecasts for all regions for up to 5 days;
- characteristics of heliophysical and radiation regime; and
- forecasts of hydrological phenomena.

Since 2003, Armstatehydromet has been included in the European Climate Assessment & Dataset (ECA&D) and regularly provides observation data, which are used by IPCC for calculating indexes used for the assessment of climate change. According to the procedures defined by WMO, the data from observations at Yerevan aerological and Amberd stations are regularly communicated to the relevant centres. Since 2007, Aragatz, a high-elevation station (3226 m), the only station in the region operating at over 3000 m of altitude, is included in the GCOS Surface Network (GSN). The station has been operational since 1929 and has enormous significance for climate change studies in the region.

Armstatehydromet has provided data to the Global Precipitation Climatology Centre (Offenbach, Germany) established within the framework of the Global Climate Observation System (GCOS), where studies of precipitation distribution and its global changes are conducted based on the collected data. Armstatehydromet, in partnership with the German Meteorological Organization (DWD), is implementing the programme “The use of CM-SAF satellite products for monitoring of the climate on Armenia’s territory”.

Research activities and programmes on climate change

The research activities in Armstatehydromet are conducted by the Climate Study Centre, which has four departments: Climatology; Digital Modelling of Hydrometeorological Processes; Global and Regional Climate Change Studies; and Applied Climatology. The climatology department processes data from the 280 stations and observation points for various periods, as well as publishing books where the climatic resources of the territory are presented in detail. In the department for digital modelling of dangerous hydrometeorological phenomena, dynamic statistical models for short-term forecasts are developed and further elaborated. The algorithms developed are used for assessment and forecasts of precipitation, river flows, mudslides, yield of agricultural crops, droughts, and atmospheric pollution. The global and regional climate change studies department develops models for climate change scenarios in Armenia, also reflecting changes occurring at a global scale. Long-term forecasting methods (monthly, seasonal, annual) have been developed for various purposes. The applied climatology department develops methodologies for forecasting hydrological and water resources, agro-meteorological, bio-meteorological, alternative energy-related phenomena, as well as frequency and intensity of droughts.

Studies and programmes on climate change issues in Armenia are basically devoted to vulnerability, assessment of climate change consequences and developing adaptation measures. Since 2008, the following studies have been financed from the state budget:

- Dynamics and nature of changes to Armenia's flora as a result of the spread of invasive plant species and global climate change.
- Study of zoo-complexes of Armenia's invertebrates in order to identify climate change biomarkers and to develop the scientific basis for monitoring biodiversity vulnerability.
- Assessment of water, temperature and radiation resources for crop yields, based on modern principles.
- Assessment of the changes to water resources of large basins in Armenia.
- Development of methodologies for assessing and forecasting drought conditions and the losses to agriculture crops, and the piloting of these methodologies in Armenia's regions.
- Development of a methodology for forecasting crop yields in Armenia.
- Testing of the methodology for assessment and forecasts of Lake Sevan active water exchange zone, as a pre-condition for the management of the lake's water resources.

In spite of limited funding for forest/climate change study, independent research on “Assessment of carbon sequestration of Pallas pine plantation in the north-eastern region of Armenia” was initiated and conducted by Artur Gevorgyan from 2002–2007. The goals and objectives of the study were first presented as a poster in the Youth Sector of the exhibition area of the FAO XII World Forestry Congress, Quebec City, Canada, in September 2003. Later the research results were directly applied in development of the first A/R CDM project in Armenia under the TACIS initiative in 2006. During 2008–2009, for assessing climate change impacts on various sectors and developing adaptation measures, the following pilot projects were implemented with UNDP support:

- Assessment of climate change impact on the economy of Shirak region. Adaptation measures for mitigating the impact of climate change on the region's economy were proposed. Public opinion on climate change was assessed, and public awareness building measures were implemented.
- Assessment of climate change impacts on Lusadzor community of Tavush region. In Lusadzor, as a target community of the UNDP community development project (UNDP Armenia, 2009), the current and forecasted changes to the climate were analysed in detail, the impacts influencing community development projects were identified, and priority adaptation measures were identified.
- Comprehensive assessment of climate change impact on water resources in Marmarik River basin. The project assessed the changes to the water resources of Marmarik river basin up to 2007, forecasted the vulnerability of water resources by 2030, 2070 and 2100, assessed the potential financial-economic losses from the water system as a result of climate change, and developed adaptation measures with economic justifications in four categories: without significant expenditures; with minimum expenditures; economically justified measures; and long-term measures (UNDP Armenia, 2009b).
- Climate change-related risk assessment in Ararat region. Based on the natural disasters assessment project implemented in the region with UNDP financing, as well as the results of a survey conducted in more than 30 communities of the region, the dynamics and risks of dangerous hydrometeorological phenomena and natural disasters in the Ararat region were analysed within the context of climate change impacts, and measures for mitigating the impacts were proposed.

Proposed areas for cooperation

Development of a National Forest Carbon Accounting and Reporting System in Armenia

The role of the forests in the carbon cycle is significant. However, in order to account and report the changes occurring in the forest carbon balance, a proper system should be established and maintained at the national level. Elaboration of the national GHG inventory for the LULUCF

sector has revealed new priorities, as well as a number of challenges faced by the country in order to meet relevant IPCC reporting requirements for the LULUCF sector.

The SNC of Armenia under the UNFCCC has identified the LULUCF sector as a key category and Forest Land as a significant sub-category within the overall national GHG inventory for 2000 year. At present, it is urgent to improve the quality of the GHG inventory related to forestry and to strengthen forest mitigation measures at various levels. In particular the project may cover the following aspects:

- Development of guidelines and a common reporting framework designed for all forest land users, including state forest management units, specially protected nature areas (i.e. forest reserves, reservations, national parks, etc.), communities, the private sector, and individual landholders.
- Ensuring the data can identify relevant forest management activities and land use changes, including deforestation, afforestation and reforestation.
- Providing systematic training for project beneficiaries at local, sub-national and national level.
- Making recommendations for forest inventory for short-term and long-term improvement.
- Building capacities for Reducing Emissions from Deforestation and Forest Degradation (REDD) initiatives.

Feasibility study to foster A/R project development under the CDM

Carbon forestry projects can demonstrate mutual benefits for the mitigation of climate change and achieving sustainable development in developing countries. During the first commitment period of the Kyoto Protocol, LULUCF projects are limited to A/R activities. However; in spite of obvious benefits, A/R activities have not yet gained much popularity, which is in part attributed to complexity in developing and implementing such projects.

Normally, in order to foster A/R CDM project development in a country, it is strongly encouraged to undertake feasibility studies, aiming to review existing forest policy, legal, institutional and technological capacities. More importantly, possible barriers should be identified and measures to mitigate them addressed.

The necessity for such study was still very high in 2006, when the draft Project Design Document for Community Small-Scale Afforestation/Reforestation project in Lori region of Armenia was developed under the TACIS regional initiative. However, due to lack of time and resources, many aspects related to a detailed feasibility study were omitted at that time, expecting to return to them once a potential donor had been identified. Surely, without a comprehensive country feasibility study, efforts to foster A/R CDM projects may not be successful, unless properly covering the following aspects:

- Identification of investment, institutional and technological barriers, as well as barriers due to prevailing (first of its kind) practices, ecological and social conditions.
- Preparation of adequate measures to address identified barriers.
- Consideration of climate change impact for establishment and further tending of forest plantations, aiming to increase their adaptive and mitigation capacities.
- Ensure development of human capacities to deal with carbon forestry projects.
- Assessment of potential for eligible pilot A/R sites to be used under the CDM project activity.

Integration of forest adaptation and mitigation objectives securing forest development

The current UNDP/GEF project “Adaptation to Climate Change Impacts in Mountain Forest Ecosystems of Armenia” has provided good opportunities for cooperation with the forest sector in relation to climate changes issues. The project is also envisaged to serve as a model not only for other parts of the country, but also for the region. It embraces key forest actors at different levels,

addressing three aspects of forest adaptation: pest outbreaks, forest fires and increased forest fragmentation.

However there may be some opportunities for strengthening forest adaptation capacities, as well as ensuring that forest mitigation measures are in place. The combination of forest adaptation and mitigation objectives is not only possible, but also co-beneficial for forest development. Therefore, the implementation of complementary activities would allow maximization of the positive experience gained by the pilot project implementation, for subsequent dissemination to other interested parties. It does not necessarily mean affecting ongoing project implementation structures, but rather carrying out additional activities in parallel with other current UNDP projects. In particular, the following areas could be addressed:

- Redefining management priorities for the use and conservation of vulnerable forests areas.
- Adjusting the ways and methods of forest utilization in climate change-affected sites.
- Developing recommendations for improved silvicultural treatments, fostering more adaptable forest species and hybrids, as well as affecting local soil preparation, tree planting and tending techniques.
- Highlighting areas to reduce GHG emissions associated with forest degradation and deforestation, as well as strengthening forest carbon sequestration capacities.
- Raising public awareness of the impact of forest management on carbon balance and forest mitigation capacities, in line with forest adaptation considerations.

However, it is recognized that it will not be easy to alter the UNDP/GEF project already in implementation by adding new priorities or bundling with other parallel projects.

References

- Anon. 2009. Overview. Implementation of the Kyoto Protocol's Clean Development Mechanism in Armenia, 2009. Report of "Enabling Activities for the Preparation of Armenia's Second National Communication to the UNFCCC" Project UNDP/GEF/00035196. Available at: www.nature-ic.am/ccarmenia/download.php?fid=685031814
- Anon. 2008. Securing natural carbon sinks and habitats of special significance for adaptation to the consequences of climate change. BMU Caucasus Proposal.
- Anon. 2008b. Forest Biodiversity of Armenia's Syunik Marz and Global Climate Change, 2008. Available at: www.nature-ic.am/ccarmenia/download.php?fid=179757464
- EC. 2006b. Technical Assistance to Armenia, Azerbaijan, Georgia and Moldova with respect to their Global Climate Change Commitments, EC EuropeAid/111523/C/SV/Multi- Lot No.2 Final Report, September 2006, 31p. Available at web site: www.nature-ic.am/ccarmenia/download.php?fid=326695383
- EU. 2006a. Clean Development Mechanism Handbook for Armenia. The European Union's TACIS programme for Eastern Europe, the Caucasus and Central Asia. Available at: www.nature-ic.am/ccarmenia/download.php?fid=227584152
- Gevorgyan, A. 2008. Integration of Climate Adaptation and Mitigation measures is Co-Beneficial to Forest Development. Presentation at International Forest Adaptation Conference, IUFRO/SLU/FAO, 25–28 August, 2008, Umea, Sweden. Available at: www.forestadaptation2008.net/51746@122028/en/
- Ministry of Nature Protection/UNDP Armenia/GEF. 2003. Capacity building in the Republic of Armenia for technology needs assessment and technology transfer for addressing climate change problems. "Armenia - Country Study On Climate Change" Project, II Phase. Available at www.nature-ic.am/ccarmenia/download.php?fid=834618567
- Ministry of Nature Protection/UNDP Armenia/GEF. 1998. First National Communication of the Republic of Armenia under The United Nations Framework Convention On Climate Change, October, 1998. Available at www.nature-ic.am/ccarmenia/download.php?fid=291493448

- Second National Communication of Armenia under the UNFCCC. Final draft, English summary.
Available at: www.nature-ic.am/ccarmenia/download.php?fid=121137701
- SEI. 2009. The Socio-Economic Impact of Climate Change in the Republic of Armenia, Stockholm Environmental Institute (USA)/UNDP project.
- UNDP Armenia. 2009. Armenia: Lusadzor Village Climate Change Impact Assessment.
Available at: www.nature-ic.am/ccarmenia/download.php?fid=121994435
- UNDP Armenia. 2009b. See: www.nature-ic.am/ccarmenia/download.php?fid=804357239
- UNDP/GEF. 2009. Adaptation to Climate Change Impacts in Mountain Forest Ecosystems of Armenia, UNDP/GEF project. Inception report. Available at: www.nature-ic.am/ccarmenia/download.php?fid=818226157
- UNDP/GEF. 2004. [Report of] National Capacity Self-Assessment for Global Environmental Management project. Project UNDP/GEF/ARM/02/G31/A/1G/99. Available at: www.nature-ic.am/ccarmenia/download.php?fid=607138983
- UNFCCC. 2006. Project Design Document for “Community small-scale afforestation/reforestation project in Lori, Armenia” by Artur Gevorgyan and Julia Funck, November 2006. Available at: www.nature-ic.am/ccarmenia/download.php?fid=906419005