

CLIMATE CHANGE IMPACT ON AGRICULTURE OF ARMENIA: VULNERABILITY ASSESSMENT AND ADAPTATION MEASURES

BRIEF DESCRIPTION OF AGRICULTURAL SECTOR IN ARMENIA

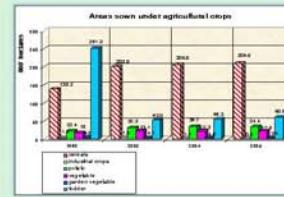
The food and agriculture sector and food processing is one of the most important branches of the Armenian economy and provides about 30% of the Gross Domestic Product, of which the share of agriculture is around 19%. It is the main source of rural livelihood, with farm income accounting for some 51% of the total income of rural households. Agro-food sector includes more than 340,000 private farms and a great number of privately owned suppliers, agricultural product marketing and processing organisations. Land is mostly privately held, but plots are very small (averaging 1.3 ha). The major land users in agriculture are the small farms, which have 75.9 % of arable land, 74.7 % - perennials and 44.9 % - grassland. At present more than 98% of the gross agricultural product is produced by the private sector.

Armenia is not rich in land resources. Only 46.6 % of the total area of the republic can be used for agriculture. 90% of the land of agricultural significance is located on the altitude of more than 1000 m above sea level. Considerable deviations in the altitude and surface characteristics, complex geomorphologic conditions and hydrothermal features have led to the formation of variegated soils (brown semi-desert - 5.1%, chestnut - 8.2%, black - 24.1%, meadow-steppe - 9.5, brown Forest - 4.5%, mountain-meadow - 11.6%) and different land types.

Land resources of Armenia and their structure

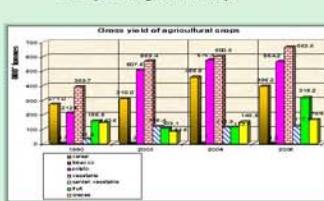
LAND TYPES	Area, thousand ha	Structure %	Including area requiring irrigation	Area, ha	Structure, %
Total agricultural lands, including	2135.3	100		179.7	100
Arable lands	457.7	21.4	145.0	80.7	
Perennials	29.0	1.4	28.2	15.7	
Grasslands	127.8	6.0	3.1	1.7	
Pastures	885.1	41.4	2.1	1.2	
Other lands	635.7	29.8	1.3	0.7	
Forests	398.0	-	1.4	-	

Area sown under agricultural crops

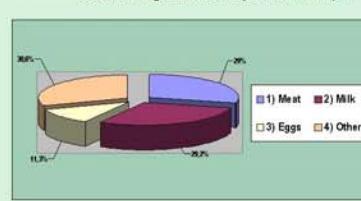


The crop yield is still low because of insufficient agricultural activities, poor availability and use of chemicals and fertilizers, as well as violation of the agro-technical rules. In general the increase of cultivated areas led to increase of cereal, vegetable and potato gross production. Animal production was also seriously damaged. The number of animals and the produce of animal origin sharply decreased during the transition period because of the reduced purchasing ability of the population, shortage of fodder production and imported volumes and under use of full potential of the natural pastures.

Gross yield of agricultural crops



Structure of gross livestock produce in 2005, %



The Government's objectives for the agricultural sector are specified in its Agricultural Sustainable Development Strategy, 2006. The overall objectives are to promote sustainable agricultural development, to ensure greater food security and to increase rural incomes. Key priorities in support of sustainable growth in the sector are to: (a) continue and deepen agrarian reform; (b) ensure food safety and improve food security; (c) promote the application of advanced agricultural technologies; (d) promote pedigree breeding and the improvement of animal health; and (e) promote agricultural processing and the development of associated supply and service infrastructure.

THE TARGET PROCESSES INTO WHICH CLIMATE CHANGE RISKS ARE INTEGRATED

Development of new or revision of policies and legislation in following sectors: National Security, agriculture and rural development, food security, public health, natural resources management including, forestry) and specially protected areas, hydroenergy resources, meteorological observation system:

- **Strategy on National Security** (2007) has special provisions: creation of favorable environment for vital activities of present and future generations, conservation and efficient use of natural resources, coordinated improvement of environmental conditions; country integration into organizations involved in monitoring and prevention of natural and technological disasters; reliable forecasting, prevention and mitigation of natural and technological risks, ensuring safety, reliability and stability of town-planning systems.
- **Agricultural Sustainable Development Strategy of the Republic of Armenia** (2006) is consistent with the Government programme on "Poverty Reduction Strategy Paper" and defines a number of activities relevant to climate change risk reduction. Although there is not clear formulation of climate change risks in the strategy text, such actions as forecasting and prevention of natural disasters (drought, floods etc.) and implementation of complex measures targeted at mitigation of consequences are stated.
- **Food Security Policy** (2005) includes issues on climate change, desertification, biodiversity protection and biological security and stipulates that the agricultural policy should take into consideration the global warming, together with its consequences. The components of food security programme include: creation of data bank on natural resources usage, assessment and monitoring of natural resources; development and implementation of land consolidation projects, regeneration of valuable and rare ecosystems, creation of early warning system to prevent crop damage in case of dangerous hydro-meteorological forecasts.
- **National Forest Policy and Strategy** (2004) and **Forest National Programme** (2005) include issues on climate change risks. The following activities related to climate change are envisaged: assessment of forest vulnerability as a result of forecasted climate change, efficient use of international financing mechanisms in forest sector (as envisaged by Kyoto Protocol) for implementation of afforestation projects; assessment of the damage caused to forests by pests and diseases, application of integrated methods of forest protection (due to this statement forest area treated increase in 30 times from 2004 to 2007; forest maintenance improvement (budget allocations for construction of fire prevention roads, forest guarding, etc. increase on 80% from 2005 to 2007).
- **National Action Plan to Combat Desertification in Armenia** (2002) anticipates development and application of target programs for mountainous settlements, promotes traditional use of community pastures.
- The Strategy on Specially Protected Areas (2002) envisages the following types of activities aimed to increase natural ecosystems adaptive potential: establishment of 12 new specially protected areas; optimization of the territory of the existing specially protected areas.
- The National Program for Combating and Preventing Malaria (1999). Following the adoption of the program, more pro-active measures aimed at prevention and treatment have been taken, resulting in significant decrease in the morbidity rate.

ADAPTATION MEASURES

Genetic measures

- ▷ introduction of new high-yielding frost-resistant and drought-tolerant crops and varieties
- ▷ improvement of the breed structure of herd
- ▷ introduction of more valuable species and varieties of grass

Land reclamation measures

- ▷ increase soil water keeping capacity (manure, organic matter increase some polymers, mulching the soil with volcanic rocks (tuff, perlite, slag))
- ▷ optimization of use of land reserve
- ▷ change of crops structure
- ▷ expansion of zones of crop production for 200-300m
- ▷ application of crop rotation schemes
- ▷ implementation of the secondary salinization prevention measures

Agricultural practices

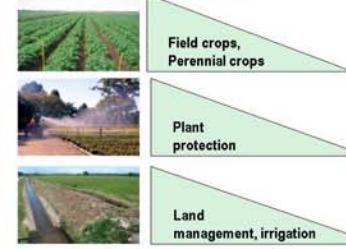
- ▷ wide introduction of soil moisture saving technologies (e.g. application of evening and night watering)
- ▷ soil cultivation technologies application (reduced tillage, water harvesting, mulching, etc.)
- ▷ sowing time change for winter crops
- ▷ revision of rates for fertilizers application, pest and diseases control
- ▷ regulation of the photo- and micro-climate
- ▷ improvement of pastures management (e.g. long-term rest)

Irrigation measures

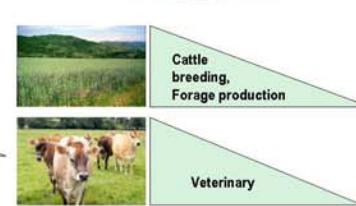
- ▷ revision of zone distribution of irrigated lands
- ▷ building of new irrigation schemes
- ▷ application of the drop method of irrigation of vineyards and orchards

THE MOST VULNERABLE AREAS OF AGRICULTURE

Crop production



Animal Husbandry



VULNERABILITY ASSESSMENT (First National Communication) Forecasted impact on agriculture

Global climate change and internal micro-climatic changes on the territory of Armenia might result in vulnerability of natural ecosystems and have the following consequences are forecasted:

- ▷ Change of the borders of natural climatic zones;
- ▷ Significant change of the biota;
- ▷ Change of the mode of the rivers' runoff, and quantitative indicators of water resources;
- ▷ Change of amount of precipitation and soil moisture content.

The climate change scenario selected: increase of the air temperature in 2°C and reduction of atmospheric precipitation for 10 % for the republic as a whole.

A significant fall of efficiency of the agriculture of Armenia is possible.

Crop Production:

- ▷ humidity of soil will decrease for 10-30%, depending on the vegetation period and height of the district
- ▷ natural moisture provision of various agricultural crops will decrease for 7-13 %
- ▷ moisture deficit in soil will increase for 25-50mm
- ▷ efficiency of crop production in Armenia can be reduced for 8-14 %
- ▷ productivity of crops, cultivated in the bottom hot and drought zones, will be reduced for 10-14%, and cultivated in moderate zones - for 7-10%
- ▷ productivity of cereals will be reduced on the average for 9-13%, vegetable crops - for 7-14%, potato - for 8-10%, horticultural - for 5-8%
- ▷ productivity of more heat-tolerant grapes can rise for 8-10%

Forage production and Animal husbandry:

- ▷ reduction of pasture areas as a whole and of their productivity for 4-10%
- ▷ expansion of the areas of low-yield pastures of the semi-desert belt for 17%
- ▷ reduction of the areas of the most valuable and high-yield pastures of the sub-Alpine belt for 19% and Alpine belt - for 22% and the productivity of mountain grasslands for 7-10%
- ▷ increase of the share of poisonous prickly and weed plants in structure of vegetation pastures, fall of their productivity and reduction of forage quality of the grass
- ▷ reduction of the head of the livestock for 30% and the dairy cattle production for 28-33%.

Documented impact of climate change on agriculture

Losses from the outbreaks of pests, droughts, frosts registered during the last decade

- ▷ In 2000 the losses from the droughts in agriculture made 66,7 min. USD, including 35% share of potatoes yield, 20% of cereals, 18% of vegetable melons;
- ▷ In 2004 the losses in fruit-growing and viticulture from frost made 25 min. USD;
- ▷ In 2005 the crop yield loses from hail, floods and frost made about 15 min. USD;
- ▷ More than 30 thousand hectares in Ararat valley is under the risk of salinization;
- ▷ Increase in the number of malaria morbidity: in 1999 the number of people contracting the three-day malaria reached 1166. In the framework of the National Program for Combating and Preventing Malaria, more active prevention and treatment measures were taken and morbidity rate dropped significantly, but the geography of the disease became more widespread;
- ▷ Increase in the number of cholera vibrio of group O1 (El Tor vibrio) from 1.4 to 2.4 percent in Armavir region of Armenia from 1998 till 2001.

NECESSARY ANALYSIS AND CHANGES IN DECISION MAKING AND MANAGEMENT OR PRACTICES

Necessary analysis:

- ▷ Analysis of strategic and programme documents in terms of climate change risks integration
- ▷ Identification of gaps and shortage in strategic papers in terms of inclusion of climate change related issues
- ▷ Review and analyze the activities carried out in the country since the First National Communication, implementation of a survey on changes in agricultural sectors during the last 10-20 years
- ▷ Assess the barriers, gaps and uncertainties related to the data collection, analyze of uncertainties for vulnerability assessment envisaged by the Convention
- ▷ Identification of the most vulnerable sectors of agriculture (e.g. crop production, animal husbandry, veterinary and forage production, land management, etc.), including analysis by agricultural zones and ownership forms
- ▷ Assess the vulnerability of agricultural sectors (including key crop species, productivity of pastures and hayfields, productivity of pastures and hayfields, structural and territorial changes in pastures and hayfields, spread of plant and animal disease, soil fertility, salinization, soil erosion) to the forecasted climate change scenarios applying relevant models recommended by IPCC, based on the indicators identified
- ▷ Assessment of economic losses of the years with climate acute fluctuations
- ▷ Analysis on separation of the climate impact on different sectors from socio-economic policies
- ▷ Develop recommendations for the adaptation measures in strategic long term and in short term perspective based on economic feasibility and stakeholder consultations

Changes in decision making and management or practices:

- ▷ Combination of awareness raising, regular studies, monitoring and evaluation
- ▷ Building knowledge sharing networks
- ▷ Establishment of the Board responsible for implementation of the adaptation policy under CC
- ▷ Advocacy and preparation of technical papers development of analytical papers
- ▷ Development of relevant insurance schemes and creation of conditions for their implementation
- ▷ Long term planning of the rural systems and diversification of agricultural practices
- ▷ Inclusion of climate change related issues in state funded research programmes
- ▷ Improved use of existing extension services