

**Fifth National Report
of the Republic of Armenia
to the Convention on Biological Diversity**



September 2014

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LIST OF ABBREVIATIONS

ADA	Austrian Development Cooperation
AMD	Armenian Dram
ANAU	Armenian National Agrarian University
ASPB	Armenian Society for the Protection of Birds
ATP	Armenia Tree Project
BMU	Building and Nuclear Safety, Ministry for the Environment, Nature Conservation, and Nuclear Safety of Germany
BMZ	Ministry for Economic Cooperation and Development of Germany
BSAP	Biodiversity Strategy and Action Plan
CARMC	Community Agricultural Resources Management and Competitiveness
CBD	Convention on Biological Diversity
CE	Continuing Education
CENN	Caucasus Environmental NGO Network
CEPF	Critical Ecosystem Partnership Fund
CI	Conservation International
CIMMYT	International Maize and Wheat Improvement Center
CITES	Convention on International Trade in Endangered Species
CJSC	Closed Joint Stock Company
CM/ResDip	European Diploma of Protected Areas
CNF	Caucasus Nature Fund
CCN	Civil Cooperation Network
ENA-FLEG	Europe and North Asia Forest Law Enforcement and Governance Programme
ENPI-FLEG	European Neighborhood Policy Instrument – East Countries Forest Law Enforcement and Governance Programme
ES	Ecosystem Services
EURISCO	web catalogue of ex-situ specimens under the European Cooperative Program for Plant Genetic Resources
FAO	Food and Agriculture Organization
FSC	Forest Stewardship Council
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIS	Geographic Information System
GIZ	German Federal Enterprise for International Cooperation
HPP	Hydropower Production
ICARDA	International Center for Agricultural Research in the Dry Areas
IUCN	International Union for Conservation of Nature

KfW	German government-owned development bank
LLC	Limited Liability Company
MSBP	Millennium Seed Bank Project
NAS RA	National Academy of Sciences of Republic of Armenia
NBSAP	National Biodiversity Strategies and Action Plan
NGO	Non Governmental Organization
OECD	Organization for Economic Co-operation and Development
OSCE	Organization for Security and Co-operation in Europe
PoWPA	Program of Works on Protected Areas
RA	Republic of Armenia
RECC	Regional Environmental Center for the Caucasus
REDD	Reducing Emissions From Deforestation and Forest Degradation
SHPP	Small Hydropower Plants
SNCO	State Non-Commercial Organization
SPNA	Specially Protected Nature Areas
TEEB	Economics of Ecosystems and Biodiversity
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
WB	World Bank
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

Armenia is a typical mountainous country, where the landscapes and ecosystems form a complex multi-functional system. In general, ecosystems of Armenia are characterized by a number of peculiarities, which all together contribute to formation of rich and unique biodiversity. Geographical distribution of main biotypes of flora and fauna of Armenia is conditioned by vertical zonation and topographic diversity of the area, thanks to which biodiversity of each zone is characterized by its species composition, qualitative and quantitative indicators and consequently its specialized role. Dependent on the geological history of the areas, landscape components and local climate 10 landscape-climatic zones have been formed in Armenia. Their typical conditions contributed to formation of high diversity of habitats of flora and fauna species and as a consequence the presence of unique communities, high level of endemism as well as rich agrobiodiversity. The abundance of species composition of biodiversity in Armenia is conditioned also by the fact that Armenia as a part of the Armenian Highland is located in the intersection of important provinces of formation of flora and fauna of the region as well as is a crossroad of migration routes of birds. In the result, on the small territory of the country (about 30 thousand km²) there are about 3800 species of vascular plants, 428 species of soil and water algae, 399 species of mosses, 4207 species of fungi, 464 species of lichens, 549 species of vertebrates and about 17200 species of invertebrates. The biodiversity of Armenia is notable for high endemism: about 500 species of fauna (about 3% of the fauna) and 144 species of flora (3.8% of total flora) are considered endemics. In the country all main natural ecosystems of the Caucasus are presented except moist subtropical ecosystems. By the density of high vascular plants Armenia is ranked among first-place countries in the world with about 107 species per 1000 km².

The territory of Armenia is notable also for intensive speciation processes and it is not accidental that the researchers of flora and fauna of the country often identify new species for the science. Only over the last 10 years more than 50 new species for the science have been described, which are rare species.

Armenia is a globally significant center of origin of agrobiodiversity; wild relatives of numerous cultivated plants and a number of domestic animals still occur on the territory of Armenia. At present in Armenia there are wild sheep, wild goat and wild boar, which have been the predecessors of modern domestic animals.

Armenia is known also for 252 species of wild relatives of cultivated plants, thanks to which the country is considered a global conservation center of wild wheat, rye, barley and aegilops; many species have been disseminated from Armenia throughout the world. Rich diversity of plant genetic resources in Armenia includes also ancient local and modern selection varieties and wild edible plants.

Changes of the status of biodiversity during 2009-2013 and the main trends by landscape zones are briefly presented below:

- a. Semideserts. Over the last five years with intensified processes of soil erosion and desertification the expansion of semidesert zone up by profile by about 50 m has been observed and several edificators have been registered 200-300 m above the previous altitudinal limits of their distribution. According to the data clarified during recent years in semidesert ecosystems of Armenia 101 species of vertebrate animals (4 amphibians, 30 reptiles, 23 birds, 44 mammals) and 1687 species of invertebrates (including 59 molluscs, 97 arachnids and 1531 insects) were registered. Some reptiles are typical for the limited desert areas.

- b. Steppes and meadow-steppes. Over the last five years the reduction of the lower part of steppe belt has been observed due to the expansion of semidesert vegetation. Penetration of typical steppe species into meadow-steppe zone is taking place with reduction of its altitudinal limits. According to the data clarified during recent years 96 species of vertebrates (4 amphibians, 32 reptiles, 19 birds, 41 mammals) and 992 species of invertebrates (81 molluscs, 126 arachnids and 785 insects) were registered as typical for the steppes. The steppe invertebrate fauna is younger by origin and relatively more uniform.
- c. Arid open woodlands. In recent years expansion of the areas covered by this ecosystem has been observed first of all at the expense of penetration of typical species of open woodlands and shibliak, mainly *Paliurus spina-christi* and *Rhamnus pallasii*, as well as due to reducing density of forest cover at the lower timberline.
- d. Forests. In the result of various natural and antropogenic impacts the natural seed regeneration of the main valuable forest species such as oak and beech is not satisfactory. The stands dominated by *Pinus kochiana*, *Taxus baccata*, *Corylus colurna* and other rare tree species have reduced, which at present occur in the form of patches and sporadic trees. The steppe-meadow vegetation types are often replacing valuable forests. Instability of forest ecosystems has an impact on productivity of agricultural crops as well as diversity of species composition of hay-making areas and pastures. According to the data clarified during recent years 90 species of vertebrates (6 amphibians, 25 reptiles, 42 birds, 17 mammals) and 2212 species of invertebrates (95 molluscs, 85 arachnids and 2032 insects) were registered as typical forest species. Forest ecosystems are notable for the highest species diversity of invertebrate animals.
- e. Sub-alpine and alpine meadows. Over the last years probably due to the change and redistribution of pasture use as well as climatic changes some successional changes have been observed such as shift of sub-alpine species to alpine zone, whereas the alpine carpets are gradually replaced by alpine meadows with domination of grasses. Almost everywhere the expansion of expansive species not suitable as fodder is observed, especially of the species *Tripleurospermum transcaucasicum*. According to the data clarified during recent years 58 species of vertebrates (3 amphibians, 10 reptiles, 12 birds and 33 mammals) and 508 species of invertebrates (49 molluscs, 12 arachnids and 447 insect) have been registered as typical species.
- f. Wetland ecosystems. Thanks to the increased water level in Lake Sevan and formation of shallow littoral areas the living conditions for a number of bird species have been improved and feeding areas have been rehabilitated, especially of wetland species such as *Egretta garzetta*, *Ardeola ralloides*, *Ncticorax nycticorax*, *Plegadis falcinellus* and species of *Haematopodidae*. After 60 years of absence the great cormorant (*Phalacrocorax carbo*) has started nesting in the area again. During the winter inventory in Lake Sevan in 2013 a large number of waterfowl was registered, in particular of the Eurasian Coot (*Fulica atra*) and red-crested pochard (*Netta rufina*). At the same time the reduction of quantities is registered for the species, which are connected mainly with the littoral zone (ASPB, 2013). Measures on artificial reproduction of subspecies summer bakhtak and gegharkuni have been implemented in the lake aimed at protection of endemic fish species of the lake. Over the last 7 years about 2 mln young fishes (with the cost of 348 billion AMD) have been released to Lake Sevan. In the result of artificial reproduction a population of mature individuals of summer bakhtak and gegharkuni has been registered. However, these species spawn in rivers and their natural reproduction becomes impossible due to almost complete obstruction of the rivers, which are their spawning grounds, and disturbance of their hydrological regime. In the fauna of wetland ecosystems in total 255 species of

vertebrate animals (7 amphibians, 5 reptiles, 213 birds and 30 mammals) and 786 species of invertebrates (50 molluscs, 12 arachnids and 724 insect) have been registered. The wetlands of the Ararat valley are habitats and nesting areas for more than 200 species of birds. Fish farms of Armash are the only nesting area in Armenia for the species *Oxyura leucocephala* and *Marmoronetta angustirostris* included in the IUCN Red List.

Over the last five years some encouraging positive changes have been registered in terms of the status of the most vulnerable species of the fauna. The status of some species is sustainably good, for example, bear (*Ursus arctos*), wolf (*Canis lupus*) and golden jackal (*Canis aureus*) and some populations of rodents. Not only stabilization of the status, but also certain positive trends are observed in the populations of Caucasian leopard (*Pantera pardus ciscaucasica*), Armenian mouflon (*Ovis orientalis gmelinii*), bezoar goat (*Capra aegargus*) and a number of birds. According to WWF data in 2004 in Armenia 2-3 leopards, 150-200 mouflons and 1500-2000 bezoar goats were registered, whereas 4-6 leopards, 350-400 mouflons and 3200-3500 bezoar goats were registered in 2014.

During 2007-2009 the large-scale analyses of scientific studies have been done in the frames of the project "Revision of the Red Book of Armenia". In the course of the project two volumes of the Red Book of Armenia were prepared in Armenian and English languages (2010) based on existing data and new field surveys. For that purpose on the whole territory of Armenia the current status, quantitative and qualitative indicators of ecological features and distribution of rare fauna and flora species and of those under the threat of extinction were identified, the status of habitats was evaluated and mapped, and a database was created.

In the Red Book of Plants of Armenia 452 species of vascular plants (11,89 % of the flora of Armenia) and 40 species of fungi (1,05% of the biota of Armenia) are registered. Of them 141 species of plants and 6 species of fungi were assessed as Critically Endangered (CR) by IUCN criteria and they need urgent protection.

In the Red Book of Animals of Armenia 308 species, including 155 vertebrates and 153 invertebrates are registered. Of them 50 species of invertebrates and 62 species of vertebrates were assessed as Critically Endangered (CR); they need urgent protection.

According to the clarified data obtained by GIZ in 2011 through remote sensing method the forest cover of the Republic of Armenia makes 332.333 ha or 11.17 % of the total territory of Armenia. By the official data forest loggings during 2009-2013 have not exceeded 37 thousand m³, out of which the construction wood makes 8-11%. 75% of the forests of Armenia is managed by "Hayantar" SNCO under the RA Ministry of Agriculture and 25% (forests in specially protected nature areas) – by the RA Ministry of Nature Protection. In general, during 2008-2012 significant reduction in the volumes of illegal loggings was observed, which is mainly conditioned by development of the natural gas supply system.

Biodiversity conservation in Armenia is implemented mainly in the specially protected nature areas, where 60-70% of the species composition of the flora and fauna is concentrated including the overwhelming majority of rare, critically endangered, threatened and endemic species.

At present in Armenia the total territory covered by SPNAs in Armenia makes 387,054 ha, which comprises 13.1% of the total territory of Armenia. At present the SPNAs of Armenia are as follows:

- 3 state reserves (Khosrov, Shikahogh and Erebuni), which cover the territory of 35,439.6 ha making 1.19% of the total territory of Armenia.
- 4 national parks (Sevan, Dilijan, Arpi Lake and Arevik), which cover the territory of 236,802.1 ha making 7.96% of the total territory of Armenia.
- 232 natural monuments.

- 27 state sanctuaries, which cover the territory of 114,812.7 ha making 3.95% of the total territory of Armenia.

In the period of 2009-2014 the number of SPNAs and their total territory have significantly increased with establishment of the following new protected areas: Jermuk Hydrological State Sanctuary, Hanqavan Hydrological State Sanctuary, Zangezur State Sanctuary, Zikatar State Sanctuary, Khustup State Sanctuary, Arpi Lake National Park and Arevik National Park.

The RA Government and different international organizations have contributed efforts to development of SPNAs in Armenia.

The analyses implemented during preparation of the fifth national report show that during 2009-2013 in comparison with the previous five years no changes occurred in the structure of the threats to ecosystems and biodiversity conditioned by antropogenic impact.

As it is mentioned in the fourth national report on biodiversity of Armenia, the antropogenic impact brings about:

- Changes, fragmentation and loss of habitats of biodiversity components;
- Overuse of biological resources;
- Pollution of environment (soil, water, air, food);
- Introduction of alien species;
- Climate change.

The natural factors, which are risky for ecosystems and their components, are also mainly conditioned by unconscientious approaches of human towards nature.

In the analyzed period the severity of negative impact on biodiversity and territorial indicators of impacted ecosystems have changed. It should be mentioned that the loss of biodiversity and changes of ecosystem services in many cases is not a result of the impact of just one factor, but of a complex impact.

Over centuries the population of Armenia has been dependent on biodiversity. However this dependence is not always obvious and properly valued. Forest ecosystems and pastures of the country as well as Lake Sevan, which have unique biodiversity and provide essential ecosystem services, is indispensable natural wealth, which contributes to socio-economic development and safeguards human well-being in the country. Changes of biodiversity components in the mentioned ecosystems and their direct loss (fish stock in Lake Sevan, non-timber forest resources, fodder plants in pastures making the basis for live-stock breeding) first of all affect socially insecure population, which directly depends on natural bioresources and respective ecosystem services. The loss of biodiversity and changes of ecosystem services have also indirect impact on the standards of living of population, incomes and local migration and sometimes can event bring to internal political conflicts.

The table below presents the threats to ecosystems and biodiversity, their causes and possible consequences for human well-being and health. The consequences can be direct and rather significant and visible or indirect, but still influential. In this case they are assessed as alarming and colored red. If affecting causes and related consequences are stable during the last five years, but assessed as potentially risky, then they are colored yellow. The color is green if certain positive trends of improvement of the status of ecosystems and biodiversity are registered.

Threats to ecosystems and biodiversity, their causes and possible consequences for human well-being and health

Threats	Causes	Consequences for ecosystems and biodiversity	Consequences for human well-being and health	Assessment of trends
Fragmentation and loss of habitats	Impact of agriculture: Land cultivation	Soil erosion and secondary salination, changes and degradation of natural ecosystems, fragmentation of biodiversity components and direct loss due to improper agricultural practices	Decline of productivity of cultivated plants due to loss of humus layer of soil, decreased food security and farmers' income. Exacerbation of health problem due to use of additional quantities of fertilizers aimed at increase of yield.	Lands under cultivation are almost not expanding
	Live-stock breeding	Disturbance of plant cover in pastures, soil erosion, soil compaction, desertification, change of species composition of biocenoses, ecosystem degradation, change and loss of biodiversity	Decline in agricultural production from live-stock, decreased incomes and increased poverty	The status of pastures is still not good
	Fish breeding	Increased rates of changes of flora and fauna composition in parallel with desertification processes due to reduction of the volume of underground (artesian) water resources and decrease of aquifers attributed to water use for fish breeding needs in the Ararat valley.	Shortage of drinking water and food for population, exacerbation of health problems.	Sharp changes of ESs in the Ararat valley
	Drying of marshes and wetlands	Soil salination, degradation of natural ecosystems, change and loss of biodiversity		At present not implemented
	Loggings	Erosion of forest soils and desertification, activation of natural calamities (mudflows, landslides), disturbance of hydrological regime in forests and increased water shortage, siltation and eutrophication of forest rivers and reservoirs, qualitative and quantitative changes in the most hydrophilous plant species, anthropogenic succession and degradation of forest ecosystems, direct elimination of nesting areas and habitats, decline of fauna.	Exacerbation of health problems, decrease in volumes of agricultural products and non-timber forest products, decreased incomes and increased poverty due to unfavorable climate change and water shortage	Direct and indirect consequences are very significant and visible
	Open mining	Alienation of new areas and disturbance of natural landscapes, air and water pollution, disturbance of plant cover, extinction of	Exacerbation of numerous diseases, reduced surface of the areas used for personal needs, decreased agricultural	Direct and indirect consequences are very significant and

Threats	Causes	Consequences for ecosystems and biodiversity	Consequences for human well-being and health	Assessment of trends
		populations of individual plant species, direct elimination of nesting areas and habitats.	production and incomes.	visible
	<i>Disturbed stability of Lake Sevan ecosystem</i>	Sharp changes of water biodiversity due to decrease of the lake water level and decline of its qualitative indicators, reduction of fish species and fish stock, extinction of two subspecies of Sevan ishkhan, negative qualitative and quantitative changes in ESs	Increased water level in Lake Sevan in recent years gradually results to restoration of lake biodiversity, in particular of fish and bird fauna as well as to stabilization of ecosystems.	A population of mature individuals of summer bakhtak and gegharkuni fish species has been registered in the lake, which is the result of artificial reproduction.
	<i>Development of hydropower production sector</i>	Change of hydrological regime of water ecosystems, depletion of water resources and drying of river courses, inaccessible spawning grounds and reduced fish reproduction, disturbance of migration routs, degradation of water biocenoses and biodiversity reduction.	Reduction of irrigated areas, agricultural production and fish products from natural water ecosystems due to water shortage. Decreased incomes and increased poverty.	Direct and indirect consequences are very significant and visible
	<i>Constuction</i>	Alienation of new areas and disturbance of natural landscapes, disturbance of plant cover and migration routs of animals, fragmentation of populations of plants and animals, decline of biodiversity components and threat of extinction.	Reduced surface of the areas used for personal needs, decreased agricultural production and incomes. Exacerbation of health problems due to air, water and soil pollution.	The threat is not big as the volumes of construction in the country have reduced.
	<i>Recreation and tourism</i>	Recreational trampling of plant cover, pollution of areas, disturbance caused to animal species by human presence, animals leaving their living areas, change of landscapes and ecosystems.	Trends of reduced tourism development and decreased incomes of population due to the reduced attractiveness of landscapes.	The impact still is not significant and visible
	<i>Imperfect legislative framework</i>	Uncontrolled use of bioresources by population – illegal fishing, hunting, loggings and use of non-wood forest products. Changes of biodiversity, reduced volumes and quality of ESs.	Reduction of biodiversity (included food resources) due to overuse of bioresources, increased poverty in the long term	The impact is indirect and not significant and visible

Threats	Causes	Consequences for ecosystems and biodiversity	Consequences for human well-being and health	Assessment of trends
Overuse of bioresources (wood, medicinal, fodder, edible, technical and decorative plants, fungi, wild nuts, fruits and berries, fish and other water animals, game species)	<i>Insufficient control over use of bioresources</i>	Continuous growth of anthropogenic impact on natural ecosystems due to illegal fishing, hunting and forest use, reduced capacities of biodiversity components and ecosystems to restore	Risk of disruption of the functions of natural ecosystems and depletion of bioresources, increased poverty in the long term	The impact is indirect, but significant and visible
	<i>Lack of data on stock-taking, inventory of biodiversity as well as on bioresources and their volumes subject to use (quotas)</i>	Increasing anthropogenic impact on natural landscapes, disturbance and degradation of forest, semidesert, meadow and steppe ecosystems, disturbance of terrestrial and water communities and populations, change of their species composition, disturbance of plant cover in pastures, reduction of productivity of fodder plants, reduction of economically valuable species as well as rare species and those under the threat of extinction.	Risks to disrupt the functions of natural ecosystems, exceed optimal volumes of use of bioresources and eliminate bioresources; increased poverty in the long term	The impact is indirect, but significant and visible
	<i>Lack of biodiversity monitoring system</i>	Lack of possibility to assess the status of species, populations and ecosystems, set norms and quotas and make scientifically justified political and administrative decisions	Uncontrolled use of bioresources, high risk of overuse of bioresources, reduction of the standards of living of population due to disruption of ESs and elimination of biodiversity components.	The impact is indirect, but significant and visible
Environmental pollution	<i>Impact of industry</i>	Accumulation of harmful chemical substances in soil, air pollution with solid and gas particles, pollution of underground waters and rivers, accumulation of industrial waste and tailings and landscape degradation, unfavorable conditions for growth, development and reproduction of species, elimination of valuable, threatened and rare species in forest ecosystems, reduction of productivity and yield quality.	Various health problems and reduced income due to disruption of ESs and reduction of the quality of agrobiodiversity	The impact is very significant and visible especially in mining areas
	<i>Impact of agriculture</i>	Soil and water pollution, elimination of soil biodiversity (invertebrates, bacteria), change of species composition of plant cover, reduction of valuable and rare plant species	Health problems due to disruption of ESs	Lack of statistical data on the used volumes of mineral fertilizers,

Threats	Causes	Consequences for ecosystems and biodiversity	Consequences for human well-being and health	Assessment of trends
		in communities of semidesert, meadow and steppe ecosystems due to use of mineral fertilizers, pesticides and chemical weed-killers (in many cases of unknown chemical composition)		pesticides and chemical weed-killers. The impact is indirect and not significant and visible
	Transport	Soil, air and water pollution, accumulation of harmful substances in agrocenoses, ecosystem degradation, reduction of species and populations	Health problems due to disruption of ESs and change in the quality of agricultural products	The impact is indirect and still not significant and visible
Impact of alien species		Disturbed stability and balance of ecosystems, changes of species composition of natural communities and agrocenoses, reduction or elimination of native valuable species	Reduced standards of living and income due to disruption of ESs	The impact is indirect and still not significant and visible
Climate change		Reduction of water resources, including underground waters, acceleration of drying processes in wetland ecosystems, desertification of new areas, increased frequency of natural calamities, reduced stability of mountainous ecosystems, vertical shift of the limits of the flora and fauna distribution, change of phenological indicators of species, change of species composition in communities, increased risk of elimination of native species including endemics, increased cases of pest outbreaks, increased cases of forest fire	Changes of biodiversity and ESs disturb water regime and current state of the agrarian and forest sectors, which can become real threat to human health, food and water supply. At present these changes still are not significant and visible.	The impact is indirect and still not significant and visible

The table above shows that the consequences of anthropogenic impact are somehow linked with a certain branch of economy with each of them having its specific impact on landscapes and biodiversity of Armenia. The main branches of economy include (listed by intensity of impact) mining industry, forestry, hydropower production, livestock breeding, land cultivation, construction, transport, tourism and recreation.

The concept of green economy, which in recent years has been widely applied in many countries, is based on the provisions that nature protection is a key and undeniable fundamental condition for country development and viability of humanity, whereas the economy and social sectors should accept this concept and make their policies compliant with the environmental policy. The complex environmental policy and synergic sectoral strategies should be based on the following principles:

- Political decision-making should be based on the actual role and values of ecosystems and biodiversity as their key component.
- Degraded ecosystems should be rehabilitated by cost-efficient (low-cost) measures or conserved with the aim to recover their natural state through natural processes.
- Improved standards of living of population should be ensured through the methods on use of ecosystem services and use of renewable natural resources in economic activity, which exclude their depletion and ensure their renewal for the benefit of future generations.
- Decisions regarding biodiversity problems should be based on the best available scientific data with use of ecosystem approach.
- In practice it is necessary to strengthen cooperation between state structures, citizens, entrepreneurs and other stakeholders ensuring their consistent participation in respective processes.
- In order to minimize the harmful antropogenic impact on biodiversity it is necessary to develop new effective forms of inter-sectoral cooperation, which should be applied in the process of development of draft decisions and programs.

PART 1.

THE STATUS AND TRENDS OF BIODIVERSITY, THREATS TO BIODIVERSITY IN ARMENIA AND THEIR IMPLICATIONS FOR HUMAN WELL-BEING

1.1 General information on the country and its biological diversity

Armenia is a small landlocked mountainous country located in the Southern Caucasus. Forty four percent of the territory of Armenia is a high mountainous area not suitable for inhabitation. The degree of land use is strongly unproportional. The zones under intensive development make 18.2% of the territory of Armenia with concentration of 87.7% of total population. On these areas the population density exceeds several times the ecological threshold index (200 person/km²) reaching here up to 480-558 person/km². The poorly developed zones make 38.0% of the territory, where only 12.3% of total population resides with a very low density of 11-20 person/km². The zones under intensive development are provided by engineering-transportation infrastructures. In this zone there are most available public services, more human resources and financial opportunities. At the same time, the poorly developed areas have rich natural resources with preserved unique natural ecosystems, beautiful landscapes, clean water and air, and biological resources.

Armenia is a country of the landscape and climatic contradictions; due to the complex relief and altitudinal and zonal alternation even on the small territory of the country it is possible to distinguish six climatic types and 10 landscape zones from semidesert areas to snow covered highlands. The location of the country in the intersection of three biogeographical provinces, diversity of climatic conditions and active geological processes have resulted to formation of diverse ecosystems and rich biodiversity with high level of endemism. In the result, on the small territory of the country (about 30 thousand km²) there are about 3800 species of vascular plants, 428 species of soil and water algae, 399 species of mosses, 4207 species of fungi, 464 species of lichens, 549 species of vertebrates and about 17200 species of invertebrate, many of which are considered endemics (Table 1). In the country all main natural ecosystems of the Caucasus are presented except moist subtropical ecosystems. By the density of high vascular plants Armenia is ranked among first-place countries in the world with about 107 species per 1000 km².

The territory of Armenia is notable by intensive speciation proceses and it is not accidental that the researchers of flora and fauna of the country often identify new species for the science. Only over the last 10 years more than 50 new species for the science and Armenia have been described, which needed protection.

Armenia is a globally significant center of origin of agrobiodiversity. The wild relatives of numerous cultivated plants and of a number of domestic animals have been preserved in Armenia. Armenia is considered a global conservation center of wild wheat (*Triticum*), rye (*Secale*), barley (*Hordeum*) and aegilops (*Aegilops*); many species have been disseminated from Armenia throughout the world.

Due to intensive nature use the level of anthropogenic changes of natural landscapes in Armenia is high. More than 60% of the territory is under active agriculture, in semidesert and mountainous steppe zones the figure reaches up to 80-90%. Overexploitation has resulted in reduction and pollution of the territories covered by wild biodiversity, loss of habitats of certain species and changes in the services provided by ecosystems.

Armenia is a part of the Caucasus, which is notable for its very rich biodiversity. WWF has included the Caucasus in the list of 200 Global Ecoregions. However, the Caucasus has been recognized

also as a threatened area and included in the list of 34 biodiversity hotspots by Conservation International.

Table 1. Flora and fauna species and endemics of Armenia by taxonomic groups (according to data clarified during 2010 – 2014)

<i>Fungi</i>		<i>Plants</i>		<i>Animals</i>		
<i>Number of species/number of endemics</i>		<i>Number of species/number of endemics</i>		<i>Number of species/number of endemics</i>		
<i>Microfungi</i>	<i>Macrofungi</i>	<i>Lower plants</i>	<i>Higher plants</i>	<i>Invertebrates</i>	<i>Vertebrates, including</i>	
2987	1220/2	Algae (soil and water)	Mosses	~17200/479	Fishes	
		428	399		39/3	
		Lichens	Vascular plants		Amphibians	
		464	3800/142		7/0	
					Reptiles	
					53/6	
					Birds	
			357/1			
			Mammals			
			93/6			
Total		Total		Total		
4207/2		5091 /142		17749/495		

1.2 Importance of biodiversity for Armenia

In the Strategic Plan and Aichi Targets of the Convention on Biological Diversity (CBD) adopted in 2010 the issue of ecosystem services is emphasized along with biodiversity conservation. It is a very justified approach, as the uniqueness of each flora and fauna species is not only in its genetic fund, but also in its role for ecosystems. It is proven that effective functioning and sustainability of ecosystems are ensured by the richness of flora and fauna species. At present, in addition to the conviction that extinction of biological species can bring irreversible loss of genetic resources, it is also realized that the process can have much more serious implications in terms of loss of ecosystem services. In Armenia also the volume and quality of ecosystem services are conditioned by the status of natural ecosystems and integrity of natural biodiversity, which is a part of ecosystems.

The well-being of Armenia's population is greatly dependent on availability of biological resources, which are strategic resources for the country, equally to underground resources. Having realized the above mentioned fact, the Government of the Republic of Armenia ranks the environmental and particularly biodiversity conservation issues within the list of national and state priorities.

The biodiversity has been used and being actively used in Armenia in various aspects of social life including its use as food, fuel, construction material, medicines and for other purposes.

Food. Since ancient times the Armenian nation has been maintaining its existence through hunting, fishing and use of various wild plants with transferring those traditions to generations. The flora of Armenia is very rich in useful species among which the following groups of used plants and macrofungi are of unique importance:

- a) Edible plants. There are about 200 species. They are used both in fresh and processed (cooked, pickles and others) form making up to 10-15% of the consumed food. Among the

most used species are the species of sickleweed (*Falcaria*), horse fennel (*Hippomarathrum*), asparagus (*Asparagus*), chervil (*Chaerophyllum*) and of other genera.

- b) Wild fruits and berries. There are about 120 species making close to 40% of the dendroflora of Armenia. The most valuable species include walnut (*Juglans*), hazel (*Corylus*), pear (*Pyrus*), apple (*Malus*), cornel cherry (*Cornus*), strawberry, blackberry (*Rubus*), raspberry (*Ribes*) and numerous other species. Wild fruits and berries are widely used also for canned food production as well as for getting economically valuable and high-yielding sorts of fruits and berries through their use as resistant wildlings.
- c) Honey plants. There are about 350 species widely distributed in all landscape zones. The honey plants belong to the following groups: a) fruit trees (apricot, plum, peach, cherry, sour cherry, apple and pear); b) forest tree species (maple, oak, sea-buckthorn, Jerusalem thorn, lime-tree and others); c) meadow herbs (*Nepeta*, *Stachys*, *Anchusa*, *Rapistrum*, *Thymus*, *Medicago*, *Salvia* and others).
- d) Edible mushrooms. There are 290 species. The most used species are oyster mushroom (*Pleurotus ostreatus*), meadow mushroom (*Agaricus campestris*), field blewit (*Lepista personata*), Saffron milkcap (*Lactarius deliciosus*), chanterelle (*Cantharellus cibarius*), etc.

Recreational fishing is allowed in all the rivers and lakes of Armenia except protected areas. It is mainly done for household consumption. Ninety percent of commercial fishing is done in Lake Sevan. During some years of the 20th century it has reached up to 2000 tons. Before the drop of the lake water level the main fishing species have included Sevan ishkan (*Salmo ischchan*) and Sevan khramulya (*Varicorhinus capoeta sevangi*) and after the drop of the water level – white-fish (*Coregonus lavaretus sevanicus*). In the 80ies of the 20th century goldfish (*Carassius auratus*) and crawfish (*Pontastacus leptodactylus*) penetrated to the lake. Those species till now make an important reserve of food for the population in the littoral area of the lake.

Recreational hunting is allowed through licences. By statistical data the most hunted species include common quail (*Coturnix coturnix*), rock partridge (*Alectoris Graeca*), wild duck (*Anas platyrhynchos*) and rock dove (*Columba livia*).

Wood. The wood of oak, beech and hornbeam is highly valued. The construction wood makes 8-11% of the annually looged total wood. For example, the wood harvested in 2012 made 39 542.4 m³, out of which the construction wood made 3 586.9 m³.

Medicines. Medicinal plants make about 10 percent of the species composition of the flora of Armenia. Since long ago numerous representatives belonging to buckthorn (*Rhamnus*), hawthorn (*Crataegus*), juniper (*Juniperus*), dog-rose (*Rosa*), St. John's Wort (*Hypericum*), barberry (*Berberis*) and other genera have been widely used in folk medicine. It has been proven, that the useful properties of wild medicinal plants growing in mountainous regions are obviously higher, due to which their collection is increasing every year. About 15 species are used for production of refreshing and medicinal teas, which are of high demand both in Armenia and other countries.

122 species of macrofungi growing in Armenia also have pharmacological properties. The most rich composition of medicinal mushroom species has the subclass Agaricomycetidae (belonging to blewits) with its 14 families, of which the following families have relatively high species diversity: Tricholomataceae (10 genera, 17 species), Russulaceae (2 genera, 15 species), Boletaceae (2 genera, 8 species) and Amanitaceae (2 genera, 7 species). Out of identified species 12 are included in the Red Book of Armenia (*Agaricus xanthodermus*, *Amanita muscaria*, *A. phalloides*, *Astraeus hygrometricus*, *Boletus edulis*, *B. satanas*, *Hericium erinaceus*, *Mutinus caninus*, *Phallus impudicus*, *Pleurotus eryngii*, *Podaxis pistillaris*, *Suillus grevillei*).

The medicines produced from several mushroom species with pharmacological properties (*Inonotus obliquus* – chaga mushroom, *Ganoderma lucidum* – Reishi mushroom) are sold in pharmacies and a number of mushroom species having demand among consumers (*Agaricus campestris*, *A. bisporus*-champignons, *Pleurotus ostreatus*-oyster mushroom) are grown in greenhouses.

The venom of Armenian viper (*Vipera raddei*) and Lebetina viper (*Vipera lebetina*) is also used for medicinal purposes.

Plants of economic significance. There are more than 2000 species of fodder plants. The most valuable are the species belonging to the genera sainfoin (*Onobrychis*), clover (*Trifolium*), medick (*Medicago*) and foxtail (*Alopecurus*).

The ether-bearing plants are represented by about 150 species, out of which the most valuable are the species of thyme (*Thymus*), helichrysum (*Helichrysum*), wormwood (*Artemisia*) and other genera.

On the territory of Armenia there are about 120 species of dye plants, out of which the species of the genera euphorbia (*Euphorbia*), buckthorn (*Rhamnus*), elder (*Sambucus*), madder (*Rubia*) and others have been traditionally used since far ago. It is notable that an endemic insect *Porphyrophora hammelii* as a source of resistant and unique dye carmine has been used for centuries in Armenia; its existence and life-cycle depend on halophytic plant communities, it parasitizes on roots of the species *Aeluropus littoralis*.

Numerous plants with vitamin, tannin and rubber producing properties also have economic significance.

Genetic diversity of wild plants. The wild relatives of a large number of cultivated plants (cereals, fruity trees and others) identified in Armenia is a specific source of genetic material. Thanks to rich diversity of wild relatives of cultivated plants Armenia has been rendered by N.I.Vavilov as one of the rich centers of origin of cultivated plants. At present the territory of Armenia belongs to the Southwest Asian center of origin of cultivated plants (soft and hard wheat, pea, lentil and grape). The rich genetic pool of wild relatives of cultivated plants is used for getting new varieties of plants resistant to drought and cold as well as having high adaptability.

The Southwest Asian center of origin is first of all distinguished by diversity of wheat species and ecotypes. Three out of four species of wild wheat known in the world grow in Armenia: *Triticum boeoticum* Boiss., *T.urartu* Thum. ex Gandil.) and *T. araraticum* Jakubz. The last two species have been first identified in Armenia. The species *T.araraticum* grows in semidesert and mountainous-steppe conditions; it is considered as the predecessor of the cultivated species *T.timofeevii* Zhuk.. The species *T. boeoticum* is considered as the direct predecessor of the cultivated species *T.monococcum*. The species *T.urartu* grows on tertiary red clay soils and basalts on the altitudes of 1300-1400 m above sea level as a component of semiarid vegetation; it is a donor for polyploid wheats. Along with the other wild wheats the species is protected in Erebuni State Reserve.

In Armenia there are 9 species of goat grass with rich intraspecies diversity. The diploid self-pollinated species *A. tauschii* Cosson (*A. squarrosa* L.) is of special value for breeding purposes. The mentioned species of goat grass occurs in semidesert and steppe zones on the altitudes of 500-1650 m above sea level. The other 8 species of *Aegilop* are considered to have the genes ensuring resistance to drought, diseases and pests and other properties.

Among wild cereals of Armenia there are also two (with 36 varieties) species of rye (*Secale*) and eight species of wild barley (*Hordeum*).

In Armenia there are numerous wild species of cultivated leguminous plants as well as wild relatives of vegetables (280 species), oil-bearing and medicinal plants and spicy herbs.

Among fruit and berry species on the territory of Armenia there are wild relatives of apple, pear, rowan, hawthorn, plum, cherry, pistachio, pomegranate, almond, grape, raspberry, currant and other species.

1.3 Main changes and trends of the status of biodiversity in Armenia during 2009-2013

1.3.1 Landscapes and ecosystems

The mountainous relief is the decisive factor for the richness of biodiversity of Armenia and its distribution. The detailed zoning of landscapes is presented in the National Atlas of Armenia (published in 2007), according to which in Armenia there are 10 landscape zones (Figure 1). There are also a number of intrazonal ecosystems (wetlands, rocks, screes), which are present almost in all altitudinal zones.

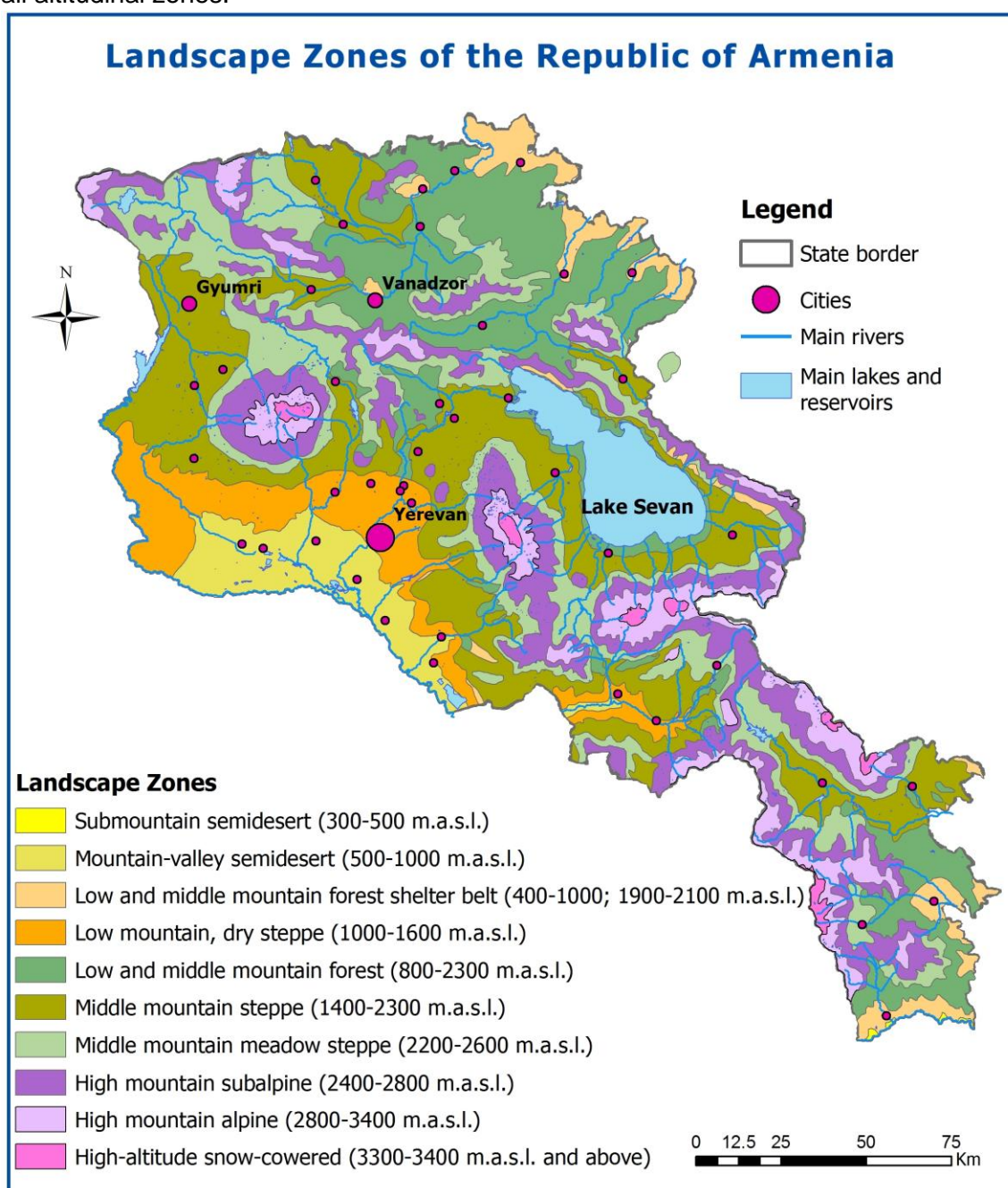


Figure 1. Landscape zones of the Republic of Armenia

1.3.1.1 Semidesert zone

80-90% of the semidesert zone territory is used for agricultural purposes, where often the rules of irrigation and soil cultivation are not followed, which has resulted in soil erosion and secondary salination processes.

In recent years a new alarming problem has occurred in the Ararat valley, which is connected with reduction of the volume of underground (artesian) water resources and decrease of aquifers. As it was shown in the document "Assessment Study of Groundwater Resources of the Ararat Valley" prepared in the frames of the Clean Energy and Water Program (USAID, 2014) as of 2013 in the zone of positive pressure of the Ararat artesian basin 1235 artesian boreholes were exploited with the leakage capacity of 50.5m³/second. In the result, the average annual allowable water use quantity of 20.8 m³/second through boreholes was violated; it was exceeded 2.4-4.5 times. The fish-breeding sector is the main consumer of artesian water; the water use for its needs made 35.5 m³/second.

In the result the upper soil layers were subject to artificial drying, the trends of changes in natural ecosystems are obvious with acceleration of the rates of changes in flora and fauna species in parallel with desertification processes. On the other hand in some places the processes of sod-formation and eutrophication have started. However, the actual scale and implications of this process have not been studied so far. Certainly, the area needs permanent monitoring.

Artificial drying of saline marshes (due to use of soils for agricultural purposes as well as for improvement of sanitary-epidemiological situation) is a good example of natural ecosystem degradation and their complete extinction in semidesert zone; saline marshes have been present in this zone before middle of the 20th century. In the result of changes the valuable rare plants and animals typical only for that ecosystem have disappeared. At present, the remaining marsh areas are being spontaneously drying, the loss of habitats of a number of wetland plants and birds is observed along with decomposition of the whole wetland ecosystem.

The semidesert landscape located in the south-west of Armavir Region in the Araks River valley is of high interest. It is a unique landscape with rich composition of plant, fungi and animal species. Due to geographical conditions of the area a number of rare, threatened and endemic species of the flora, mycobiota and fauna of Armenia have been preserved here, which almost do not occur in the other landscapes. Many out of 51 species of reptiles of Armenia occur in the Ararat Valley including Armavir Region. Among reptiles the most endangered are the species *Testudo greaca*, *Eremias pleskei*, *Phrynocephalus horvathi*, sharply reducing species *Eremias shtrauchi*, *Trachylepis septemtaeniata*, *Eryx jaculus* and others.

In the Araks River nearby areas in some places there are accumulations of sand and on the low-land saline lands the saline deserts have been formed. The main threat to them is the industrial use of sand for construction purposes. The most interesting part of the sand desert is the Calligonum desert, which is the only site in the Lesser Caucasus with the presence of Calligonum communities. The area is included in the territory of Goravan Sands State Sanctuary.

Saline ecosystems are practically not protected in Armenia with reduction of their territory over years.

In the terrestrial semidesert ecosystems of Armenia 101 species of vertebrate animals (4 amphibians, 30 reptiles, 23 birds, 44 mammals) and 1687 species of invertebrates (including 59 molluscs, 97 arachnids and 1531 insects) were registered. Some reptiles are typical for the limited desert areas with xerophyte vegetation.

Numerous endemic invertebrate species occur in semideserts, including those of mediterranean, iranian, caucasian and crimean origin. The existence of an endemic species *Porphirophora hamelii* is linked to the saline halophilic communities.

Extension of agricultural lands in semideserts results to reduction of the bird species composition (*Pterocles orientalis*, *Calandrella brachydactyla*). At the same time replacement of semidesert landscapes with fruit orchards results in changes of species (*Fringilla coelebs*, *Carduelis carduelis*).

In total 623,14 ha of semidesert ecosystems and habitats are under protection in Erebuni and Khosrov Forest State Reserves and Arevik National Park as well as Vordan Karmir and Goravan Sands State Sanctuaries.

1.3.1.2 Steppe zone

The mountainous steppe zone is the largest on the territory of Armenia, it starts from the altitude of 1300-1400 m above sea level and extends up to 1900 m in the north and 2000-2200 in the south. In the north-west and on the folded and fragmented relief of Syunik Region the mentioned altitudes are occupied by forests, where in separate patches there are also steppe landscapes formed in place of forests. On low altitudes this zone is a typical steppe zone and on high altitudes – a meadow steppe zone.

The mountainous steppes of Armenia unlike the large and homogenous plateau steppes are very diverse and distinguished by diversity of plant communities and richness of species composition. The typical peculiarity of steppe vegetation in Armenia is the presence of xerophilous grasses belonging to Poaceae family, which form thick sod, and thorny pillow-like motley plants.

In Armenia 96 species of vertebrates (4 amphibians, 32 reptiles, 19 birds, 41 mammals) and 992 species of invertebrates (81 molluscs, 126 arachnids and 785 insects) were registered as typical for the steppes. The steppe invertebrate fauna is younger by origin and relatively more uniform.

Soil cultivation in steppes and establishment of field protective forest belts as well as use of areas for hay-making and fires have negative impacts on plant cover and fauna. The natural plant cover is replaced by cultivated plants such as wheat, corn and sunflower and fruit orchards as well as by vegetable cultivation in alluvial areas.

To date the benefits and services provided by steppe ecosystems have not been practically evaluated. Local population actively collects and uses numerous medicinal and edible steppe plants for personal consumption and for selling in local markets and the steppes located on steep slopes are even used as pastures and hay-making areas (limited cases). However, the majority of steppe lands especially on not steep slopes and plateaus has been plowed and are being used for agriculture. Only separate areas of mountainous steppe remained as natural areas on very steep and stony slopes as well as in small patches between mountainous plateau fields.

At present in Armenia the steppes loss their typical features and functions such as retention of water resources and regulation of evaporation, soil protection, reduction of the risk of pasture digression, prevention of water and wind erosion, neutralization of pollution including in soil, biota and agricultural products, protection of the habitats of rare species registered in the Red Book of Armenia, securing the quantity of pollinators through reproduction of natural vegetation and others.

The steppe ecosystems are protected in a number of specially protected nature areas (SPNA) including Khosrov Forest State Reserve, Sevan, Dilijan, Arpi Lake and Arevik National Parks and in a number of sanctuaries with the total territory of 61 391.7 ha, which makes 15.8 % of the total territory of SPNAs.

1.3.1.3 Forest zone

According to the clarified data obtained by GIZ in 2011 through remote sensing method the forest cover of the Republic of Armenia makes 332.333 ha or 11.17 % of the total territory of Armenia.

The volume and quantity of services and benefits provided by forest ecosystems is extremely high. However, due to the present anthropogenic pressure on forest ecosystems including overuse of forests, irregular loggings, grazing, hay-making, land occupations and others, the valuable forest areas are being reduced, the changes in species composition and forest structure are registered in forests and the stands lose the capacities of natural regeneration with reduction of their productivity.

Due to various socio-economic problems and high demand of wood the forest loggings still exceed the rates of natural regeneration of forests. The accessibility of wood, increasing prices of power-bearing substances and low solvency of socially insecure population contribute to that. Fuelwood is still the main source of fuel for the forest adjacent population. According to the surveys implemented among population of Armenia by the "State Forest Monitoring Center" State Non-Commercial Organization (SNCO) in 2010, the demand for fuelwood made 709851 cubic m, which exceeds more than 20 times the volume of legally harvested wood. Illegal loggings and illegal wood marketing have been practiced in Armenia for about two decades, which ensure turnover of millions of dollars. Below the official data on the volumes of wood harvesting and marketing are presented (Figures 2 and 3).

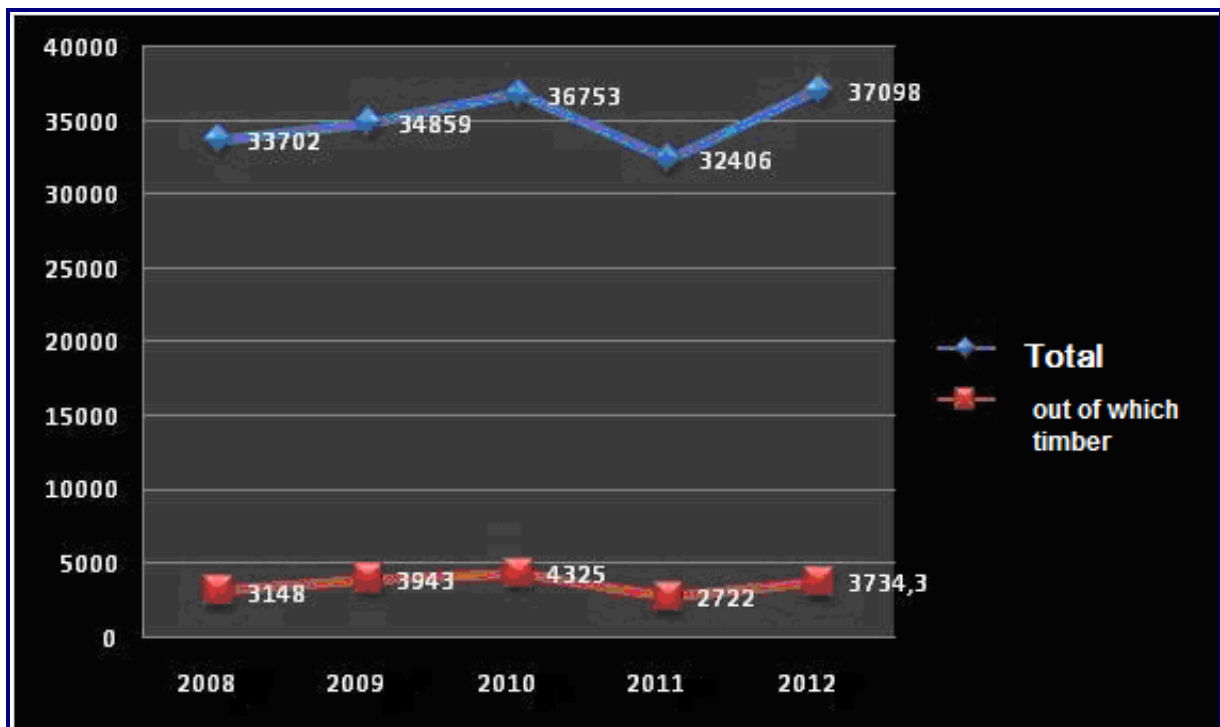


Figure 2. The volumes (m³) of wood harvesting in the Republic of Armenia (Source: RA Ministry of Agriculture, "State Forest Monitoring Center" SNCO)

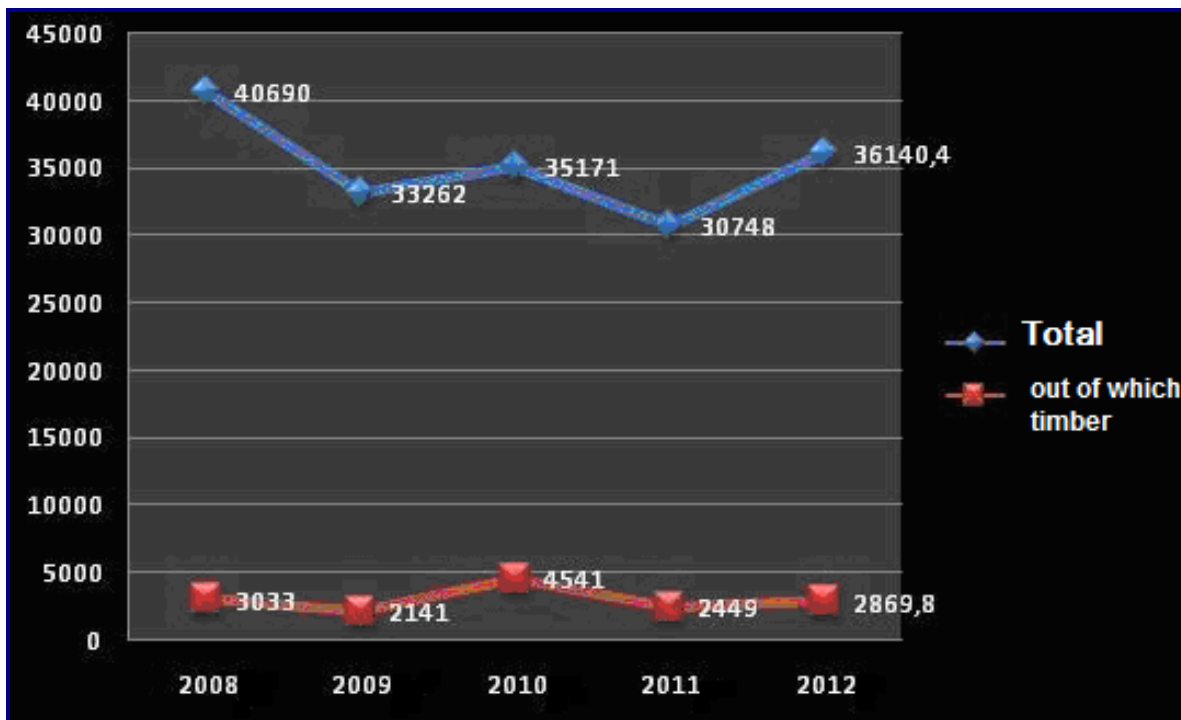


Figure 3. The volumes (m³) of wood marketing in the Republic of Armenia (Source: RA Ministry of Agriculture, “State Forest Monitoring Center” SNCO)

In general, during 2008-2012 significant reduction in the volumes of illegal loggings was observed (Figure 4), which is mainly conditioned by development of the natural gas supply system.

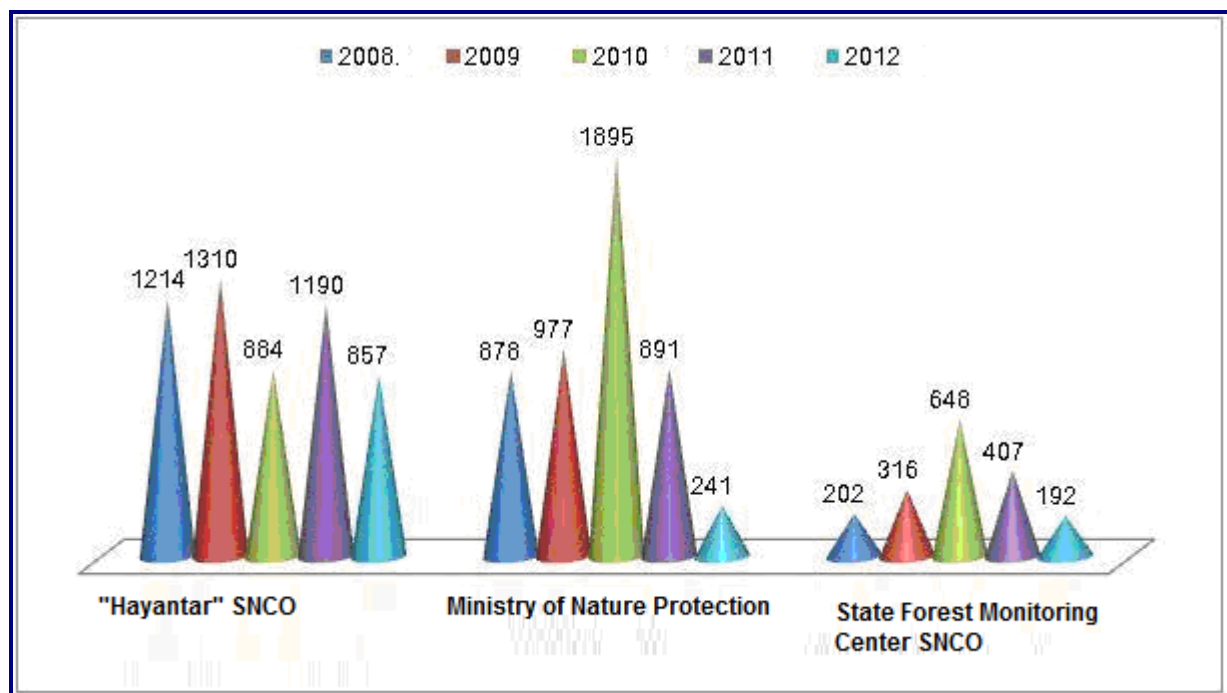


Figure 4. Illegal loggings identified and registered (number of trees) in forest areas during 2008-2012 (Source: RA Ministry of Agriculture, “State Forest Monitoring Center” SNCO)

According to the data of “Hayantar” SNCO the trend of illegal logging reduction continued also in 2013.

The results of the analysis of information on illegal loggings registered by the state bodies in the forest areas of Armenia are presented on Figure 5 below.

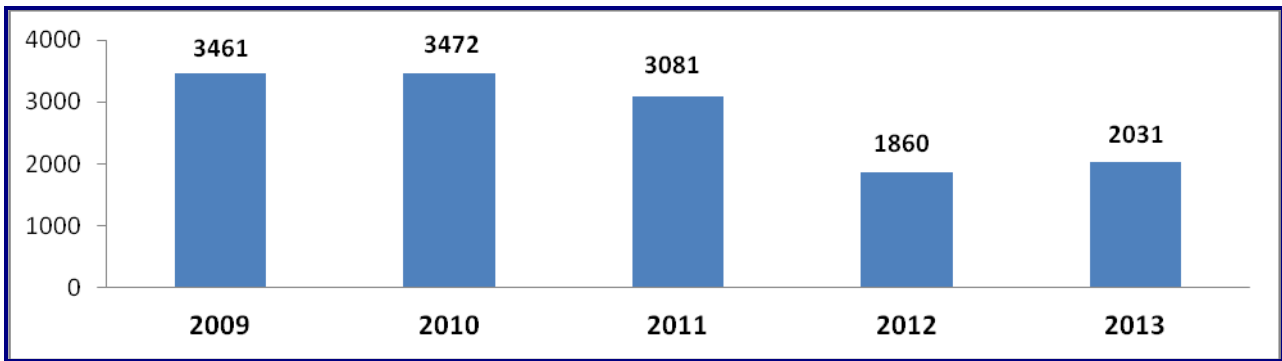


Figure 5. The numbers of illegally logged trees during 2009-2013 (Source: RA Ministry of Agriculture, “Hayantar” SNCO)

The RA Governmental decision #1535-N from 2011 had some positive impact on prevention of illegal loggings. According to it the households living nearby forests are allowed, at their expenses, to harvest and take for free up to 8 cubic m of residual fuelwood.

However, given the limited forest cover of Armenia, deforestation is more than crucial threat, which can have destructive and irreversible implications for environment as well as become the cause of significant loss of income through reduction of the volumes and quantities of ecosystem services during the long-term impact.

In recent years in the logged forest areas and adjacent territories the instability of ecosystems has been observed with increase of wind-fallen or snow-fallen areas, activation of soil erosion, landslides, avalanches, drying of springs, formation of dust clouds and other processes, which cause serious damage to communities and areas of agricultural significance.

As a consequence of changes of forest ecosystem qualitative features the mass outbreaks of pests (especially insects feeding of leaves) can be mentioned. They require urgent implementation of forest protection measures. In total during 2003-2013 the works on chemical control of forest pests and diseases with use of aviation were implemented on a territory of 76786 ha, out of which about 23242.5 ha during 2009-2013 (control with use of aviation on a territory of 22828 ha).

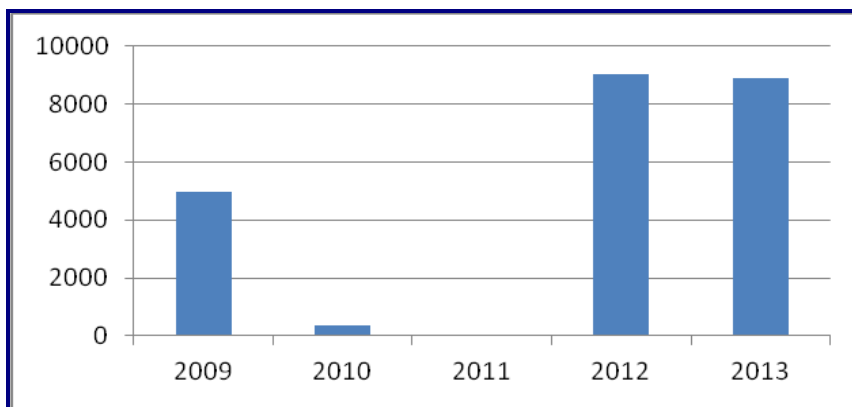


Figure 6. Activities (ha) on pest and disease control during 2009-2013 (Source: RA Ministry of Agriculture, “State Forest Monitoring Center” SNCO)

It should be mentioned that the major part of the mentioned activities is implemented as chemical control with use of aviation, which in many cases is destructive for existence of a number of forest fauna species. In 2014 the chemical control of forest pests and diseases with use of aviation was implemented in forest areas of Vayots Dzor, Kotayk and Aragatsotn Regions of Armenia.

The cases of forest fires have increased. In 2003 fires were registered on 3.92 ha of forest lands and in 2013 – on 91.575 ha. By statistical data during 1998-2013 the highest rates of forest fires were observed in 2006, 2010 and 2011. In total, the forest lands damaged by fire during 1998-

2013 made 2875.3 ha, out of which 2323.9 ha were the areas covered by forest. By official information, 198 cases of forest fire were registered during 2009-2013 with total territory of 1616.721 ha (Figures 7 and 8). The main cause of the majority of forest fires is the burning of adjacent agricultural areas. The complex relief, poor condition of forest roads, absence of respective technical equipment for fire control and others cause obstacles for implementation of efficient fire control measures.

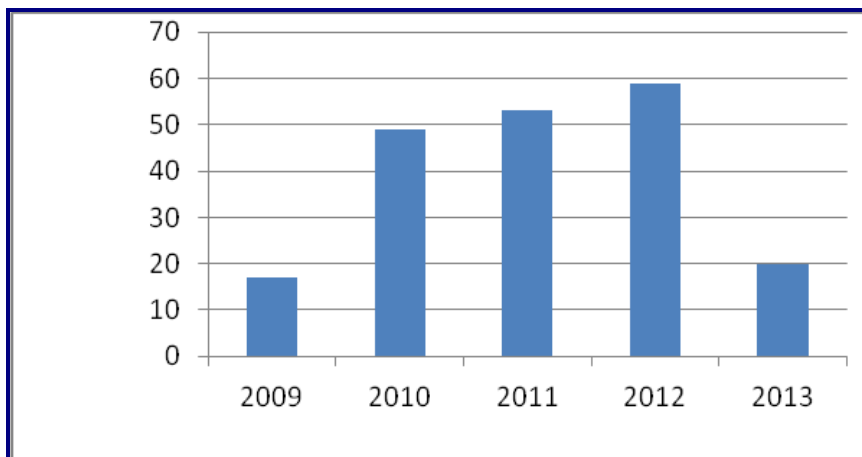


Figure 7. The number of forest fires in forests and forest lands of Armenia during 2009-2013 (Source: RA Ministry of Agriculture, “State Forest Monitoring Center” SNCO)

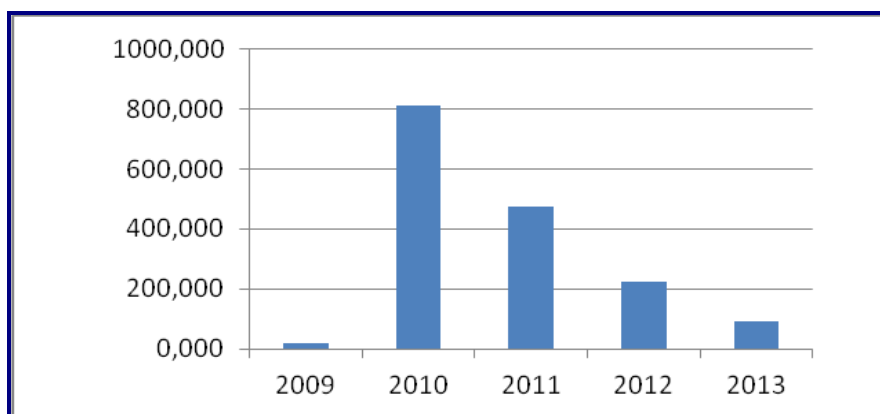


Figure 8. The total area (ha) of forests and forest lands in Armenia damaged by fire during 2009-2013 (Source: RA Ministry of Agriculture, “State Forest Monitoring Center” SNCO)

As it is known, the criteria for assessing the degree of forest ecosystem degradation include forest areas partly or fully destroyed by fire, areas with lost natural resistance due to pests and diseases, dying or dead forests, forest areas with no capacity of natural regrowth, completely logged forest areas and sparse forests located on large eroded surfaces. Almost all of the mentioned criteria characterize the current status of forest ecosystems in Armenia. Appropriate planning and implementation of long-term, consistent, multi-faceted, justified and finance-consuming works are needed to improve the situation. At the same time in recent years the public financing of “Hayantar” SNCO has reduced. In 2008-2009 the annual state financing made 1.3 billion Armenian Dram (AMD) and in 2013 it reduced down to 734 million AMD (Figure 9).

Sustainable use of wood and non-wood forest resources can become an additional source of incomes and at the same time establish favorable conditions for increased employment opportunities and improved livelihoods of the communities adjacent to forests.

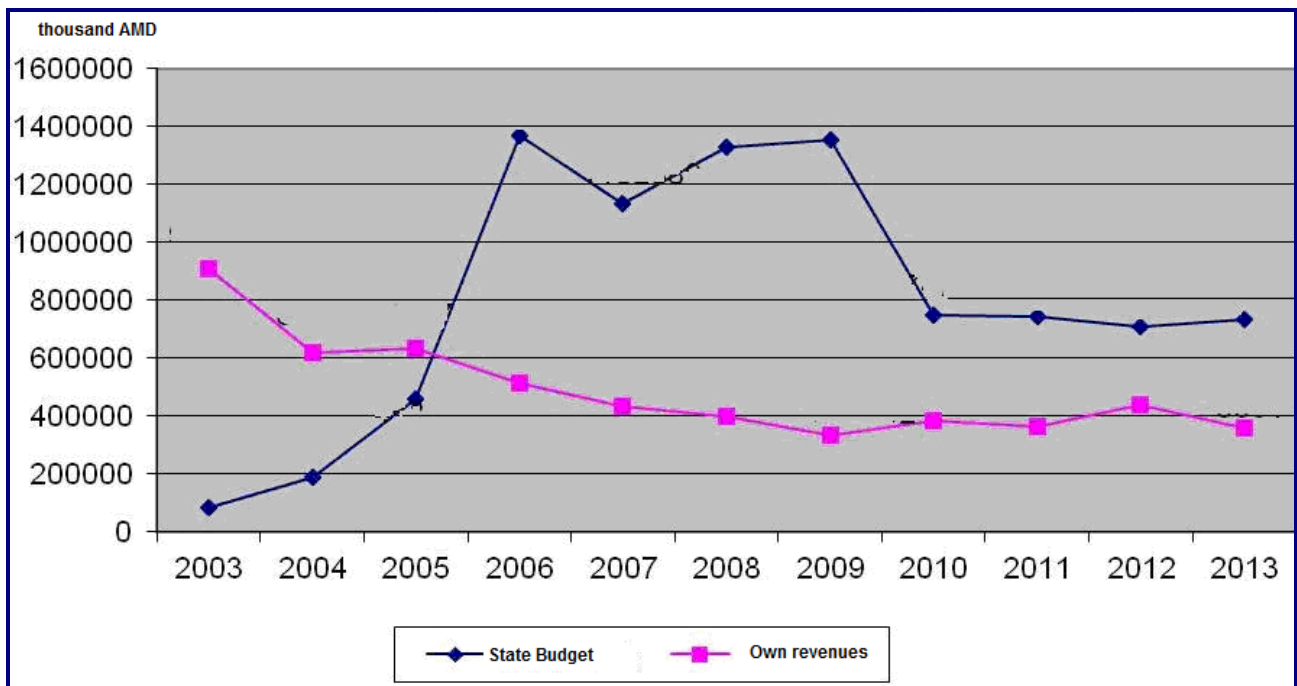


Figure 9. Financing of “Hayantar” SNCO during 2003-2013 (Source: RA Ministry of Agriculture, “Hayantar” SNCO)

75% of the forests of Armenia is managed by “Hayantar” SNCO under the RA Ministry of Agriculture and 25% (forests in specially protected nature areas) – by the RA Ministry of Nature Protection. In the structure of forest lands managed by “Hayantar” SNCO there are 13 forest sanctuaries, where at present there is a need for clarification of boundaries and development of management plans. The works on mapping and clarification of boundaries have been implemented for Arzakan-Meghradzor Sanctuary located in the structure of Hrazdan Forest Enterprise of “Hayantar” SNCO and the forest management planning activities are envisaged for implementation during 2014. Similar activities will be implemented also in the other 12 sanctuaries.

The forest covered areas dominate in the specially protected nature areas under the RA Ministry of Nature Protection. They include Khosrov Forest and Shikahogh State Reserves, Dilijan, Sevan and Arevik National Parks, a number of sanctuaries with forest landscapes occupying 110 269.2 ha, which makes 28.5 % of the total territory of SPNAs.

1.3.1.4 Sub-alpine and alpine meadow zone

The sub-alpine and alpine landscapes are the main areas of hay-making and summer pastures in Armenia. In the structure of agricultural lands of Armenia the hay-making areas make 10 % and pastures make 49 %. At the same time according to the data of the RA Ministry of Armenia, the pastures of Armenia occupy 1 mln 118 thousand ha (in all landscape zones), out of which only 30% is used effectively.

At present in the structure of annually produced livestock breeding products about 70% of milk, more than the half of meat and the total quantity of wool come from use of pasture fodder. In addition to being a source of fodder, the sub-alpine and alpine meadows are the most valuable part of the genetic pool and cenofund of the flora of Armenia.

Despite the importance of natural grasslands in Armenia at present their biological and economic situation is far from being satisfactory. The studies show that nowadays about 57% of pasture lands in Armenia is degraded (eroded, tramped and decomposed). Its main cause is not so much the unfavorable natural-climatic conditions, but unsustainable use of pastures as well as almost

complete absence of maintenance and improvement measures. In addition, at present the community nearby and distant pastures are used very unproportionally. The remote pastures are underused or almost not used, whereas the nearby pastures are severely overloaded.

In the fauna of this zone 58 species of vertebrates (3 amphibians, 10 reptiles, 12 birds and 33 mammals) and 508 species of invertebrates (49 molluscs, 12 arachnids and 447 insect) have been registered as typical.

In the structure of specially protected nature areas the sub-alpine and alpine meadows make 87 516.24 ha, which is 22.6 % of the total territory of SPNAs. They are well represented in Arpi Lake and Arevik National Parks, Zangezur, Khustup, Aragats Alpine, Sev Lich and Jermuk Hydrological State Sanctuaries.

1.3.1.5 Intrazonal ecosystems

The total area of intrazonal ecosystems is difficult to estimate as such territories are practically present everywhere. However they rarely occupy large territories. Wetlands also belong to intrazonal ecosystems. According to definition of the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) the wetlands in Armenia are represented by lakes, small lakes, rivers, reservoirs, water courses, areas temporarily covered by water, marshes and peat areas.

The rivers of Armenia are the tributaries of two large rivers of the Southern Caucasus – the Araks River and the Kura River. In Armenia there are about 9500 rivers and small rivers with the total length of about 23 thousand km.

The average annual flow of the rivers originating in Armenia makes 6.3 billion m³, the total volume of surface waters is 7.2 billion m³. A part of these resources flows to the neighbouring countries; this volume has significantly increased during this century due to the sharp reduction of water use in Armenia after independence.

In Armenia six river basin management areas have been defined and management plans should be developed for them. Over the last five years draft management plans for a number of river basins have been developed. Upon their integration respective watershed management plans should be developed for sustainable use and protection of water ecosystems (Figure 10).

In the structure of inner waters the lakes and small lakes are of special importance. According to up-to-date hydrological studies on the territory of the Republic of Armenia there are about 250 lakes; more than the half of them is of a temporary character, they are periodically drying. Lake Sevan is the largest lake of Armenia. The other large lakes are Arpi Lake, Sev Lake and Akna Lake. The total water resources of the lakes of Armenia are estimated as much as 39.8 million m³.

The water resources of Lake Sevan have been used for years for economic purposes resulting in gradual deterioration of ecological situation of the lake. By 1999 the lake water level has dropped by 19.3 m in comparison with its initial mark. In order to prevent the lake eutrophication processes and improve the situation in the lake since 2002 the works on increase of the water level has started (Table 2). As of 1 August 2013 the water level of the lake reached to the mark of 1900.52 m above sea level, its surface made 1278.73 km² and the volume made 38.20 km³. In total, as of 1 January 2014 the water level of the lake increased by 3.84 m in comparison with the mark of 1 January 2002.



Figure 10. Basin Management Areas of the Republic of Armenia (Source: State Water Cadastre, 2014)

Table 2. The change of the level of Lake Sevan during 2002-2013

Year	Level, m above sea	2007	1898,8
2002	1896.32	2008	1899,2
2003	1896.76	2009	1899.34
2004	1897.24	2010	1899.77
2005	1898.07	2012	1900.10
2006	1898.23	2013	1900.16

The marsh formations located in the Araks River valley also belong to wetlands. In the Armenian side the Khor Virap wetland is known, which is located in the place of Araks River old watercourse, as well as the system of Metsamor marsh formations, which includes Lake Ayghr, the River Sevjur and nearby marshes. On the territory of Armenia marshes occur also in the River Masrik valley and nearby Sevan peninsula as well as in the relict marsh-lake formations in the meadows of Lori Plateau. In total, the marshes and peat areas in Armenia occupy 42 km².

Lake Sevan, Lake Arpi and Khor Virap wetland area are included in the list of wetlands of international importance under the Ramsar Convention. These three water objects are also included in the system of specially protected nature areas of Armenia. In total, the surface of water and wetland areas in the system of SPNAs makes 127 254.08 ha or 32.9 % of their total area, the majority of which (124 759.0 ha) is on the territory of Sevan National Park.

1.3.2 Flora and Vegetation

The last 11th volume of the multi-volume edition “Flora of Armenia” was published in 2010. In the published 11 volumes 3260 species of plants are presented. In addition to that, in the last volume the list of 452 species and 16 sub-species (belonging to 33 genera and 4 families) new for Armenia (including new for science) are presented, which have not been included in the previous volumes of the “Flora of Armenia”. After publication of the last volume, additionally 19 new species for science and 33 new species for Armenia have been described. Thus, at present the flora of Armenia is represented by about 3800 species of vascular plants belonging to 160 families and 913 genera (Figure 11).

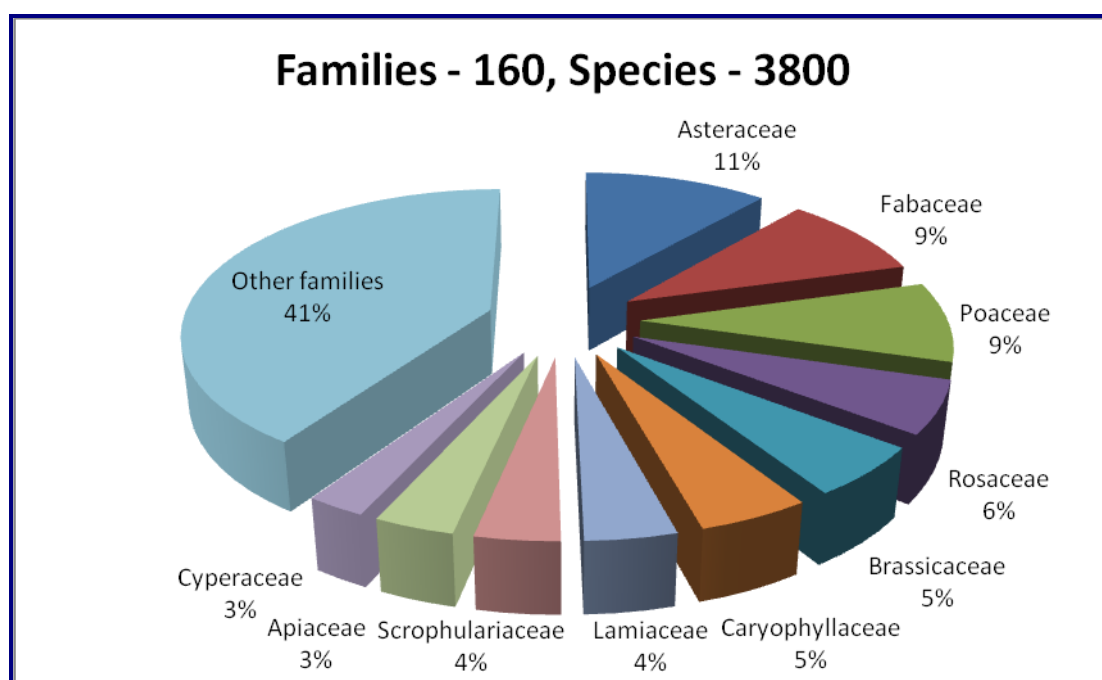


Figure 11. The species composition of vascular plants registered in Armenia

From the previous list of endemic plants of Armenia (124 species) 9 have been removed as it was identified that they have wider distribution. At the same time thanks to new taxonomic studies 29 species have been added to the list of endemics, the majority of which is new for science and the others are the species with clarified distribution. Thus, at present the flora of Armenia includes 144 endemic species (3.8% of total flora) (Table 3).

Table 3. Endemic plants of Armenia by families and genera

Family	Endemics	Genera	Endemics
Rosaceae	30	Pyrus	10
Asteraceae	27	Psephellus	8
		Centaurea	7
Fabaceae	15	Astragalus	12
Poaceae	13		
Caryophyllaceae	10		
Scrophulariaceae	8	Verbascum	4
Brassicaceae	7	Isatis	3
Papaveraceae	5	Papaver	5
Colchicaceae	4		
Other families	26		

Twelve floristic regions are defined on the territory of Armenia, their location and comparative characteristics are presented in Figure 12 and Table 4.

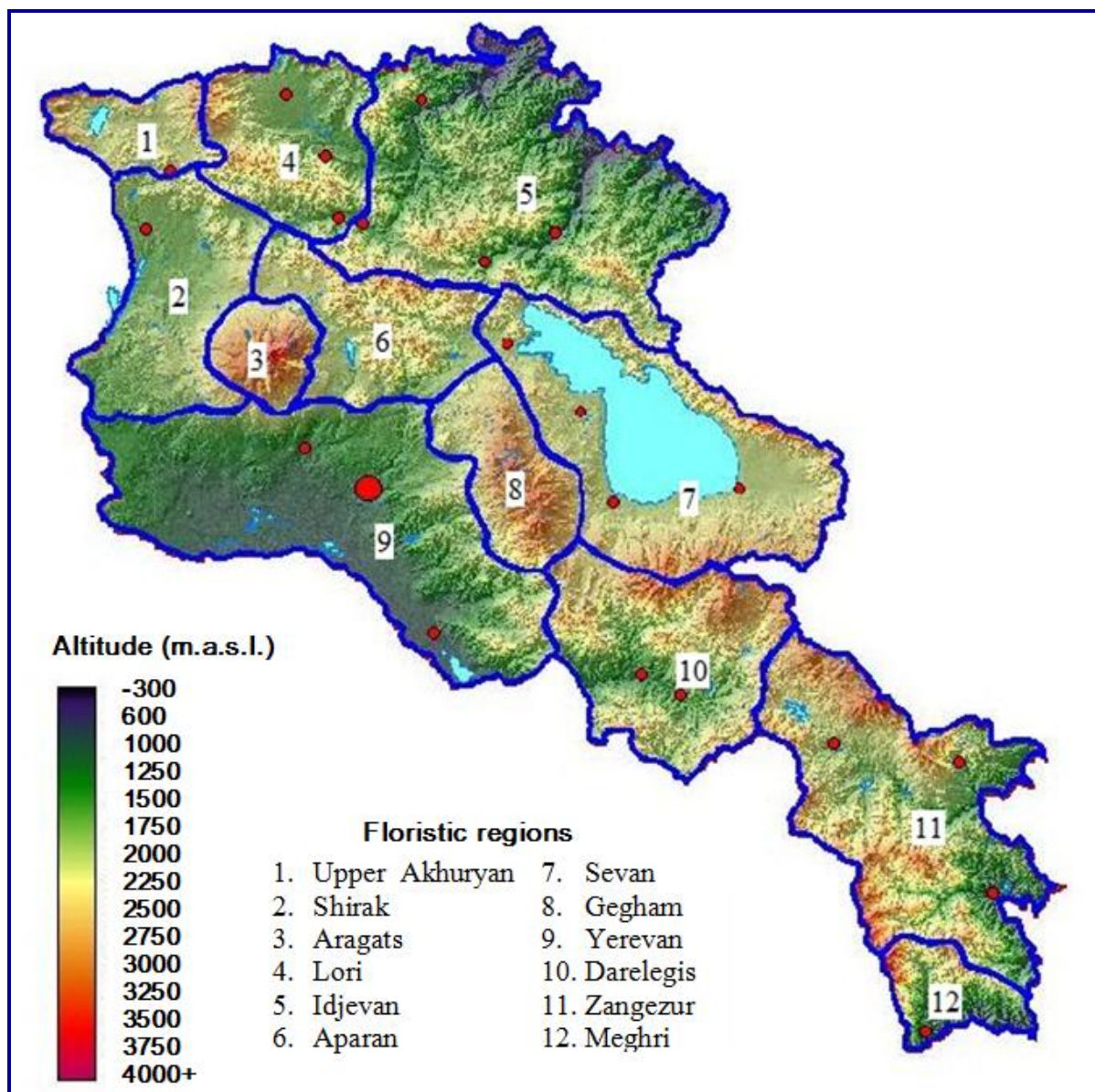


Figure 12. Floristic regions of the Republic of Armenia by Academician A.L. Takhtajyan (1954)

Table 4. Comparative characteristics of floristic regions of Armenia

N	Floristic region	Number of plant species	Main types of vegetation	Limits of vertical altitudes, m above sea level	Presence of endemic species	Number of species registered in the Red Book of Armenia
1.	Upper Akhuryan	880	Steppes, meadow-steppes, meadows	1700-3100	4	25
2.	Shirak	1126	Semideserts, steppes, meadows	900-2400	15	39
3.	Aragats	916	Forests, meadow-steppes, sub-alpine and alpine meadows	1400-4095	10	19

N	Floristic region	Number of plant species	Main types of vegetation	Limits of vertical altitudes, m above sea level	Presence of endemic species	Number of species registered in the Red Book of Armenia
4.	Lori	1280	Meadows, forests, wetlands	1400-2550	7	47
5.	Ijevan	1160	Open woodlands, forests, meadows	400-3100	19	71
6.	Aparan	1320	Steppes, meadow-steppes, forests	1300-3100	17	26
7.	Sevan	1660	Steppes, meadows, oak forests and juniper open woodlands	1850-3500	28	48
8.	Gegham	820	Sub-alpine and alpine meadows, oak forests	1700-3590	20	14
9.	Yerevan	1920	Semideserts, salty marshes, desert, steppes, juniper open woodlands	700-1700	46	144
10.	Darelegis	1740	Semideserts, deserts, forests, meadows	900-3500	38	98
11.	Zangezur	2000	Semideserts, forests, steppes, meadows, open woodlands	600-3900	41	95
12.	Meghri	1680	Semideserts, forests, open woodlands, meadows	400-3100	26	112

In recent years the study of invasive and expansive plants on the territory of Armenia has been implemented by botanists of Armenia for the first time. The most alarming is dissemination of 77 aggressive species, out of which 38 have penetrated into natural ecosystems and threaten local plant diversity.

During 2007-2009 the analyses of large-scale floristic studies were done in the frames of the project "Revision of the Red Book of Armenia". In the course of the project two volumes of the Red Book of Armenia were prepared in Armenian and English languages based on existing data and new field surveys. For that purpose on the whole territory of Armenia the current status, quantitative and qualitative indicators of ecological features and distribution of rare fauna and flora species and of those under the threat of extinction were identified, the status of habitats was evaluated and mapped, and a database was created.

In the Red Book of Plants of Armenia 452 species of vascular plants (11,89% of the flora of Armenia) and 40 species of fungi (1,05% of the biota of Armenia) are registered.

The plants belong to the following categories:

- Critically Endangered (CR) - 141 species
- Endangered (EN) - 248 species
- Vulnerable (VU) - 64 species

Totally 452 species of vascular plants were included in the official list of protected species (decision #72-N of the RA Government, 2010). In addition, the Red Book of Plants includes

information on the species belonging to the other categories: Near Threatened (NT) – 21 species, Data Deficiency (DD) – 96 species and Least Concern (LC) – 106 species (Table 5).

Table 5. The numbers of the species registered in the Red Book of Plants by categories

Critically Endangered	CR	141
Endangered	EN	248
Vulnerable	VU	63
Near Threatened	NT	21
Least Concern	LC	106
Data Deficiency	DD	96

In the revised version of the Red Book of Plants in comparison with the first edition of the Red Data Book, the number of high vascular plants increased by 227 species. New species were added as:

- the species were assessed according to international criteria (IUCN),
- the areals of species distribution reduced,
- the number of populations and the number of individuals in populations reduced, and
- new species were identified, which are very rare.

Reassessment of 387 plant species included in the first edition of the Red Data Book (1989) resulted in removal of 159 species from the list due to the following:

- the species has relatively wide distribution in Armenia with no direct threats to its existence,
- new habitats were identified, there is no more direct threat to existence of the species, and
- the presence of the species in Armenia is not proved by factual materials.

The updated Red Book of Plants of Armenia includes also fungi (40 species), which were not included in the previous edition. They belong to the following categories:

- Extinct (EX) – 1 species
- Critically Endangered (CR) – 6 species
- Endangered (EN) – 15 species
- Vulnerable (VU) – 12 species

Five of the mentioned fungi are included in the European Red List of Fungi. In addition, the maps of 10 fungi species identified in Armenia are presented on the map of threatened fungi of Europe.

The studies on lichens diversity have also been implemented. In the result at present 462 taxa of lichens and 2 species of lichenicolous fungi are known to be distributed in Armenia. The web-site of the lichens of Armenia and on-line lichenology has been created (www.lichenology.am).

In 2010 the international project “Coordination and Development of Plant Red List Assessments for the Caucasus Biodiversity Hotspot” (CEFP) was finalized. In the result, 375 endemic species of the Caucasus Ecoregion including 109 species from Armenia were included in the IUCN’s Red List Data Base.

General description of the vegetation of Armenia

Origination, development and phyto-geographical distribution of the types of vegetation in Armenia are conditioned by the mountainous relief of the country, climatic conditions and location of Armenia in the intersection of different floristic provinces (Figure 13).

The vegetation distributed by altitudinal belts is distinguished by the abundance of biocenoses, rich species composition and high level of endemism. In Appendix 2 main indicators of different types of vegetation are presented by geographical distribution of plant cover in Armenia.

Vegetation Cover of the Republic of Armenia

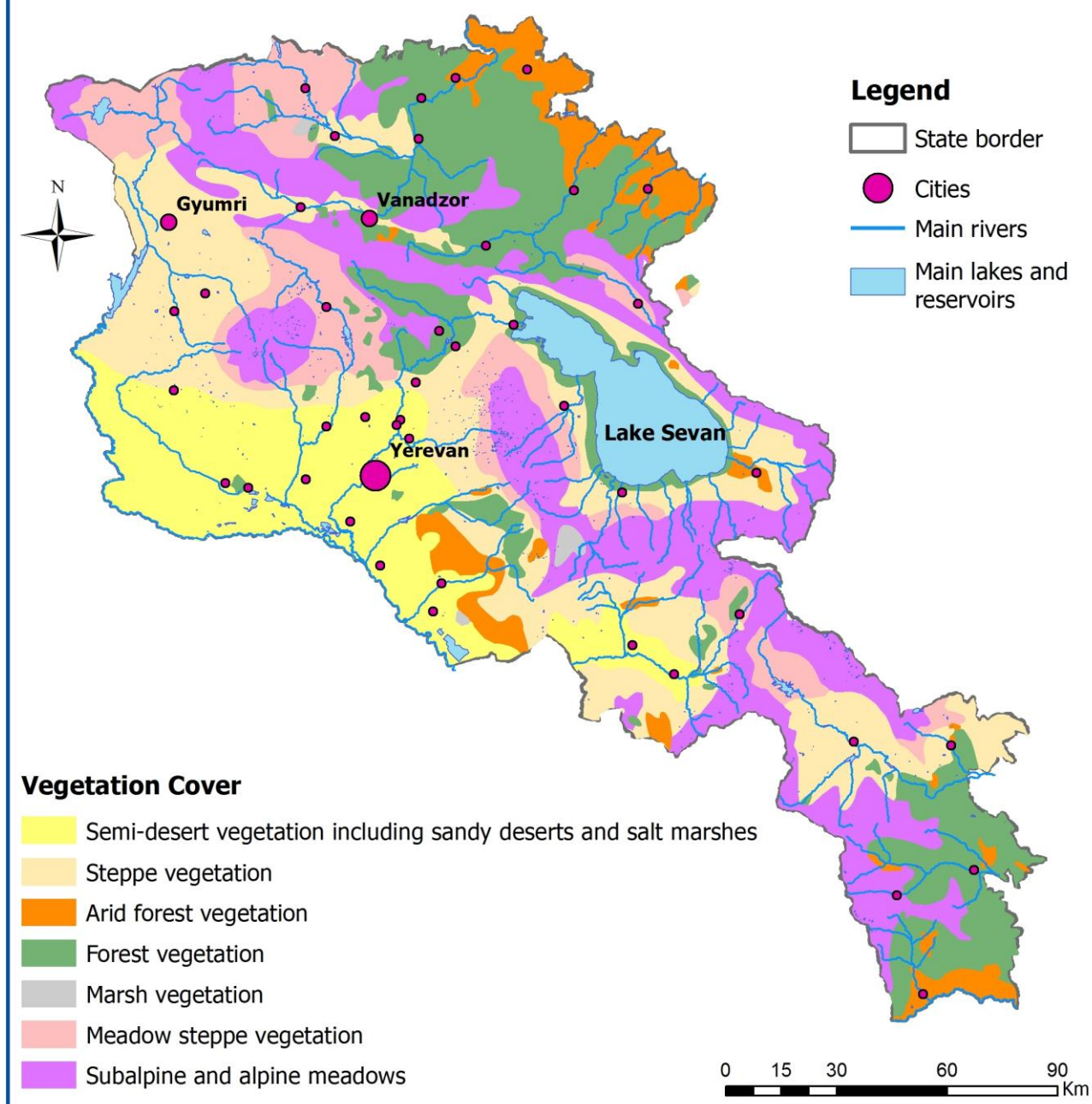


Figure 13. Vegetation cover of Armenia

Semideserts and deserts

The semidesert and desert vegetation of Armenia is very rich in endemic and rare species. The active speciation processes is one of the peculiarities of semidesert flora of Armenia. Over the last five years with intensified processes of soil erosion and desertification the expansion of semidesert zone up by profile by about 50 m has been observed and several edificators, in particular the species *Artemisia fragrans*, *Capparis spinosa* and *Rhamnus pallasii* have been registered 200-300 m above the previous altitudinal limits of their distribution.

Steppes and meadow-steppes

They represent the richest vegetation in terms of species with the largest number of endemic species of Armenia. Over the last five years the reduction of the lower part of steppe belt has been

observed due to the expansion of semidesert vegetation. Penetration of typical steppe species into meadow-steppe zone is taking place with reduction of its altitudinal limits. Though 5-year period is a short term for registration of significant changes in ecosystems, however the trend of change is obvious.

Arid open woodlands

Arid open woodlands are one of the oldest types of vegetation represented both by coniferous (juniper woodlands) and deciduous species (*Pistacia mutica*, *Acer ibericum*, *Celtis glabrata*, *Pyrus salicifolia*, *Amygdalus fenzliana*, *Punica granatum* and others) and shibliak. In recent years expansion of the areas covered by this ecosystem has been observed first of all at the expense of penetration of typical species of open woodlands and shibliak, mainly *Paliurus spina-christi* and *Rhamnus pallasii*, as well as due to reducing density of forest cover at the lower timberline.

Forests

The forest biodiversity of Armenia is represented by valuable species of trees (125 species), shrubs (111), small shrubs (30), semishrubs (48) and woody lians (9). In general, forest communities in Armenia are distributed on foothills and in the lower and middle mountainous zones at the mountainous slopes with inclination of 20-25⁰. The lower timberline in Northern Armenia (Tavush Region) is on the altitude of 500 m, the upper timberline reaches up to 2300-2400 m, though separate trees occur above the upper timberline on higher altitudes. The oak and beech forests are of the highest productivity, they are located on the altitude of 1300-2000 m above sea level.

It is known that the forests with high biodiversity are more resilient to main threats, for example, climate change or pests and diseases. In the result of various natural and antropogenic impacts the natural seed regeneration of the main valuable forest species such as oak and beech is not satisfactory. The stands dominated by *Pinus kochiana*, *Taxus baccata*, *Corylus colurna* and other rare tree species have reduced, which at present occur in the form of patches and sporadic trees. The steppe-meadow vegetation types are often replacing valuable forests. Instability of forest ecosystems has an impact on productivity of agricultural crops as well as diversity of species composition of hay-making areas and pastures.

Sub-alpine and alpine meadows

These are ecosystems typical for upland zones of Armenia. Over the last years probably due to the change and redistribution of pasture use as well as climatic changes some successional changes have been observed such as shift of sub-alpine species to alpine zone (in Syunik, Mount Aragats), whereas the alpine carpets with domination of *Taraxacum stevenii*, *Campanula tridentata* and *Pedicularis crassirostris* are gradually replaced by alpine meadows with domination of grasses. Almost everywhere the expansion of expansive species not suitable as fodder is observed, especially of the species *Tripleurospermum transcaucasicum*.

Wetland vegetation

These are extremely diverse ecosystems including lakes, rivers, strimlets and marsh areas, which vary dependent on environmental conditions and elevations. Over the last centuries the changes due to economic activities have resulted in extinction of some wetland species (for example, termination of rice cultivation in the Ararat valley caused extinction of the species of genus *Sagittaria*). During the last years the following processes cause serious threats: construction of small hydropower plants on rivers with scarce water resources, which results in ecosystem alteration; fluctuation of water level in Lake Sevan, which results in redistribution of water plants in the lake; as well as changes of hydrological regime of rivers and lakes (for example, Lori Plateau).

1.3.3 Fauna

At present the process to clarify the species composition of vertebrate animals in Armenia can be considered finalized, which cannot be said about invertebrate animals. Presumably, 30% of invertebrates has been studied so far. According to recent data in the fauna of Armenia the vertebrates are represented by 549 species, including 93 mammals (instead of previously mentioned 83), 357 birds (instead of previously mentioned 353), 53 reptiles, 7 amphibians and 39 fish species. In Armenia the smallest terrestrial mammal Etruscan shrew (*Suncus etruscus*) has been identified. Insects (Insecta) make 90% of invertebrates. The fauna of Armenia is notable for high endemism (about 500 species making about 3% of the fauna). Distribution of some groups of animals by landscape zones is presented in Appendix 3 and the fauna species richness by highest taxonomic groups is presented in Appendix 4.

Over the last five years some encouraging positive changes have been registered in terms of the status of the most vulnerable species of the fauna. The status of some species is sustainably good, for example, bear (*Ursus arctos*), wolf (*Canis lupus*) and golden jackal (*Canis aureus*) and some populations of rodents. Not only stabilization of the status, but also certain positive trends are observed in the populations of Caucasian leopard (*Pantera pardus ciscaucasica*), Armenian mouflon (*Ovis orientalis gmelinii*), bezoar goat (*Capra aegargus*) and a number of birds. According to WWF data in 2004 in Armenia 2-3 leopards, 150-200 mouflons and 1500-2000 bezoar goats were registered, whereas 4-6 leopards, 350-400 mouflons and 3200-3500 bezoar goats were registered in 2014.

Since 2002 WWF has been implementing a project on leopard conservation. In the frame of the project, the presence of leopard in Armenia was proved through monitoring and photos.

To date it was possible to get photos of leopard only during four years in 2005, 2007, 2013 and 2014. In the period of September 2013 – April 2014 the WWF succeeded to get 14 photos of Caucasian leopard through camera-traps. The analyses of the photos testify that at least one male and two female individuals have been living in the south of Armenia for about one year. It gives hope that in 2014 leopard cubs will appear, which in its turn will require more attention and efforts for making leopard conservation in the region more effective.



Figure 14. Caucasian leopard. © WWF-Armenia

According to the photos of camera-traps and data of field monitoring the quantity of prey species of leopard (bezoar goat, Armenian mouflon) has also increased.

According to ASPB (“Armenian Society for the Protection of Birds” NGO) data, before 2002 the number of individuals of the only one population of black vulture (*Aegypius monachus*) in Armenia on the territory of Khosrov Forest State Reserve has been decreasing. However, thanks to the measures initiated by the organization (artificial feeding, protection of eggs and nestlings) it was possible not only to prevent the reduction of the quantity of individuals, but also to stabilize the situation. Thus, four pairs of black vulture were registered during 2000-2002, 6 pairs in 2003, 7 pairs in 2004, 7-8 pairs during 2005-2008 and 11-12 pairs in 2013-2014.

The avifauna of Lake Sevan has started to rehabilitate. Thanks to the increased water level and formation of shallow littoral areas the living conditions for a number of bird species have been improved and feeding areas have been rehabilitated, especially of wetland species such as *Egretta garzetta*, *Ardeola ralloides*, *Ncticorax nycticorax*, *Plegadis falcinellus* and species of *Haematopodidae*. After 60 years of absence the great cormorant (*Phalacrocorax carbo*) has started nesting in the area again. During the winter inventory in Lake Sevan in 2013 a large number of waterfowl was registered, in particular of the Eurasian Coot (*Fulica atra*) and red-crested pochard (*Netta rufina*). At the same time the reduction of quantities is registered for the species, which are connected mainly with the littoral zone (ASPB, 2013).

Some new data have been obtained about distribution of various species, new localities of their occurrence and the changes in species distribution to the north and south. In the Ararat valley new localities have been identified for 12 species of insects registered in the Red Book of Armenia. For the fauna of Armenia the collections of the striped hawk-moth (*Hyles livornica*) in Meghri region are new findings; supposedly its migration route has been located to the south and west from the territory of Armenia. The species form instable populations in Armenia, due to which it is very rare. The poplar hawkmoth (*Laothoe populeti*) has been also collected many times in Meghri; the zone of its distribution is limited by the north of Turkey and Iran.

New localities of the rare in Armenia European pond turtle (*Emys orbicularis*) have been identified along with the fact that the southern limit of its distribution reaches to the River Araks.

In recent years a lot of work has been implemented to identify and assess the risk of extinction of the rare and vulnerable animals with analysis and overview of existing data, implementation of new studies and assessment of conservation status of the threatened species according to IUCN criteria. In the result the Red Book of Animals of Armenia has been prepared and published, which includes 308 species: 155 vertebrates and 153 invertebrates (Table 6).

Table 6. The species registered in the Red Book of Armenia (2010) and their status by IUCN criteria

Taxonomic group	Extinct (EX)	Regionally extinct (RE)	Critically endangered (CR)	Endangered (EN)	Vulnerable (VU)	Data deficiency (DD)	Total
Invertebrate animals (Invertebrata)							
Type Mollusca (Molluscs)							
Class Gastropoda (Gastropods)		2	10	2			14
Class Bivalvia (Bivalves)			2				2
Type Arthropoda (Arthropods)							
Class Insecta (Insects)	1		38	62	38		139
Sub-total	1	2	50	64	38		155

Taxonomic group	Status by IUCN criteria						
	Extinct (EX)	Regionally extinct (RE)	Critically endangered (CR)	Endangered (EN)	Vulnerable (VU)	Data deficiency (DD)	Total
Vertebrate animals (Vertebrata)							
Class Osteichthyes (Fishes)	2 subspecies		2	1	3	2	7
Class Amphibia (Amphibians)			1		1		2
Class Reptilia (Reptiles)			7	2	10		19
Class Aves (Birds)				18	65	13	96
Class Mammalia (Mammals)		3	3	10	12	1	29
Sub-total		3	12	31	91	16	153
Total	2	5	62	95	129	16	308

The analysis shows that over the last decades the fauna of Armenia has been subject to quantitative and qualitative changes. The comparison of data on vertebrate animals in the Red Book of Armenia (2010) and the Red Book of the Armenian Soviet Socialist Republic (1986) is a good proof for that (the invertebrate animals were not represented in the first Red Book).

Table 7. The number of vertebrate animals registered in the Red Book of Armenia

Taxonomic group	Number of species	
	1986	2010
Fishes (Osteichthyes)	2	7
Amphibians (Amphibia)	1	2
Reptiles (Reptilia)	11	19
Birds (Aves)	67	96
Mammals (Mammalia)	18	29
Total	99	153

The status of some species is of great concern due to a negative impact of various antropogenic and natural factors on biodiversity.

After publication of the Red Book of Armenia (2010) the status of some species registered there even worsened. Thus, out of 9 localities previously known for Transcaucasian racerunner (*Eremias pleskei*) only 1 has been possible to find, out of 27 localities known for Horváth's toadheaded agama (*Phrynocephalus horvathi*) from scientific sources only 2 has been possible to find along with 1 new identified locality. At present all known populations of the mentioned species are isolated from each other and their extremely limited quantities are gradually reducing (10-12 individuals on 1 ha in 1954, 1-2 individuals on 1 ha in 2013). The main threat is the agricultural use of lands as in recent years in many areas of Ararat plateau large farms are being established as well as fruit orchards and vineyards are being established on previously not cultivated lands. The mentioned species do not come back to cultivated areas. However, there are other data proving the presence of these species in Armavir Region, Goravan Sands and other areas, which means that additional studies are needed.

The status of the racerunner (*Eremias arguta transcaucasica*), which has only one limited population in Armenia with small areal is of concern. The main threat to the species is again an antropogenic factor, including urbanisation and road construction. The areas and numbers of each of one populations of the common tortoise (*Testudo graeca*) located in Armavir and Ararat Regions of Armenia have severely reduced due to land privatization and agricultural use. Urgent studies and conservation interventions are needed for the mentioned species.

Though numerous cases of wolfs appearing in human inhabited areas and attacking domestic animals were registered during 2011-2012, however it was not conditioned by the increase of their number, but reduction of the species they feed on. Thus, according to the specialists of the Scientific Center of Hydroecology and Zoology of the RA National Academy of Sciences, almost 50% reduction has been observed for hare, 90% for wild boar and 30-40% for roe-deer. According to WWF data reductions of the numbers made 20% for hare and 70% for wild boar, whereas the status of roe-deer is rather good. It is clear that stock-taking of these species is necessary with consideration of larger territories of their habitats.

The number of wild boar (*Sus scrofa*) has severely dropped both in specially protected nature areas (Shikahogh and Khosrov Forest State Reserves) and in forest areas out of the SPNAs. This is conditioned by the outbreak of African plague during 2008-2012. According to specialists, the number of wild boar in the southern parts of Armenia has reduced by about 70%. By the way, even the capacity of wild boar to regenerate quickly cannot stabilize its population, as the annual outbreaks again reduce the number of animals.

The status of many species of birds (especially rare species) is of concern on the territory of Armash fish farms and littoral areas of the Rivers Sev Jur and Qasakh. It is conditioned by not rational use of water resources and worsening of water supply to fish farms. Thus according to the winter (January) stock-taking in 2013-2014 the limited species and quantitative diversity were observed in Armash fish farms: 26 species were registered in 2013, which make 3.2% of the birds of Armenia and 14 species in 2013, which make 1.6% of the birds of Armenia.

Due to reduction of small natural lakes used as fish farms and increase of the number of concreted fish-breeding ponds the number of waterfowl species has reduced, for example, the species *Netta rufina*, *Aythya ferina*, *Anas strepera*, *Anas platyrhynchos*, *Fulica atra*, *Gallinula chloropus*, *Podiceps* sp. and others.

In 2014 it was not possible to find the species *Ammoperdix griseogularis* and *Bucanetes mongolicus*) registered on the territory of Armenia in 2004 as well as *Rhodospiza obsoleta* registered in 2013. The status of the Caspian snowcock (*Tetraogallus caspica*) is concerning as its areal is shrinking over years. The cause of this is not definitely clear, but probably it is connected with the fact that its areal is located in the border areas of Armenia.

Due to elimination of green areas in cities and some other areas the number of wood-peckers and other birds nesting in tree hollows has reduced.

In the fauna of invertebrates a global trend is observed, which is the reduction of the number of pollinating insects and mass outbreaks of agricultural pests conditioned by numerous factors including the antropogenic and climatic factors. During 2011-2014 the southern forests of Armenia were severely damaged by *Euproctis chrysorrhoea*, in 2014 in a number of areas in Armavir and Kotayk as well as in foothill areas the outbreaks of *Ocnogina loevii armena* were registered. The latter has not been even registered in Armenia as a serious pest and its last mass outbreak was observed in 1939.

1.3.4 Water biodiversity

During 2009-2003 relatively extensive studies of water biodiversity of Armenia were implemented though not in all water ecosystems.

The studies have been continued in Lake Sevan and Lake Arpi. The Rivers Pambak, Shnogh, Debed, Aghstev, Voghji and Vorotan, the main rivers of the Arpa and Sevan Lake basins as well as Spandaryan and Kechut reservoirs have been covered by the studies of river systems.

The fish community of Lake Sevan has radically changed. Over centuries the fish fauna of the lake has been known for endemic fish species Sevan ishkhan with 4 subspecies (winter ishkhan, bojak, summer bakhtak and gegharkuni), Sevan khramulya and Sevan barbel.

Due to the drop of the lake water level two subspecies of ishkhan (winter ishkhan and bojak) disappeared and the number of the other fish species critically reduced and they are under the threat of extinction.

The measures on artificial reproduction of subspecies summer bakhtak and gegharkuni have been implemented in the lake aimed at protection of endemic fish species of the lake. Over the last 7 years about 2 mln young fishes (with the cost of 348 billion AMD) have been released to Lake Sevan (Table 8).

Table 8. Indicators on replenishment of the populations of endemic fish species in Lake Sevan during 2009-2013

Year	Number of young fish released to Lake Sevan
2009	312 000
2010	192 000
2011	366 700
2012	366 700
2013	366 700

In the result of artificial reproduction a population of mature individuals of summer bakhtak and gegharkuni was registered. However, these species spawn in rivers and their natural reproduction becomes impossible due to almost complete obstruction of the rivers, which are their spawning grounds, and disturbance of their hydrological regime.

The commercial fish species of Lake Sevan have also been subject to serious changes. The stock of whitefish, which is the main commercial species, has reduced. Over recent decades the trend on reduction of quantitative indicators of commercial fish species has been continued (Table 9). Insignificant increase was registered in 2013, which was the result of the presence of whitefish mature generation in the lake during 2011-2012 as well as of the reduced antropogenic impact due to less dense fish population. At present the commercial stock of fish is at the lowest threshold.

Table 9. The total biomass of fish in Lake Sevan during 2005-2013

Year	Average density, kg/ha	Total fish biomass, ton
2005	5.0	600
2006	3.0	250
2007	1,5	205
2008	2.8	366
2009	2.1	279
2010	2.5	326
2011	0.094	8.5*
2012	0.051	6.5*
2013	2.0	324*

* calculated only for whitefish

The fish fauna of the lake has significantly changed. The alien species foldfish (*Carassius auratus*) and common carp (*Cyprinus carpio*) have penetrated into the lake.

In the period of water level increase two new fish species were identified in the lake: *Alburnoides bipunctatus armeniensis* in 2010 and *Pseudorasbora parva* in 2011. The latter was identified in the littoral areas of Small Sevan as well as the mouth of the Dzknaget River and the source of the Hrazdan River. The species *Alburnoides bipunctatus armeniensis* was identified in Lake Sevan, in the lower courses of the Rivers Argichi, Vardenis, Tsakhqar and Gavaraget Rivers as well as in the source of the Hrazdan River (the causes are presented in section 1.4.4, Figure 15).

At present the following fish species occur in the lake:

- **Family Salmonidae**
- Gegharkuni (*Salmo ischchan gegarkuni*)
- Summer bakhtak (*Salmo ischchan aestivalis*)
- **Family Coregonidae**
- Whitefish (*Coregonus lavaretus*)
- **Family Cyprinidae**
- Sevan khramulya (*Capoeta capoeta sevangi*)
- Sevan barbel (*Barbus goktschaicus*)
- Goldfish (*Carassius auratus gibelio*)
- Common carp (*Cyprinus carpio*)
- Armenian riffle minnow (*Alburnoides bipunctatus armeniensis*)
- Topmouth gudgeon (*Pseudorasbora parva*)

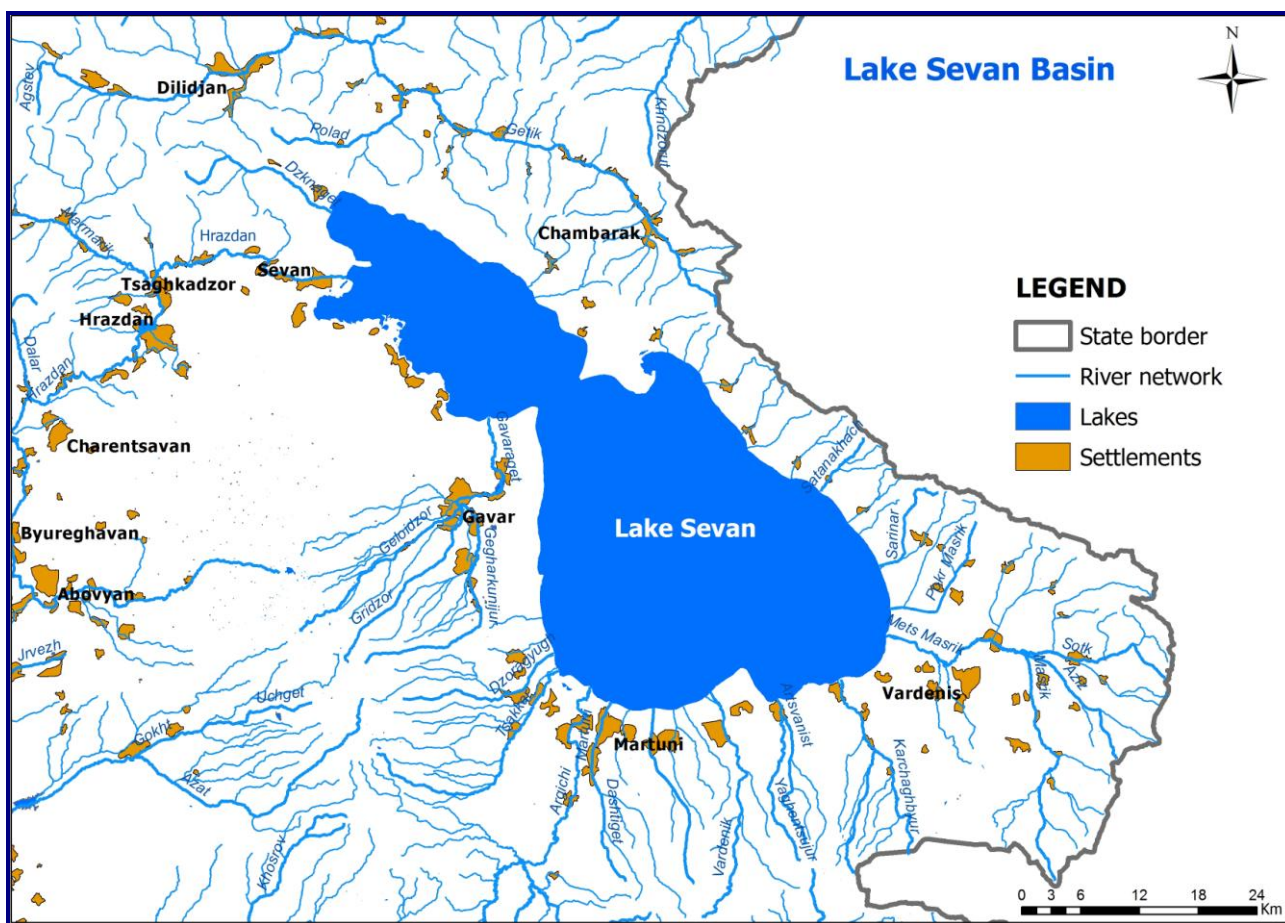


Figure 15. The Lake Sevan basin

The crayfish (*Pontastacus leptodactylus*) is another commercial hydrobiont having wide distribution in the lake. It penetrated into Lake Sevan in the 1980s due to accidental introduction. Having occupied a free ecological niche and gradually getting accustomed to the new environmental conditions, the species has increased in quantity and become the main actor in processing organic silt. Due to reduction of fish stock in the lake the main antropogenic load is on this hydrobiont. The commercial resources of crayfish have reduced during 2005-2013, however in 2013 a sharp increase of its quantity was registered (Table 10).

Table 10. The commercial resources of crayfish (ton) in Lake Sevan during 2004-2013

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
1800	2100	1700	1500	1370	980	830	860	810	1530

Three main groups of algae (diatom, green and blue-green) make the basis for the lake algae fauna, which is typical for the lakes of temperate zone. In phytoplankton communities the most diverse by species composition is the group of diatom algae (50%), the next is the group of green algae (30%). The plankton algae belong to 13 classes, 15 orders, 37 families and 79 genera. Almost in all groups of algae some species previously not known in the pelagic zone have been described, some of them are registered in the lake for the first time (green alga *Scenedesmus obtusus* Meyen and diatom alga *Cyclotella stelligera* Cleve et Grunow).

During 2008-2011 in the rivers of the Lake Sevan watershed basin 184 species of algae belonging to 5 phylums, 8 classes and 16 orders. The benthos forms dominated, which are cosmopolitans by geographical distribution. The richest biodiversity was observed in phytoplankton communities of the mouths of the Masrik, Maqenis, Lichq and Argichi Rivers.

The algae species composition in the rivers is as follows:

- Diatom algae (Bacillariophyta) 109 species
- Green algae (Chlorophyta) 39 species
- Blue-green algae (Cyanophyta) 31 species
- Yellow-green algae (Xantophyta) 3 species
- Euglena algae (Euglenophyta) 2 species

The studies on hydrobiology and fishes implemented in 2013 in the Rivers Vorotan and Arpa and Kechut Reservoir belonging to the Sevan watershed basin included the main components of trophic chain – bottom fauna (zoobenthos), plankton community (zooplankton), macrophytes and ichthyofauna. The hydrobiological studies did not reveal any species registered in the Red Book of Armenia and IUCN Red List. However, endemics of Armenia and the Caucasus were identified in different water ecosystems.

The ichthyofauna of Armenia has been studied since the beginning of the last century. Compared to the other groups of water fauna it has been better studied, which allows to make comparisons with up-to-date data (Table 11).

Table 11. The presence of fish species in the Rivers Arpa and Vorotan and Kechut Reservoir

Water object	Data of 1990s	Data of 2013
Kechut Reservoir	<i>Coregonus lavaretus</i> , <i>Barbus lacerta cyri</i> , <i>Acanthalburnus microlepis</i>	<i>Alburnoides bipunctatus armeniensis</i> , <i>Pseudorasbora parva</i> , <i>Capoeta capoeta</i> , <i>Carassius auratus gibelio</i>
Arpa River	<i>Salmo trutta fario</i> , <i>Parasalmo mikissa</i> , <i>Barbus mursa</i> , <i>Alburnoides bipunctatus armeniensis</i> , <i>Capoeta capoeta</i> , <i>Aspius aspius</i> , <i>Alburnus charusini hohenackeri</i> , <i>Acanthalburnus microlepis</i>	<i>Alburnoides bipunctatus armeniensis</i> , <i>Barbus lacerta cyri</i> , <i>Salmo trutta fario</i> , <i>Alburnus charusini hohenackeri</i>
Vorotan River	<i>Salmo trutta fario</i> , <i>Barbus mursa</i> , <i>Alburnoides bipunctatus armeniensis</i> , <i>Capoeta capoeta</i> , <i>Aspius aspius</i> , <i>Alburnus charusini hohenackeri</i> , <i>Acanthalburnus microlepis</i>	<i>Alburnoides bipunctatus armeniensis</i> , <i>Carassius auratus gibelio</i> , <i>Salmo trutta fario</i>)

The study of zoobenthos community in the upper and lower courses of the Arpa River shows that in spite of the fact that compared to the upper course more organic matter exists in the lower course, however in the lower course, like in the upper course, lots of bioindicators of water purity were registered. Thus it can be concluded that at present the water of the Arpa River is not subject to serious antropogenic impact and is of high quality.

The zoobenthos of the Vorotan River is rich in numerous endemic species of the Caucasus and Minor Asia. They are of great significance in terms of biodiversity. The water quality varies from “high” to “good” dependent on the season. At the same time, in the basin of the Vorotan River the construction of a tailings pond is envisaged. The future exploiter of the Amulsar mine – “Geoteam” LLC does everything to prevent possible damages to the environment. However it will not be possible to exclude fully the damage to water ecosystems given the open mining system and the presence of the tailings pond. The HPPs constructed on the Vorotan River disturb the hydrological regime with most visible changes at the sites of HPPs.

1.3.5 Agrobiodiversity

Rich agrobiodiversity of Armenia with high capacities to ensure stability of ecosystems and integrity of biocenoses at the same time is a precondition for economic development of the country. The sub-sectors of agriculture, such as crop production, live-stock breeding, bee-keeping and fishery as well as a number of important sub-sectors of the light and food industry depend on the wild useful plants and representatives of endemic animal species. The agrobiodiversity has invaluable role in maintenance of qualitative and quantitative features of ecosystem services, especially when it comes to protection of the genetic pool of cultivated plants and domestic animals, breeding, production of medicines and new substances through biotechnologies as a precondition for food security of population.

The significance of protection and sustainable use of genetic resources of plants and animals is increasing and gradually becoming an important component of the policy in the sectors of agriculture and nature protection.

The protection and use of genetic resources used for food and agriculture is implemented according to the priorities defined in the strategy on sustainable agricultural development, which emphasizes the conservation of the old local varieties and wild relatives of cultivated plants, enhancement of the capacities of genetic banks, establishment of plantations and breeding units of the species having economic value as well as the balanced use of natural resources.

The genetic resources of Armenia are mainly represented by the species belonging to the groups of cereals, legumes, fodder plants, vegetables, melons and oil-bearing plants.

Given the conditions of the Republic of Armenia the cultivated cereals (wheat, barley, spelt) are of strategic significance in terms of food supply and consequently they dominate in the structure of areas occupied by cultivated plants as well as in seed collections (this refers to both cultivated and wild species).

According to the data of the RA Statistical Service in 2013 the areas under cultivation of the main agricultural cultures had the following structure:

- Cereals and legumes – 178367 ha
- Potato – 30680 ha
- Vegetables – 25400 ha
- Melons and gourds – 5356 ha

Among wild cereals in Armenia there are three species of wild wheat, nine species of aegilops, two species of rye and eight species of wild barley, which have rich intraspecies diversity and are considered to have genes responsible for resistance to drought, diseases and pests and other properties. Numerous aboriginal forms and wild species of cultivated legumes also occur.

In the list of the vegetable crops of primary significance for Armenia is tomato, cabbage, cucumber, onion, abergine and pepper. Their proportion in the total vegetable crops makes 61,9%. The

territory of Armenia is also a primary and secondary center of origin of a number of vegetable plants. That is why the majority of the main cultivated vegetables and melons in Armenia is also represented by wild relatives (280 species).

The flora of Armenia is rather rich in fruit and berry species, the cultivated plants mainly belong to *Rosaceae* family. Conservation of the genetic pool of wild relatives of cultivated fruit species is an important issue at national and global levels.

The fodder plants are represented by *Poaceae* and *Fabaceae* families, which grow in numerous species, ecotypes and forms. Only from the family *Fabaceae* 346 species of plants are registered in Armenia.

Over the last years for the first time in Armenia the mycobiota of pathogenic fungi parasitising on 96 species of fodder plants belonging to 12 genera of *Fabaceae* and *Poaceae* families has been subject to the target study. It has been identified that the mycobiota includes 160 species of microscopic fungi belonging to 51 genera, 18 orders, 7 classes and 3 phylums. For the first time in the mycobiota of Armenia 13 species of fungi parasitising on fodder plants have been identified.

Diversity of the modern selection varieties

Thanks to various soil-climatic conditions a large number of cultivated plants is grown in the country. As an integral part of genetic resources they create a basis for breeding.

The works on breeding in Armenia are implemented in the directions of full-scale and adaptive breeding. At present a limited number of old traditional varieties is cultivated along varieties imported from abroad and locally bred ones. The number of cultivated varieties registered in the State Register of Breeding Achievements increased during 2008-2013, with significant increase especially in the number of new varieties of vegetables (85%) (Figure 17).

These data testify that thanks to use of genetic resources in breeding process the diversity of cultivated plants is maintained, which according to Target 13 of the Aichi Biodiversity Targets should continue to be maintained by gradually involving more crops in the breeding processes.

In addition to the varieties registered in the official list, some imported, but still not registered varieties are also cultivated in farms of the country. Their exact number is not known. Taking into account that this sector has been out of supervision, the presence of new imported varieties is a risk factor also for wild biodiversity.

Diversity of the local varieties

Before 1950 more than 20 local varieties of wheat have been cultivated in Armenia. At present in some farms 2-3 traditional local varieties of wheat are being cultivated, the others were removed from cultivation due to low productivity. The local varieties of wheat thanks to a number of important features can serve as a valuable basis for breeding. For example, the local varieties Spitakahat, Galgalos, Deghnazarda and Tavtukhi are known for their resistance to drought, the varieties Deghnazarda and Grnani – for resistance to fungi and the varieties Gyulgani and Alti-aghaj – for resistance to cold.

Out of local varieties of barley the local variety Nutans is under cultivation, which is resistant to cold and does not require high quality soil. Out of perennial fodder plants from *Fabaceae* family the local variety-populations of alfalfa (*Medicago*) and sainfoin (*Onobrychis*) are mainly cultivated. They have rather stable genetic features and ensure high productivity over years.

Out of vegetables and melons the local variety-populations of cucumber, pepper, abergine, bean, cabbage, carrot, asparagus, onion and melon are being cultivated in limited quantities. Almost all varieties of spicy herbs cultivated in Armenia are of local origin.

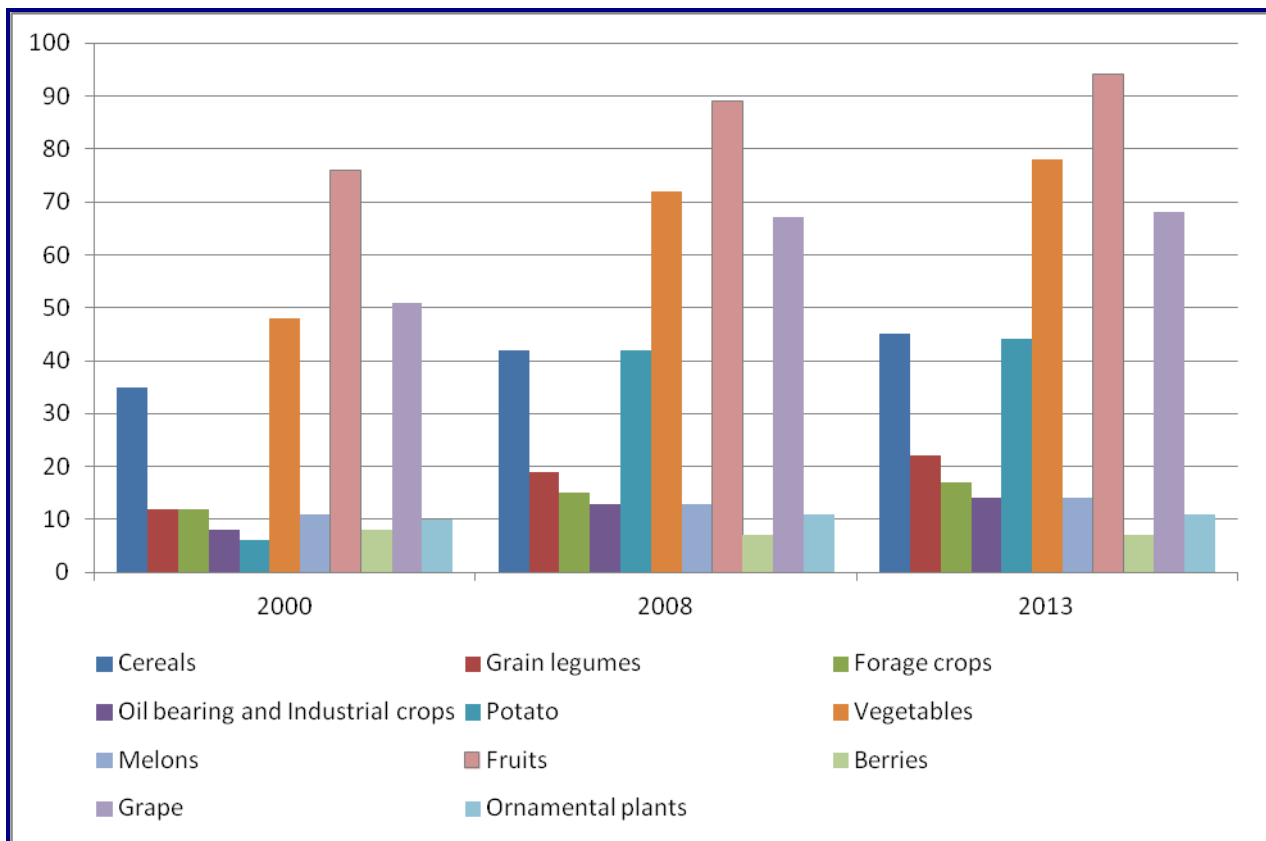


Figure 16. The number of registered varieties of crops, 2000-2013

The Armenian Highland being one of the centers of origin of cultivated plants is known also for diversity of traditional varieties of fruit trees. In particular, some variety-populations of apple (40), pear (15), apricot (15), peach (8), plum and sour cherry have been preserved in private farms in the form of unique individual trees. They can also disappear during the coming several years unless urgent measures on their conservation and reproduction are undertaken.

It should be mentioned that the majority of the mentioned local varieties has not been conserved in the seed collections. Therefore it is needed to develop and implement special programmes to import them from abroad genbanks and provide seed collections with these valuable genetic resources through their reproduction in Armenia. According to Target 13 of Aichi Biodiversity Targets it is necessary also to take steps aimed at minimizing the genetic erosion of local traditional varieties with consideration of the importance of diversity of the above mentioned local varieties as the basis for breeding and as the varieties with unique organoleptic features, which characterize the Armenian cuisine and culture connected with traditions.

1.4 The main threats to ecosystems and important components of biodiversity, their causes and mechanisms of impact

The second decade after independence of Armenia (1990) has been characterized by a trend of overcoming various crises (energetic, socio-economic, phsycological) with certain improvement of the economic and social situation in the country. Some progress registered in Armenia during 2001-2008 was short due to the world financial crisis of 2008-2009, which resulted in a sharp decline of the gross domestic product (GDP) also in Armenia (Table 12).

Table 12. Economic growth in Armenia by main branches of economy (percentage compared to the previous year)

	2005	2008	2009	2010	2011	2012	2013
GDP	13,9	6,9	-14,1	2,2	4,7	7,2	3,5
Industry	5,6	2,2	-6,9	9,2	13,6	6,3	5,4
Agriculture	11,2	3,3	6,0	-16,0	14,0	9,5	7,2
Construction	27,9	11,3	-41,6	3,3	-12,2	4,8	-10,8

In 2012 the GDP by the current prices made 3981.5 billion AMD, the actual GDP increased by 7.2%. Indicators of the growth were registered in the four main branches of economy – the industry, agriculture, construction and services.

In 2013 the economy continue to be active, but the growth rate slowed down conditioned by the low growth of the world economy and decreased investments in local economy. In 2013 the actual economic growth made 3.5 % (7.2 % in 2012). The growth rate was the highest in the mining and processing industry sub-branches.

The presented economic indicators show that the branches of economy can be main threats to the environment. The analysis of reports by the Ministry of Nature Protection and Ministry of Agriculture, Ministry of Territorial Administration, Ministry of Energy and Natural Resources, Ministry of Emergency Situations, regional governments, National Academy of Sciences and other institutions during 2009-2013 shows that in comparison with the previous five years no changes occurred in the structure of the threats to ecosystems and biodiversity conditioned by antropogenic impact. As it is mentioned in the fourth national report on biodiversity of Armenia, the antropogenic impact brings about:

- Changes, fragmentation and loss of habitats of biodiversity components;
- Overuse of biological resources;
- Pollution of environment (soil, water, air, food);
- Introduction of alien species.

The natural factors, which are risky for ecosystems and their components, are also mainly conditioned by unconscientious approaches of human towards nature.

In the analysed period (2009-2013) the severity of negative impact on biodiversity and territorial indicators of impacted ecosystems have changed, which is briefly presented below. It should be mentioned that the loss of biodiversity and changes of ecosystem services in many cases is not a result of the impact of just one factor, but of a complex impact.

In the early post-soviet period this has been connected with the hard socio-economic conditions, energetic crisis and poverty of wide classes of population in the country. In recent years the negative impact on biodiversity and increased rates of ecosystem degradation are conditioned by certain activation of economic and social activities, which is expressed in overuse of biological resources, exploitation of mines, privatisation of lands, expansion of areas under construction, visible activation of agriculture and tourism development.

Basically almost all threats of the hierarchical classification of threats suggested by IUCN have some impact on biodiversity of Armenia. Almost no comprehensive analysis and assessment of all of these threats has been done in Armenia. Some works have been implemented in Meghri region, where the possible impact of threats on some species of invertebrates has been studies. The impacts of mining industry, infrastructure and agricultural development, loggings and wood harvesting, fires, use of agricultural chemicals, mass outbreaks of pests and others have been studied. According to the study results all the mentioned factors have some impact or can have impact on 38% of the vulnerable species in the region.

1.4.1 Loss of habitats

1.4.1.1 Open mining

The underground resources of Armenia are the most used elements of the environment. By approximate estimation in Armenia there are 613 mines with the value of 170 billion US dollar and the possibility to extract 60 types of minerals. Armenia has 5.1% of the total world resources and 7.6% of the confirmed resources of molybdenum. There are also significant resources of copper, zinc, iron, lead, gold, silver, rhenium, cadmium, tellurium and others. Based on these resources the mining industry in Armenia is developing with comprising 17% of the GDP of the industry.

Nowadays the mining industry is declared by the RA Government as a priority sector of economy. It is intensively developing. The Government has issued several hundreds mining licenses without having a long-term program on sustainable use of resources, appropriate tax legislation and legislation on environmental protection as well as comprehensive assessments of environmental and social implications. Nowadays the mining industry continues to have catastrophic consequences. Thousands of hectares of the territory of Armenia are covered by open mines and tailings ponds. According to the RA land balance in 2009 the lands of industrial, underground resource exploitation and other production purposes made 29.36 thousand ha, in 2010 - 12.5 thousand ha, in 2011 - 33.0 thousand ha, in 2012 - 33.6 thousand ha and in 2013 - 34.9 thousand ha, which means that the area of used territories is gradually increasing especially at the expense of the lands under exploitation of mineral resources.

The mines in Armenia are mainly concentrated in two regions – in Alaverdi area of Lori Region and Kapan-Qajaran area of Syunik Region. The main geocological consequences of the mining industry include the damage to land cover, expansion of tailings ponds, accumulations of wastes, and pollution of water resources. It is natural, that the damage/removal of land cover and accumulation of wastes definitely cause fragmentation of plant and animal populations and communities, disturb migration routs of animals and even threatened the existence of some rare species.

Open mining in forest areas is of the greatest concern. The copper-molybdenum mine in Teghut located in the north-eastern area of Lori Region in the zone subject to earthquakes and landslides is a good example. In the area there are about 20 ancient and medieval historical-cultural monuments. The state forest fund of Lori Region makes 101835 ha, out of which 80867 ha is covered by forests (26 % of the region territory). During 1990-2000 about 30% of the forests of the region have been intensively destroyed. Afterwards decomposition of root systems of the logged trees has resulted in activation of erosion and landslide processes in the region. The forest adjacent to Teghut is the best preserved forest in Armenia with rich biodiversity including about 200 species of plants, 55 species of mammals, 86 species of birds, 10 species of reptiles and 4 species of amphibians. Many of these species are rare and endangered; 6 species of plants and 26 species of animals are registered in the Red Book of Armenia. Exploitation of an open mine in the area envisages deforestation, construction of tailings ponds, establishment of new infrastructures and other works. The consequences of all the mentioned activities can be devastating for ecosystems and biodiversity, which is the matter of great concern for environmentalists and population. It is encouraging that the “Valex Group” LLC is seriously concerned by environmental issues and implements specific actions to minimize the negative impact of the mine (see section 3.1).

The industry of construction materials has also caused damage to the environment of Armenia. At present due to the extraction of construction materials more than 7 thousand ha of agricultural lands has become unsuitable for use.

The expanding tailings ponds of mines and ore processing plants continue to be alarming. In some of them (for example, in Akhtala) ore enrichment is done by flotation method, in the result the

nature is contaminated by only several surface active substances having a negative impact on water ecosystems. Meanwhile, in the case of industries applying older technologies much more dangerous substances are used with production of much more toxic wastes. According to the data of the Center for Ecological Noosphere Studies of the NAS RA the contamination of soil and water in many areas of the country significantly exceeds the maximum allowable concentrations and the main source of contamination is the leakage from tailings ponds.

For all the above mentioned problems if it is not possible to solve them fully, however it should be possible to mitigate the environmental impact through observation of respective norms and regulations on environmental protection during mining activities.

1.4.1.2 Construction (urban development, road construction, reservoir construction)

Due to reduction of the total volume of construction works during 2010-2011 at present the risk of their impact on ecosystems is not high. In recent years the expansion of existing inhabited areas and establishment of new settlements (in the form of summer-house communities) is slower and almost without occupation of new territories.

The works on the road network are mainly aimed at widening and renovation of existing roads. The most significant damage to ecosystems and biodiversity is caused by establishment of irregular roads in the areas, where the works on geological exploration are implemented and the installation of respective technical means requires establishment of a dense road network. At the same time in the majority of cases the road network remains unchanged after completion of the exploration works and the previous state of the landscape is not recovered.

The works on establishment of new reservoirs are still not active, though it is envisaged that the works on development of the planning and budgeting documents for Kaps and Vedi Reservoirs will be finalized by the end of 2014. The programs on construction of Mastara and Yeghvard Reservoirs are under discussion with respective donor organizations.

1.4.1.3 Agriculture

After independence in Armenia the land privatization process has seriously changed the character and status of agriculture in the country. At present the main land users for agricultural production in the country are the farms, which manage more than 82% of arable lands, 75 % of perennial stands and 50% of hay-making areas. Today the absolutely major proportion (more than 98%) of the gross product from agriculture is ensured by the private sector.

In the sphere of agriculture the most serious problems connected with the environment are the losses of water due to ineffective irrigation as well as salination of soils, erosion and pollution by agricultural wastes.

According to the land balance of Armenia no significant changes have happened in the structure of agricultural lands in recent years. However, the rate of use of new areas for agriculture has increased to some extent at the expense of not-used cultivated lands. New fruit orchards and vineyards are being established, mainly in the Ararat Valley and Vayots Dzor Region. In 2012 the areas under fruit and berry production increased by 10% in comparison with 2008. The areas for cultivation of annual crops are almost not expanded in recent years.

Full and effective use of land resources is a priority for Armenia as a country with such limited land resources, where the agricultural lands make 0.65 ha per capita and arable lands – only 0.14 ha per capita. However, due to various factors at present about 33% or 150 thousand ha of arable lands is not used for the target purpose. This circumstance threatens wild biodiversity as the abandoned cultivated areas are covered by aggressive weeds and become a center of their reproduction and a source of their dissemination in cultivated fields and natural ecosystems.

As stated by international experts, in Armenia about 11% of land degradation is the result of human activity, out of which about 10% is conditioned by improper agricultural practices ("Climate Change and Agriculture" country report, 2012, World Bank). These processes bring about soil erosion and secondary salination, degradation of natural ecosystems as well as change and loss of biodiversity, which is eventually expressed in significant quantitative and qualitative changes of ecosystem services.

For the natural ecosystems being used as pastures the biggest threat is the unproportional distribution of the pasture load, when the distant pastures suffer from under-grazing, which results in change of ecosystems, in particular replacement of alpine carpets with alpine meadows as well as active penetration of sub-alpine weeds to alpine ecosystems.

The majority of the community adjacent pastures is at present overused and degraded started from changes in plant cover to erosion, which is also the result of land-slides and mudflows. Overgrazing can threaten species registered in the Red Book of Armenia: *Botrychium lunaria*, *Polystichum braunii*, *Eryngium vanaturi*, *Stenotaenia daralaghezica*, *Centaurea vavilovii*, *Doronicum balansae*, *Gladiolus dzhavakheticus*, *Gladiolus hajastanicus*, *Linaria pyramidata*, *Onobrychis hajastana*, *Onobrychis major*, *Onobrychis meschetica*, *Onobrychis takhtajanii*, etc.

Due to inefficient use and no maintenance of natural pastures over many years, a part of them (about 150 thousand ha) is not suitable for use. At present, the activation of water erosion and expansion of marsh areas is observed in natural pastures. The pastures of high importance in terms of biodiversity should be protected through focusing on their regulated efficient use, development of new technologies, assessment and improvement of the ecological status of pasture lands and wide use of local flora representatives for practical selection of new perennial fodder plants.

Desalination of natural saline lands for their further use for agricultural purposes is a very serious problem for biodiversity. Such large-scale activities have been implemented during the Soviet years, due to which at present in Armenia there are almost no natural saline areas with their typical unique biodiversity, in particular the very rare halophytes of flora and fauna. The species typical for saline areas, which are on the edge of extinction include *Halocnemum strobilaceum*, *Halostachys belangeriana*, *Kalidium caspicum*, *Microcnemum coralloides*, *Salsola aucheri*, *Salsola soda*, as well as those typical for sand deserts such as *Scorzonera gorovanica*, *Rhinopetalum gibbosum* and *Calligonum polygonoides*. All of them are included in the Red Book of Armenia.

In the result of land use in the Ararat valley the following species registered in the Red Book are under threat: *Asperuginoides axillaris*, *Lepidium lyratum*, *Leptaleum filifolium*, *Pseudoanastatica dichotoma*, *Hohenackeria excarpa*, *Oenanthe silaifolia*, *Actinolema macrolema*, *Centaurea arpensis*, *Amberboa amberboi*, *Amberboa iljiniana*, *Amberboa moschata*, *Amberboa sosnovskyi*, *Astragalus holophyllus* as well as the only one habitat of the species *Acanthus dioscoridis* in the Caucasus.

In arid counties artificial drying of wetland habitats is a very serious threat to ecosystems and hygrophilous and hydrophilous biodiversity. In the result of drying of saline marshes and livestock overgrazing in Ararat valley the following species registered in the Red Book are under threat: *Merendera sobolifera*, *Sphaerophysa salsula*, *Frankenia pulverulenta*, *Iris musulmanica*, *Juncus acutus*, *Linum barsegianii*, *Thesium compressum*, *Inula aucheriana*, *Cirsium alatum*, as well as red book registered wetland representatives growing in other regions of Armenia *Salvinia natans*, *Thelypteris palustris*, *Sagittaria sagittifolia*, *Coccyganthe flos-cuculi*, *Menyanthes trifoliata*, *Nuphar luteum*, etc.

At present no activities on artificial drying are implemented in Armenia. However, the changes in water regime due to the other economic activities result in the changes of water level in lakes and instability of water ecosystems with consequent negative impact on fauna and flora.

Due to use of water for agricultural and energy production purposes often water courses are getting dry with resulting elimination of the components of littoral and water ecosystems, especially fish species and the species they feed on. The works on cleaning and change of water courses are often not justified and result in elimination of river biotopes including food base for fish and their spawning grounds.

The results of bird inventory in the system of the River Metsamor during 2014 were not so satisfactory. In recent years the area has completely lost its significance for numerous wetland representatives in terms of serving as a wintering area. The disturbance caused by hunters during the hunting season as well as irreversible changes of habitats in the whole area due to land cultivation and drying of marshes for agricultural purposes have resulted in significant reduction of the bird fauna. During the day of inventory in the list of 16 registered species the white storks made 81%; every year a part of them winter in the area irrespective of weather conditions.

1.4.1.4 Loggings

In 2011 in the framework of the GIZ project Sustainable Biodiversity Management in the South Caucasus a study with use of modern technologies on remote sensing was implemented, according to which the forests of Armenia occupy 332.333 ha. It means that in recent years in Armenia just 1.7 thousand ha of forests has been logged – the figure, which is far from the reality. It has been identified that due to discrepancies in the maps more than 23 thousand ha of forests have not been included in the forest fund of Armenia. After the loggings in the period between 1993 to 2003-2004, the unsystematic regrowth areas are seen on the satellite images as forest covered areas. In fact, those are coppices and shrublands with low quality and capacity to become forests in future.

The remote sensing does not identify also the qualitative changes, which are obvious in the forest of Armenia. In the result of loggings undesirable changes of forest composition become more intensive, when the oak and beech having higher economic value are replaced by the relatively low-value hornbeam. Naturally, the forest density is also reducing. Besides the visible threat, the loggings result in extinction of the plant cover species of the forest, including those registered in the Red Book, such as *Galanthus alpinus*, *Galanthus artjuschenkoae*, *Galanthus lagodechianus*, *Cyclamen verum*, *Colchicum goharae* and *Colchicum umbrosum*.

By the official data the volume of illegal loggings in the country has reduced twice. However the long-term negative changes of the ecological status are observed in the areas, which have been subject to intensive loggings. The current state of forest ecosystems in the most forest covered Lori Region of Armenia, which is presented in the socio-economic development program for 2014-2017, is a good example. It was registered that due to illegal loggings for fuelwood and construction wood during 1991-2000 the conditions for natural regrowth of the forests in Lori Region have worsened and significant territories on the mountainous slopes have been deforested. The forest areas of seed origin have reduced and instead the tree and bush species of the coppicing and secondary significance have increased. The mentioned processes are very undesirable given the mountainous relief. The forests in the region have exclusively sanitary-hygienic and water protection significance. In general, the forest covered mountainous slopes in the region are rather steep. Dependent on the slope inclination and natural-climatic conditions as well as the seismological status the landslide processes have increased with removal of the black soil, which recovers very slowly in mountainous conditions. The significant part of natural springs became limited in water resources. Due to illegal and unsystematic loggings the natural regrowth

conditions of the main forest species have worsened and it is not possible to recover the previous state of forest ecosystems in the region without additional forest rehabilitation measures.

Considering the fact that the forests in Armenia cover mountainous slopes and have protection significance as well as that the wood demand exceeds several times the forest productivity rate and cannot be fully met by the country resources, it is necessary to rank the environmental significance of forests higher than their socio-economic significance. In this regard, the state forest management system should be considered as a dotation, partially self-financing and non-profit sector requiring continuous investments aimed at forest protection and rehabilitation.

1.4.1.5 Hydropower production

In Armenia the construction of small hydropower plants (SHPP) is considered a leading direction in development of the renewable energy sector. Construction of SHPPs is done according to the SHPP development scheme approved by the RA Government in 2009. By the scheme it is planned to construct 115 SHPPs. As of 1 January 2014 the licenses for hydropower production and HPP construction have been issued by the RA Committee on Regulation of Public Services to 150 SHPPs.

In parallel to implementation of the scheme on development of small hydropower plants, in Armenia the problems have occurred related to overuse of water resources and to ecosystems, biodiversity, specially protected areas, landscapes, social status of population and life quality. The studies implemented in recent years have analysed the impact of SHPPs on water regime of a number of rivers, loss of biodiversity, natural calamities, tourism development as well as socio-economic condition of communities ("Analysis of the socio-ecological impact of small HPPs", Open Society Foundation – Armenia).

The planning and implementation of SHPPs basically do not consider the needs of water fauna, at the same time the impact of water regime of the mountainous rivers on the littoral and water ecosystems and biodiversity is neither assessed nor studied.

The monitoring implemented in 2014 by a working group established in the frames of the Expert Committee on Lake Sevan Protection identified that the SHPPs constructed on the rivers, which serve as spawning grounds for fish, basically do not have appropriate fish passes and fish protection constructions and directly threaten the existence of mature individuals of fish species, which move up by rivers to get to their spawning grounds. Besides, some SHPPs do not observe the rates of maximum allowable water use, which also results in ecosystem degradation.

1.4.1.6 Recreation and tourism

The impact of recreation and tourism on ecosystems is mainly connected with recreational trampling of plant cover. On the other hand, the underuse of forests for recreation has indirect contribution to the increase of harvested volumes of wood. At the same time development of recreation and ecotourism is much more beneficial and advantageous from economic and environmental perspective, but respective approaches for organization of the mentioned activities are still missing in Armenia.

Pollution of picnic sites with domestic waste also causes problems, especially if such sites are not adjusted for recreation with provision of respective services. The situation has been improving in recent years, in particular in Dilijan National Park in Haghartsin gorge the specially equipped sites for open-door recreation have been established, the same is underway in some other often visited areas such as Garni, Orgov and others, though the scale is not sufficient.

Collection of decorative flowers especially in recreational areas is risky for reduction of the resources of some plant species and for change of species composition of flora in a given area, for example, the species *Papaver orientale* is replaced by the species *P. paucifoliatum*.

In any case, development of the tourism industry can threaten biodiversity in the most valuable and vulnerable areas unless the necessary environmental requirements are strictly observed.

1.4.2 Overuse of bioresources

The best example of this widespread process is the drastic decline of the fish species in Lake Sevan, in particular of the white-fish resources, which in fact is the result of improper management and disregard for scientific justifications (Table 13).

Table 13. Total fish biomass in Lake Sevan by years

Year	Average density, kg/ha	Total fish biomass, ton
1983	87	10788
2005	5.0	600
2007	1,5	205
2009	2.1	279
2011	0.094	8.5*
2012	0.051	6.5*
2013	2.0	324*

* calculated only for white-fish

During 2005-2012 the worsening of the state of white-fish population in the lake is explained by the specialists as resulting from unprecedent rate of illegal fishing; in spite of the ban on white-fish fishing, the sexually immature individuals have been fished.

Illegal hunting and violation of hunting regulations are also among threats. In spite of the fact that the time-frames of hunting as well as the list of species subject to hunting and their quotas are discussed with the specialists from respective organizations, however the recommendations coming from them are not always considered.

The picture is not clear when it comes to the quotas on use of plant species. According to the official data the number of licenses issued for use of medicinal, edible, technical and decorative wild plants is incredibly low (during 2011-2013 five licenses were issued for the export and import of flora objects). Therefore, it is not surprising that in the overall structure of nature use fees the bioresource use fees in 2012 made only 0.7%.

The above described non-regulated situation is conditioned not only by insufficient work of environmental supervision structures, but also improper legislation especially in terms of regulating the use of biological resources and setting the quotas. The stock-taking, inventory and monitoring as the main necessary elements of effective bioresource management are still not implemented at appropriate level and scale. The lack of a comprehensive information system on biodiversity in its turn excludes implementation of an actual assessment of the impact of antropogenic and natural factors on biodiversity, estimation of the caused damage and most importantly decision-making based on clear information.

In recent years the collection of wild decorative plants for use in flower bouquets has significantly increased, including also the species registered in the Red Book: *Nectaroscordum triprdale*, *Galanthus alpinus*, *Galanthus artjuschenkoae*, *Amberboa moschata*, *Iris elegantissima*, *Iris musulmanica*, *Nymphaea alba* and *Cyclamen verum*. This needs to be regulated by legislation and proper supervision.

1.4.3 Environmental pollution

The changes of biodiversity and ecosystem services connected with pollution are mainly caused by accumulation of hazardous chemical substances in soil, pollution of underground waters and rivers, accumulation of industrial wastes and landscape degradation. It disturbs the conditions for species growth, development and reproduction, eliminates valuable, threatened and rare species in forest ecosystems, as well as causes decline in productivity of agrocenoses and worsening of the yield quality.

At present there is no intensive industry functioning in the country. The main threat is caused in case of production, accumulation and storage of the wastes of mining industry. At present on the territory of Armenia there are 19 tailings ponds with about 220 million m³ of accumulated substances. The River Voghji is considered to be polluted by tailings; by approximate assessments there is about 150 million ton of tailings in the river valley with the presence of tellurium, selenium, bismuth, rhenium, gallium, copper, molybdenum and others. The River Debed is also in the state of ecological crisis; it is being contaminated by the copper smelting plant in Alaverdi and the ore enrichment plant in Akhtala. The fauna of the mentioned rivers along with the other contaminated rivers has been definitely reduced with worsening of the critical state of the water and terrestrial ecosystems over years.

The cement producing industry functioning in Kotayk Region is also alarming, as due to imperfect technical equipment the cement dust is emitted into air, which affects natural ecosystems and their components by changing soil conditions as well as causing impacts on invertebrate fauna and photosynthetic activity of plants.

The surface watercourses of the Republic of Armenia (rivers, streams, drainage systems) have turned into sewage canals. During 2009-2013 the total volume of sewage almost doubled. In the best case mechanical treatment is implemented in the sewage treatment stations. The rest of wastewater returns to the flowing water ecosystems. At the same time the quantities of water intake for economic purposes and of wastewater are increasing over years (Table 14).

Table 14. Water intake from water ecosystems of Armenia and water removal during 2009-2012

Years	Water intake (mln.m ³)	Water removal/out of which without cleaning (mln.m ³)
2009	22464,7	359,3 / 37,0
2010	2126,4	430,5 / 139,1
2011	2438,3	750,5 / 246,8
2012	2 941,1	813,4 / 307,4

Sixty percent of phytoplankton algae identified in the rivers have been bioindicators of the water organic pollution. The analysis of respective indicators has revealed low organic pollution in the waters of the main tributaries to Lake Sevan. By organic pollution the rivers were cleaner in 2008, whereas during 2009-2011 certain increase of pollution was observed.

The surface watercourses and landscapes are polluted also by solid domestic wastes. The problem of utilization of hazardous wastes and expired chemical substances including agricultural chemicals is still unsolved. For example, in recent years the landfill of chemical substances nearby Erebuni Reserve has become a problem.

The main threat in agriculture is an excessive use of fertilizers and pesticides. At the same time, often the expired substances are used and in more quantities for higher productivity, which cause serious threat to human health through agricultural products. The official data on this process in recent years are missing.

1.4.4 Impact of alien species

The analysis of dissemination of the most dangerous invasive and expansive plant species of Armenia shows that in recent years some of them have considerably widened the limits of their distribution (probably connected with the change of climatic conditions and expansion of degraded habitats). The density of their populations has increased with their penetration and establishment in natural ecosystems.

The studies on distribution of invasive species are not sufficient. The works on observation of distribution of the aggressive species such as *Ambrosia artemisiifolia*, *Silybum marianum*, *Ailanthus altissima* and *Robinia pseudoacacia* have started only in recent years. Intensive dissemination of the mentioned species has been observed, however no measures on control are implemented. The legislation on introduction of alien species is not regulated. For the species of agricultural significance the permits are issued by the RA Ministry of Agriculture without assessing the risks of biological invasions.



Ambrosia artemisiifolia, nearby Dzoraget train station



Silybum marianum, in southern Armenia



Ailanthus altissima, in southern Armenia



Robinia pseudoacacia, in southern Armenia



Astragalus galegiformis, in northern Armenia



Clematis orientalis, in the River Arpa gorge



Conyza canadensis, in southern Armenia

In recent years a general assessment of distribution of invasive and expansive species has been done. In the result, 77 alien invasive and locally expansive species have been listed, which at present are distributing in degraded habitats and have already penetrated natural ecosystems with causing threat to wild biodiversity. Among them the species of great concern *Achillea filipendulina*, *Ailanthus altissima*, *Anthemis cotula*, *Anthemis triumfettii*, *Astragalus galegiformis*, *Centaurea solstitialis*, *Leucanthemum vulgare*, *Onopordum armenum*, *Silybum marianum*, *Tanacetum parthenium*, *Tripleurospermum transcaucasicum*, *Acer negundo*, *Alliaria petiolata*, *Carthamus turkestanicus*, *Centaurea iberica*, *Chondrilla juncea*, *Cirsium incanum*, *Clematis orientalis*, *Conyza canadensis*, *Goebelia alopecuroides*, *Heracleum sosnowskyi*, *Onopordum acanthium*, *Verbascum laxum* and others. Besides, the modern world practice of invasive species management has been analysed and more than 300 species occurring in Armenia have been defined (introduced and aboriginal), which in future can be dangerous as invasive species.

Development of international trade results in increase of the number of introduced species. In recent years in many farms of the country significant damage is caused by *Hyphantria cunea* and *Phthorimaea oherculella*. The damage from the latter first was observed in 2012 in the Ararat valley. As no respective measures were implemented, it quickly disseminated to more than 45 communities in Ararat and Armavir Regions of Armenia. As besides the agricultural crops some

other *Solanaceae* species including weeds are also damaged, the insect has already disseminated in natural ecosystems.

A new species of parasite of cattles - the infusorium *Buxtonella sulcata* was identified in 2014. The impact of the beetle *Trichoferus campestris* on wild tree and bush vegetation has not been assessed. The species probably has been introduced with timber and in the 1990ies were registered in cities (Yerevan, Gyumri). In recent years it has been found in the vicinities of Hrazdan, Kapan and Armavir. The impact of these species on biocenoses and their components still is not well studied and estimated.

In recent years the increase of water level of Lake Sevan is gradually resulting in changes of limnosystem, especially in the lake littoral zone. The mentioned changes create favorable conditions for adaptation of new species of animals. In the lake a rather dangerous process for the lake ecosystem and its bioiversity has been observed, which is a trend of introduction of the alien species not typical for the given ecosystem, in particular of fish species. Thus, for example, in recent years in Lake Sevan and some tributaries the low-value and commercially no significant fish species Armenian riffle minnow (*Alburnoides bipunctatus armeniensis*) and Topmouth gudgeon (*Pseudorasbora parva*) have been identified. These species are quickly disseminating in the lake and can have negative impact on the valuable and endemic ichthyofauna of the lake (white-fish, ishkan, khramulya, barbel) as they compete for food with the young fish of the lake native species.

In Lake Sevan the cases of fishing of rainbow trout (*Parasalmo mykiss*) have been registered. The species most probably has penetrated into the lake from the fish farms located in the Sevan basin and it is of danger for the lake biodiversity as this predator species can feed on the young fishes of the native fish species.

The alien species, which have penetrated into the lake include also goldfish (*Carassius auratus*) and common carp (*Cyprinus carpio*). The alien crawfish (*Pontastacus leptodactylus*) appeared in the lake in the end of 1980ies in the result of an accidental introduction. It does not threaten the fish species occurring in the lake.

The control of the introduced low-value species is a rather difficult task given the huge size of the lake and small sizes of the mentioned fish species. Therefore, in order to prevent introduction of new species it is necessary to strenghten control in the lake and rivers, to raise the awareness of the lake basin population on the harmful consequences of such introductions as well as to prohibit artificial breeding of fish species not typical for the lake in the basin of Lake Sevan.

1.4.5 Climate change

According to the analyses implemented in the frames of the project “Enabling Activities for the Preparation of Armenia’s Second National Communication to the UN Framework Convention on Climate Change” (2010) in the result of climate change an expansion of the arid ecosystems, reduction of the areas covered by forests and sub-alpine and alpine landscapes and increased vulnerability of forests are expected. Ecologically most unstable forests on southern slopes will become more xerophilous and arid open woodlands will shift vertically up. In the lower timberline it is expected to have worsened conditions for seed regeneration of forests along with penetration of semidesert species as well as shift of the lower timberline up. In the lower forest zone of the central and southern Armenia an impact of the mountainous-steppe vegetation will be observed and the stands of coppiced origin will retreat. The expansion of the arid ecosystems with high surface flow will result in intensification of erosion and mudflow processes and flow of forest soils, worsening of the qualitative and quantitative characteristics of the surface flow and disturbance of the water balance. The activation of erosion processes due to aridization in the absence of preventive

measures in its turn will result in the worsening of forest growth conditions and reduction of forest cover in the lower forest zone and the forests on southern slopes in the central and southern Armen.

At present the works have started on modelling of ecosystems of Armenia in connection with the climate change. In the Institute of Botany of the NAS RA the studies are implemented with use of the ecosystem change modelling based on the «Holdridge Life Zones» system. Respective forecasts on “bioclimate” change and changes of main ecosystems have been developed on the basis of the climate change forecasts.

Based on the modelling of the changes in natural ecosystems the climate change risk assessment has been done for 452 species registered in the Red Book of Armenia. It has been identified that the expected climate change will not have significant impact on 238 plant species and the climate change will significantly improve the conditions for 140 species. These are thermophilous species, for which the effective temperature sum at present is not sufficient for their wider distribution. On the other hand, for 74 species of high vascular plants the ecosystem and habitat changes conditioned by the climate change will become decisive factors for their existence. First of all these are the species adapted to mesophilous conditions of sub-alpine and alpine belts and for which the climate change will result in a sharp reduction of their habitat area. These species include, for example, *Botrychium lunaria*, *Allium egorovae*, *Antennaria caucasica*, *Eriophorum latifolium*, *Rhododendron caucasicum*, *Lomatogonium carinthiacum*, *Scilla rosenii* and others. Some representatives of wetlands in the lower and middle mountainous belts, including *Carex pendula*, *Trigonella capitata* and others, also belong to this group; their habitats will be significantly reduced due to decreased precipitation and increased temperature. Besides, the risk of climate change is high for the mesophilous species of the steppes, meadow-steppes and meadows. Due to climate change their very limited populations with isolated habitats will become accessible. This group includes *Acanthus dioscoridys*, *Sternbergia colchiciflora*, *Grossheimia caroli-henricii* and others.

For the majority of these plants there is a number of other serious threats, in particular, their majority grows in the zone of intensive economic activity and is subject to a negative anthropogenic impact. Therefore, an additional factor of the climate change will become the main threat for their existence.

The climate change, in particular increase of water temperature can bring to the thermal stress of hydrobionts and disruption of physiological processes and change of the behaviour of organisms.

The climate change results also in the warming of the bottom cold water layers, due to which during summer months an optimal area for existence of the fish species adapted to cold waters is severely reduced. In Lake Sevan the most valuable *Salmonidae* fish species prefer cold water. Therefore, the increased water temperature will create unfavorable conditions for them. In this regard, Large Sevan is more vulnerable area, as in comparison with Small Sevan its depth is significantly less and it is more subject to temperature changes.

The success of reproduction of whitefish, which is the main commercial fish species of Lake Sevan, depends on a number of abiotic factors such as oxygen and temperature regimes, lake ground characteristics, water turbulence and others. Almost all of the mentioned factors depend on the impact of temperature. Even if for a sparse and scattered population it is easy to find respective conditions to exist in case of increased water temperature, however the change of temperature can have a negative impact also on development of their fodder base and become a limiting factor.

Increase of temperature can have a positive impact on the population of goldfish. The latter is distinguished by flexibility and being highly adaptive to new conditions can become a serious competitor to the other valuable *Salmonidae* fish species. In the first year of life the goldfish competes for food with whitefish and khramulya and later with khramulya and barbel. Considering

the high growth rate of the species and high reproduction capacity as well as similarities in fodder base, in case of climate change it can become a serious competitor for the native fish species of the lake. In general, it is expected that the increase of temperature will create favorable conditions for development of less valuable fish species.

1.5 The impact of biodiversity changes on ecosystem services, and its socio-economic and cultural consequences

Mountainous ecosystems are an important production resource for the population of the country, 50% of which resides in the countryside and for centuries has been using the goods and services provided by ecosystems. Development of branches of economy in Armenia including agriculture, which ensures 19% of the gross domestic product, directly or indirectly, completely or partially depends on the regulating, provisioning, cultural and supporting services of ecosystems. The table below presents the characteristics of ecosystem services (ES) of various landscape zones of Armenia and the role of biodiversity as well as the socio-economic and cultural implications of their changes (Table 16).

At the same time even partial recovery of ecosystems and their services is usually much more expensive than implementation of the measures aimed at their protection. A good example is the financial investments over the last 10 years aimed at increase of water level of Lake Sevan or at restoration of fish stock in the lake (annually 60 mln AMD is allocated from the state budget for the growth and release to the lake of young fish of only two species). Considering the present antropogenic impact on nature in Armenia, the maintenance and restoration of ecosystem services should become an integral part of economic activity, which requires changes in the norms and regulations regarding implementation of economic activities as well as changes in decision-making.

Underestimation of biodiversity and ecosystem services in Armenia is related to a number of problems such as:

1. Low awareness of wide public, users of ecosystem services and decision-makers, who are either absolutely ignorant about the services provided by ecosystems or perceive ecosystem services only as the resources available in ecosystems.
2. The benefits coming from the services provided by various ecosystems have not been valued yet and integrated in market relations.
3. The value of ecosystem services very often is not considered during economic assessments and decision-making as well as it is not reflected in economic indicators of the country.
4. The legislation on ecosystem services is not appropriate.

In the result, the low awareness for proper decision-making and the lack of necessary studies and imperfect information base as well as wrong understanding of the need of scientific valuation of biodiversity and ecosystem services make obstacles for taking steps aimed at mitigation of further loss of biodiversity and destruction of natural capital.

Relations connected with ecosystem services are still not regulated by the RA legislation. In 2013 the first attempt on legal establishment of main provisions of the ES concepts through adoption of a Concept on Establishment of Innovatory Financial-Economic Mechanisms in Environmental Sector (protocol decision N16 by the RA Government dated 25 April 2013). The aim of the concept is to solve the issues of underestimation of biodiversity and ecosystems in Armenia, mitigate the negative impact on environment and ensure effective (sustainable) use of natural resources as well as to increase environmental investments and financial resources. The concept emphasizes the issues of awareness about ESs, development of market relations, economic valuations, decision-making as well as integration of ESs in national economy. The proposals of the concept are aimed

at regulation of legislative relations connected with ESs, economic valuation of natural capital and development of a methodology on economic or cost valuation of ESs. In particular, it is suggested to introduce a system on payments for ecosystem services, which in practice will not replace the system of environmental and nature use fees, but will be applied in parallel with it.

In order to fill the gap in the experience on economic valuation of biodiversity and ESs and their integration in national economy recently a number of pilot projects have been implemented by different international organizations; so far their results have not been made widely available.

Under the auspices of the global Poverty-Environment Initiative of the UN Environmental Programme and the UN Development Programme a Technical Support Programme has been implemented with the primary goal to introduce the concepts of economic valuation of ecosystem services and a pilot methodology with an emphasis on understanding the necessity of sustainable management of natural capital for economic development and human well-being.

A project component on pilot valuation has been implemented with the focus on evaluating the impact of mining industry on ecosystem services in Lori Region (with use of Qaraberd gold mine example). In parallel, support has been provided to the RA Ministry of Nature Protection to incorporate the approaches and respective provisions on ecosystem services in a new framework law on environmental protection.

Similar assessments are implemented by the Regional Environmental Center for the Caucasus (RECC) in the frames of the project "Support Development of Biodiversity Conservation Policies and Practices in Mountain Regions of the South Caucasus". They include economic valuation of the flora, forests and fauna.

Table 16. Classification of ecosystem services and their role for nature and human well-being in Armenia

<i>Nature of services provided by natural ecosystems</i>	<i>Ecosystems which provide given services</i>	<i>Positive impact on nature, economy and population</i>	<i>Socio-economic and cultural implications of the change of biodiversity and ecosystem services</i>
Provisioning services: goods provided by ecosystems			
1. Food 2. Medicines 3. Substances 4. Fuel 5. Fodder	Semidesert, steppe, forest, meadow, sub-alpine, alpine ecosystems and wetlands	Use of products provided by natural ecosystems: direct consumption of the species of the flora, fauna and fungi as well as of the result of pollinators' activity. Development of various branches of economy.	Reduction of the species of edible, medicinal, fodder and technical plants and fish resources as well as degradation of forest areas and pastures due to non-regulated collection, harvesting and overuse. As a consequence the volume and quantity of goods provided by ecosystems is reducing and the poverty of population is increasing, which in its turn urge the population to put additional pressure on natural ecosystems and their components.
Freshwater	Water ecosystems	Securing human existence and healthy life, development of all branches of economy as well as existence and reproduction of the living nature	In case of the absence or reduced quantity of freshwater first of all the population of the country will suffer due to the shortage of drinking water and food, aggravation of health problems, depletion of hydroenergetic resources and others. At the same time deep changes will be registered in biodiversity as the optimal habitat conditions will be changed for numerous species.
Genetic resources	All ecosystems	For maintenance of the genetic fund of cultivated plants and domestic animals (selection), for production of medicines and new substances through biotechnologies as a precondition for biosafety of population	Risky for development of agriculture, human safety life and stability of ecosystems as populations with low genetic diversity have much lower adaptability to environmental changes.
Regulating services: benefits obtained from undisturbed processes in ecosystems			
Regulation of air quality and climate	All ecosystems, especially forest ecosystems	Securing the state and natural development of biodiversity and ecosystems, agriculture adapted to climatic conditions, stable sanitary-hygienic and epidemiological situation.	During the coming 100 years possible shifts of the limits of natural ecosystems by mountainous profile up by 200 m, with possible serious changes in the structure of ecosystems and distribution of some representatives of biodiversity. Mass outbreaks of harmful insects in forests. Aridisation of the climate, which will contribute to penetration of desert and semidesert species from the arid regions of Iran and Turkey to the southern regions of Armenia. Reduction and even elimination of the areals of

<i>Nature of services provided by natural ecosystems</i>	<i>Ecosystems which provide given services</i>	<i>Positive impact on nature, economy and population</i>	<i>Socio-economic and cultural implications of the change of biodiversity and ecosystem services</i>
			mesophilous species occurring in the high mountainous zone of these areas. Intensive dissemination of xerophilous species including weeds and invasive species as well as reduction of the areals of numerous mesophilous species. Intensive dissemination of thermophilous species in mesophilous and hygrophilous habitats. Such changes of biodiversity and ESs will cause actual threats to population in terms of health, food and water supply due to destabilization of water regime and the current status of the agrarian and forest sectors.
Carbon sequestration and retention	All ecosystems, especially forest ecosystems	Plant cover of ecosystems regulates global climate through reduction of greenhouse gases via absorbing carbon dioxide from atmosphere and accumulating carbon in tissues.	Ecosystems store a huge amount of carbon. At the same time the carbon absorbed and stored in vegetation makes 70% of the total atmosphere carbon. The carbon stored in terrestrial ecosystems is emitted during destruction and transformation of ecosystems, for example land cultivation. Undisturbed ecosystems with typical biodiversity have a positive role in climate regulation and securing healthy life for human
Regulation of hydrological regime	All ecosystems, especially forest ecosystems	Formation of river courses, maintenance of a natural periodicity of water supply, storage of water resources and regulation of their evaporation to secure water access for population	The functions of ecosystems on regulation and retention of water are more expressed in forest and other ecosystems rich in underground water resources. Disruption of this function results in various changes of natural processes and human well-being including activation of water and wind erosion of soil, increased desertification, worsening of the status of numerous flora and fauna species, disturbance of agrocenoses and others. At present in the deforested areas due to loggings the ecosystems have lost their water regulating functions, thus the drying of springs, small lakes and other wetlands, activation of landslides and reduction of hydrophilous and mesophilous species is observed.
Mitigation of extreme weather events	All ecosystems	Ecosystems secure protection zones and prevent possible damage from natural calamities for economy and population. In	Though the proportion of natural calamities is not high in the general structure of emergency situations, however 300-400 cases were registered annually during 2011-2013

<i>Nature of services provided by natural ecosystems</i>	<i>Ecosystems which provide given services</i>	<i>Positive impact on nature, economy and population</i>	<i>Socio-economic and cultural implications of the change of biodiversity and ecosystem services</i>
		spring wetland ecosystems absorb melting water and the plant cover fortifies slopes.	including floods, mudflows, landslides, heavy rains, frostbites and others. The scale of natural calamities and caused damage is mainly the result of destruction of natural ecosystems and the services they provide. Reduction of forest areas, forest degradation, obstruction of water pass in water ecosystems, drying of marshes and accumulation of wastes contributes to natural calamities in Armenia.
Regulation of soil erosion	Semidesert, steppe, forest, meadow, sub-alpine and alpine ecosystems	Plant cover prevents water and wind erosion and mitigates the likelihood of floods and landslides. It has a positive role in improvement of life quality of population in terms of preventing pasture digression in some landscape zones as well as mitigating the risk of respiratory diseases.	About 30% of suitable lands in Armenia are eroded and annually in average 3-4% of cultivated areas is being eroded. In irrigated areas the fast flowing irrigation water is a cause of erosion. It floods the fields and removes large quantities of silt, which is rich in mineral substances and humus. Improper cultivation of steep slopes, mass deforestation, elimination of plant cover, improper use of pastures and climate change have contributed to desertification of about 80% of lands in the country, out of which 30% is under severe desertification. The loss of this ecosystem service causes direct threat to food security and solution of social problems in society. The health problems are increasing as water and wind erosion in the lands treated with chemicals eventually results in penetration of the substances into organisms.
Biological treatment of waste and reduced pollution	All ecosystems, especially wetland ecosystems	Healthy life of nature and population is ensured through reduced pollution and elimination of pathogenic organisms.	In soil the major proportion of waste is decomposed via biological activity of bacteria, which eliminate pathogenic organisms as well as reduce pollution of soil, biota and agricultural products. Reduced pollution stabilizes ecosystems and provides optimal conditions for biodiversity and human livelihoods.
<i>Cultural services: intangible benefits provided by ecosystems such as spiritual enrichment, development of scientific-research activities, recreation, aesthetic values and others</i>			
Cultural diversity, spiritual and religious values, aesthetic values	All ecosystems	Impact of wild nature on human culture and development of the world outlook as well as on creation of a comfortable and	The loss of this ecosystem service brings about severe dissatisfaction by life, the lack of opportunities to create new cultural values as well as mental and somatic health

<i>Nature of services provided by natural ecosystems</i>	<i>Ecosystems which provide given services</i>	<i>Positive impact on nature, economy and population</i>	<i>Socio-economic and cultural implications of the change of biodiversity and ecosystem services</i>
		pleasant environment through safeguarding spiritual needs of people and maintaining landscape values.	problems.
Scientific and educational values	All ecosystems	Ecosystems, their components and the processes in ecosystems are a basis for development of scientific research and implementation of educational programs at different levels.	The loss of nature and its components causes insurmountable obstacles for development of science, which puts at risk development of countries as well as human safety and well-being.
Recreation and ecotourism	All ecosystems	Ecosystems and biodiversity have an important role for different forms of tourism, which in its turn ensures significant economic benefits and income. Cultural tourism and ecotourism can contribute to increased awareness on the importance of biodiversity.	Ecotourism is a practical and effective means of disseminating ecological knowledge and information, environmentally friendly use of areas and reducing tensions between the social and economic systems. The loss of this service provided by ecosystems jeopardises the protection of biodiversity, landscapes and genetic resources, the possibility of local population to have stable income as well as improvement of livelihoods and employment opportunities. Definitely, it increases the dependence of local population on natural resources and anthropogenic pressure on ecosystems.
<i>Supporting services: the services needed for functioning of the other ecosystem services</i>			
Soil formation	Semidesert, steppe, forest, meadow, sub-alpine and alpine ecosystems	Soil biota is the main actor for this service. The activity of soil formation depends on the species and sub-species diversity of the soil biota.	The lack of a fertile soil layer contributes to soil degradation and impedes the growth and development of plants. Elimination of soil biota disrupts food chain, at the same time the other components of biodiversity and the whole ecosystem depend on the food chain. The productivity of various branches of agriculture declines sharply, which affects the standards of living of population.
Nutrient biogeochemical cycling: continuous cycling of substances and water	All ecosystems	The nature and the life on the Earth definitely depend on and can survive only if these processes are continuous.	Disruption of this service can lead to elimination of all living organisms.
Photosynthesis	All ecosystems with plants	Oxygen and structural substances needed for living organisms are produced through photosynthesis.	Disruption of this service can lead to elimination of all living organisms.

The project “Introduction of Payment for Ecosystem Services schemes in Upper Hrazdan Pilot River Basin of Armenia” deals with the piloting of the criteria of the ES payments guidelines developed by the UN/ECE with the aim of introduction and application of a system of payments for ecosystem services in the river basins of Armenia. For that a pilot area has been selected, which includes the Upper Hrazdan river basin till Qakhsi settlement along with the right hand tributaries – the Rivers Marmarik and Tsakhkadzor.

In the frames of the EU funded project “European Neighborhood and Partnership Instrument (ENPI) East Countries Forest Law Enforcement and Governance (FLEG) II Program” led by the WB, working in partnership with the International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF) a TEEB scoping study for the forestry sector of Armenia has been implemented with development of a roadmap for undertaking the full TEEB study in future.

Biodiversity conservation and sustainable ecosystem management are still underestimated as a guarantee for viable nature and healthy life. They should become a priority in the list of permanent values. To reach this objective it is necessary to implement large-scale activities to change the consumer approach toward nature and especially biological resources, which is the case in the country as well as to exclude uncontrolled processes. The following principles should serve as the basis for implementation the mentioned activities:

1. The political decision-making process should be based on the actual role and values of ecosystems and biodiversity, which is a key component of ecosystems.
2. The degraded ecosystems should be rehabilitated by cost-efficient (low-cost) measures or be conserved with the aim to recover their natural state through natural processes.
3. The improved standards of living of population should be ensured through the methods on use of ecosystem services in economic activity and use of renewable natural resources, which exclude their depletion and ensure their renewal for the benefit of future generations.
4. The decisions regarding biodiversity problems should be based on the best available scientific data with use of ecosystem approaches.
5. In practice it is necessary to strengthen cooperation between state structures, citizens, entrepreneurs and other stakeholders ensuring their consistent participation in respective processes.
6. In order to minimize the harmful antropogenic impact on biodiversity it is necessary to develop new effective forms of inter-sectoral cooperation, which should be applied in the process of development of draft decisions and programs.

PART 2.

IMPLEMENTATION OF THE NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN OF ARMENIA

2.1 General analysis

The Biodiversity Strategy and Action Plan of the Republic of Armenia (BSAP-1) was developed in 1999 with the aim to improve conservation and sustainable use of biodiversity in Armenia. The BSAP-1 was developed in accordance with the requirements of the Convention on Biological Diversity. It was planned for a five year period of 2000-2004. It includes 245 activities and measures, which are fully based on the national needs on biodiversity conservation with incorporation of a number of important aspects including improvement of legislative and institutional frameworks, sustainable use of biodiversity and regulation of its use.

However, the full-scale implementation of the BSAP-1 in general was not realistic due to the limited state financing and insufficient resource base especially in the given timeframes. A number of provisions of the BSAP-1 are in the field of competences of various ministries and institutions. However, till now their respective sectoral programs almost do not reflect biodiversity conservation issues. Required specialized human resources, material-technical and especially financial resources for implementation of all the activities planned by the BSAP-1 have been lacking in the country, which is also the case till now.

The structure of the BSAP-1, its strategic directions and general outcomes of implemented activities have been analyzed and reviewed in detail in the fourth national report. The mentioned document included a comprehensive presentation of the links between the BSAP-1 activities and the Convention Targets, the national indicators of their implementation, the measures contributing to implementation of targets as well as the final or (if the activity is of a continuous nature) intermediate results. In the process of preparation of the Fifth National Report the progress to date of implementation of the activities in respective 13 directions of the BSAP-1 has been analyzed with assessment of the activities by the following scale:

- Completed activity;
- Ongoing activity in the final phase with no need to incorporate in a new BSAP;
- Activity of a continuous nature, which should be included in a new BSAP;
- Activity not implemented, which should be included in a new BSAP;
- Activity not implemented, which at present is not a priority;

The following conclusions have been done in the result of the analysis: 43% of the BSAP-1 activities were implemented, 16% of activities are ongoing at the various stages of their implementation, the rest of the activities have not been implemented due to various reasons. Among the most important reasons the followings can be mentioned: insufficient financial means allocated from the state budget, limited human and technical resources, insufficient involvement of international donors in the process as well as underestimation by decision-makers of the role of biodiversity and insufficient understanding of the importance and need for biodiversity conservation.

Among the actual positive outcomes of the BSAP-1 implementation the followings can be mentioned:

- Improvement of legislative framework;
- Improvement of institutional framework, especially in relation to the management of specially protected nature areas;

- Establishment of new specially protected nature areas, enlargement of the area covered by SPNAs (at present the SPNAs cover 13.1% of the total territory of Armenia, in comparison with 2000 when this figure was close to 10%);
- Khosrov Forest State Reserve was awarded by the Council of Europe with the European Diploma on Protected Areas (CM/ResDip (2013)2 special resolution of the European Committee of Ministers dated 10 July 2013);
- Implementation of the works on clarification and mapping of the SPNAs boundaries (including Khosrov Forest, Shikahogh and Erebuni State Reserves as well as a number of state sanctuaries);
- Development of management plans for national parks and reserves (Sevan, Dilijan and Arpi Lake National Parks, Khosrov Forest and Shikahogh Reserves) and improvement of their financial, technical and human capacities;
- Development and implementation of the programs on conservation of the species, which are rare or under the threat of extinction (Caucasian leopard, Armenian mouflon, bezoar goat, red deer, black vulture);
- Restoration of degraded ecosystems, especially increase of water level in Sevan Lake for ecosystem restoration;
- Revision of the Red Book of plants and animals of Armenia and publication of a new edition (2010);
- Inventory and approval of the list of natural monuments;
- Replenishment of fish stock in Lake Sevan and trends on restoration of populations of endemic fish species;
- Development of a National Strategy on Management and Use of Plant Genetic Resources of Armenia;
- Approval by the RA Government of the RA Strategy and Action Plan on Ecological Education.

The objectives and envisaged activities of the BSAP-1 were rather ambitious and even today a number of reasons impede their full implementation. The most important reasons include:

- Underestimation of the importance of biodiversity and ecosystem services; their value often is not considered during economic assessments;
- Lack of economic incentives as the benefits coming from the services provided by various ecosystems so far have not been evaluated and considered in market relations;
- State stock-taking and monitoring of biodiversity components is almost not implemented, which does not allow to predict changes of their status and make realistic and justified decisions regarding their conservation and use;
- Insufficient state supervision over use of bioresources, large volumes of their illegal use (the volumes of illegal logging and illegal fishing are comparable with the legal volumes);
- Insufficient financial, human and technical resources;
- Insufficient cooperation between various sectors, insufficient development of intersectoral relations and weak integration of biodiversity issues in respective sectoral policies. In practice it is necessary to strengthen cooperation between state structures, citizens, entrepreneurs and other stakeholders ensuring their consistent participation in respective processes;
- Low level of education and awareness of population on biodiversity.

According to the COP decisions X and XI of the Convention on Biological Diversity and to comply with the requirements of the Aichi Target 17, at present in Armenia a National Biodiversity Strategy and Action Plan for 2015-2020 is under development. Its draft should be submitted for adoption by the RA Government. To develop the strategic document the objectives of the Strategic Plan for Biodiversity 2010-2020 and Aichi Biodiversity Targets of the Convention have been analyzed and the relevance of the BSAP-1 unimplemented activities to the Aichi Targets has been determined. In addition, considering the current conditions of the country as well as the current state, trends and threats to biodiversity, in the process of consultations with stakeholders some new activities deriving from the Aichi Biodiversity Targets and national requirements will be determined.

2.2 Activities undertaken in Armenia on implementation of the Convention during 2009-2013 and their main outcomes

2.2.1 Improvement of legislation

In Armenia during 2009-2013 a number of legal acts on flora and fauna, forests, specially protected nature areas, education and other related fields were developed and adopted with the aim to ensure biodiversity conservation and sustainable use. In total four changes and amendments were done in two laws (the RA Law on Fauna and the RA Law on Environmental and Nature Use Fees), about 50 governmental decisions were developed and adopted by the RA Government along with 20 decisions aimed at improvement of legislation related to the specially protected nature areas.

In the mentioned period a number of other important documents were developed, which are in the process of adoption. Some of them are presented below.

Draft decision of the Government of the Republic of Armenia on adoption of the Strategy and National Action Plan on Development of the Specially Protected Nature Areas of the Republic of Armenia was developed in 2013-2014 and submitted in the established order to adoption of the RA Government after the process of wide consultations with stakeholders. Two main objectives were formulated in the draft strategy:

- a. Ensure ecological stability in the country and the right of each individual to live in a healthy and favorable environment through improvement of efficiency of the SPNA system and maintain the natural and cultural heritage for the present and future generations
- b. Contribute to maintenance of ecological, socio-economic, scientific, educational, recreational and spiritual values of the SPNAs, which should be done through following ecosystem approaches and securing natural processes, implementation of scientific researches and continuous monitoring as well as promotion of the principles of intersectoral cooperation.

The modern principles of SNPAs functioning are seen as the main targets of the strategy on SPNA development. Implementation of these principles will ensure effective protection of the SPNAs landscapes and their components, restoration of self-regulating capacities of ecosystems, long-term rational use of SPNAs and adjacent areas as well as mutually beneficial coexistence of the society and nature.

Improvement of SPNA related legislation, improvement of SPNA management and strengthening of institutional relations as well as representation of the biological and landscape diversity in the SPNA system are mentioned as the priorities of the SPNA strategy.

Draft Law of the Republic of Armenia on changes in the Republic of Armenia Law on Specially Protected Nature Areas (2014). In the draft the competences of different authorities in the field of SNPA management were clearly defined and expanded. The authorized body is vested with the competence to coordinate the SPNA management. Natural monuments and protected landscapes can be managed by local self-governing bodies, which implies wider opportunities for community management. A new category of protected areas – the protected landscape was added to the existing four SPNA categories. The protection regimes and allowed types of use including ecotourism were defined more clearly for all SPNA categories. The provisions on buffer zones, establishment and management of ecological networks and ecological corridors, natural monuments, biosphere reserves and protected landscapes were clearly defined.

At present a revised draft **Forest Code** is available, which is under circulation and consultations with various stakeholders. At the same time in the frames of the ENPI-FLEG 2 project in the list of activities to be implemented by the World Bank it is envisaged to analyze and review the forest related legislation as well as the issues on improvement of institutional and administrative frameworks. The activity will deal with the analysis and identification of contradictions and discrepancies. Most probably the existing draft Forest Code will be revised during the mentioned work.

2.2.2 Improvement of the management system

According to the decision #1185-N of the RA Government from 9 September 2010 on the basis of changes made in the charter of Sevan National Park a Managing Council of “Sevan” National Park” State Non-Commercial Organization was established chaired by the RA Deputy Prime Minister. The main objective of the Council is to improve and strengthen control over restoration of ecosystems of Lake Sevan and littoral areas as well as to make the process of the national park related decision-making more transparent.

In December 2008 by the order of the RA President a Committee on Sevan Lake Problems was established adjacent to the RA President with the objective to develop and coordinate implementation of required measures on conservation, restoration, reproduction, natural development and use of the lake ecosystem.

According to the decision #517-N of the RA Government from 28 April 2011 the Foundation on Lake Sevan Restoration, Protection and Development was established with the aim to support mobilization of necessary resources for restoration, protection and use of Lake Sevan as the strategic reserve of freshwaters in the Republic of Armenia as well as for securing water cleanness.

According to the decision #1465–N of the RA Government from 19 December 2013 the “Zangezur” Biosphere Complex” State Non-Commercial Organization was established, which included Arevik National Park, Shikahogh State Reserve, Plane Grove, Zangezur, Khustup, Boghakar and Sev Lich State Sanctuaries. By the same decision the territory of Zangezur State Reserve was expanded and a new Khustup State Sanctuary was created. The establishment of this structure is aimed at support to creation of a biosphere reserve in Syunik Region, which will include Shikahogh State Reserve along with its buffer zone and adjacent territories including with Plane Grove, Zangezur and Khustup State Sanctuaries. It is envisaged that the mentioned territories will be linked through ecological corridors within the limits of one system.

2.2.3 In-situ conservation of biodiversity

Biodiversity conservation in Armenia is implemented mainly in the specially protected nature areas, where 60-70% of the species composition of the flora and fauna is concentrated including the overwhelming majority of rare, critically endangered, threatened and endemic species.

The SPNAs in Armenia are represented by state reserve, national parks, state sanctuaries and natural monuments. They have been established on the lands of state property and are managed by state organizations. The natural monuments, which are located on the lands of both state and community property, are still not properly managed due to the absence of respective management mechanisms.

At present in Armenia the total territory covered by SPNAs in Armenia makes 387054 ha, which comprises 13.1% of the total territory of Armenia. At present the SPNAs of Armenia are as follows:

- 3 state reserves (Khosrov, Shikahogh and Erebuni), which cover the territory of 35 439.6 ha making 1.19% of the total territory of Armenia;
- 4 national parks (Sevan, Dilijan, Arpi Lake and Arevik), which cover the territory of 236 802.1 ha making 7.96 % of the total territory of Armenia;
- 232 natural monuments;
- 27 state sanctuaries, which cover the territory of 114 812.7 ha making 3.95 % of the total territory of Armenia;

These SPNAs are presented on the map in Appendix 5.

In the period of 2000-2014 the number of SPNAs and their total territory have significantly increased with establishment of the following new protected areas: Zangezur State Sanctuary (decision #1187-N of the RA Government from 15.10.2009), Zikatar State Sanctuary (decision #380-N of the RA Government from 08.04.2010), Khustup State Sanctuary (decision #1465-N of the RA Government from 19.12.2013), Arpi Lake National Park (decision #405-N of the RA Government from 16.04.2009) and Arevik National Park (decision #1209-N of the RA Government from 15.10.2009).

The RA Government and different international organizations have contributed efforts to development of SPNAs in Armenia.

The program on “Enlargement of the adopted list of natural monuments on the territory of Lori and Tavush Regions of the Republic of Armenia, clarification of their buffer zones and clarification and mapping of their boundaries” has been included in the RA state budget for 2012. In the result of its implementation a new list of natural monuments with 232 natural monuments was adopted by the decision #473-N of the RA Government from 02.05.2013. The list includes 106 geological, 48 hydrogeological, 40 hydrological, 17 natural-historical and 21 biological natural monuments.

SPNAs management plans have been developed to ensure the efficiency and development of protection and management of SPNAs. The management plan of Khosrov State Reserve was adopted in 2009 and the management plan of Lake Arpi National Park - in 2011. The process of management planning is ongoing.

The boundaries of the state reserves and of a number of sanctuaries have been clarified and mapped. The financial-technical resources have been improved (relatively increased financing of SPNAs) and the staffing has been partially improved. The programs on technical strengthening of existing SPNAs, infrastructure development of existing and planned SPNAs, establishment of visitor centers, rehabilitation of museums and others are implemented.

Considering new environmental problems of Armenia in recent years as well as new international initiatives and developments, in 2013-2014 a new draft Law on Specially Protected Nature Areas and a draft State Strategy and National Action Plan on Development of the Specially Protected Nature Areas of the Republic of Armenia were developed.

In 2013 Khosrov Forest State Reserve was awarded by the European Committee of Ministers with the European Diploma on Protected Areas, which is the first in the region.

Thirteen areas have been included in the Emerald Network being established in Armenia in the frames of the Convention on the Conservation of European Wildlife and Natural Habitats. Of them 8 are included in the systems of SPNAs of Armenia (Khosrov Forest State Reserve, Sevan, Dilijan and Arpi Lake National Parks, Khor Virap, Plane Grove, Aragats Alpine and Ijevan State Sanctuaries). Establishment of the Emerald Network is one of the most important steps aimed at implementation of the provision of the Convention on Biological Diversity. It is a precedent for establishment of an ecological network in Armenia as well as for joining international ecological networks, in particular the Pan-European Ecological Network (PEEN). Khosrov Forest State Reserve after being awarded the European Diploma on Protected Areas is already considered a core area in the PEEN. The other 11 areas of the Emerald Network upon review by the Standing Committee of the Bern Convention according to the established order will be formally adopted as the Emerald Network areas of Armenia and consequently as core areas of the PEEN.

In Armenia 18 Important Bird Areas have also been designated, where all threatened species of birds of Armenia have been taken under protection. A preliminary list of 16 Important Plant Areas has been developed.

2.2.4 Ex situ conservation of biodiversity

Ex situ conservation of plant genetic resources as an important means of biodiversity conservation allows restoration of the plant genetic resources threatened or eliminated due to natural disaster or antropogenic factors and at the same time provides an opportunity for their continuous use by researchers and farmers.

At present in the agricultural scientific entities under different institutions of Armenia there are about 13220 accessions in seed collections (Figure 18). The accessions in the seed collections of the Armenian National Agrarian University Foundation (ANAU) stored in the “Agrobiotechnology Scientific Center” Branch and the Laboratory of Plant Gene Pool and Breeding are represented mainly by the species of local origin and varieties of local breeding. The collections of the “Scientific Center of Farming” SNCO and the “Scientific Center of Vegetables and Industrial Crops” SNCO under the RA Ministry of Agriculture as well as the Gyumri Breeding Station are represented also by the accessions of the International Center for Agricultural Research in the Dry Areas (ICARDA), International Maize and Wheat Improvement Center (CIMMYT) and the breeding nurseries, which are used for breeding purposes to get the best lines and varieties.

Over the last five years significant progress has been registered in the field of *ex situ* conservation of plant genetic resources. Thus, during 2008-2013 the number of accessions in the Laboratory of Plant Gene Pool and Breeding of the ANAU has increased by 24%, the collection of the “Scientific Center of Vegetables and Technical Crops” SNCO under the RA Ministry of Agriculture has increased 3.5 times and the collection of the Institute of Botany of the NAS RA – 2,8 times. The reduction of the number of accessions in the “Scientific Center of Farming” SNCO under the RA Ministry of Agriculture is attributed to qualitative changes as the center has revised its *ex situ* conservation strategy and focused on conservation of local breeding varieties of cereals and legumes (Figure 17).

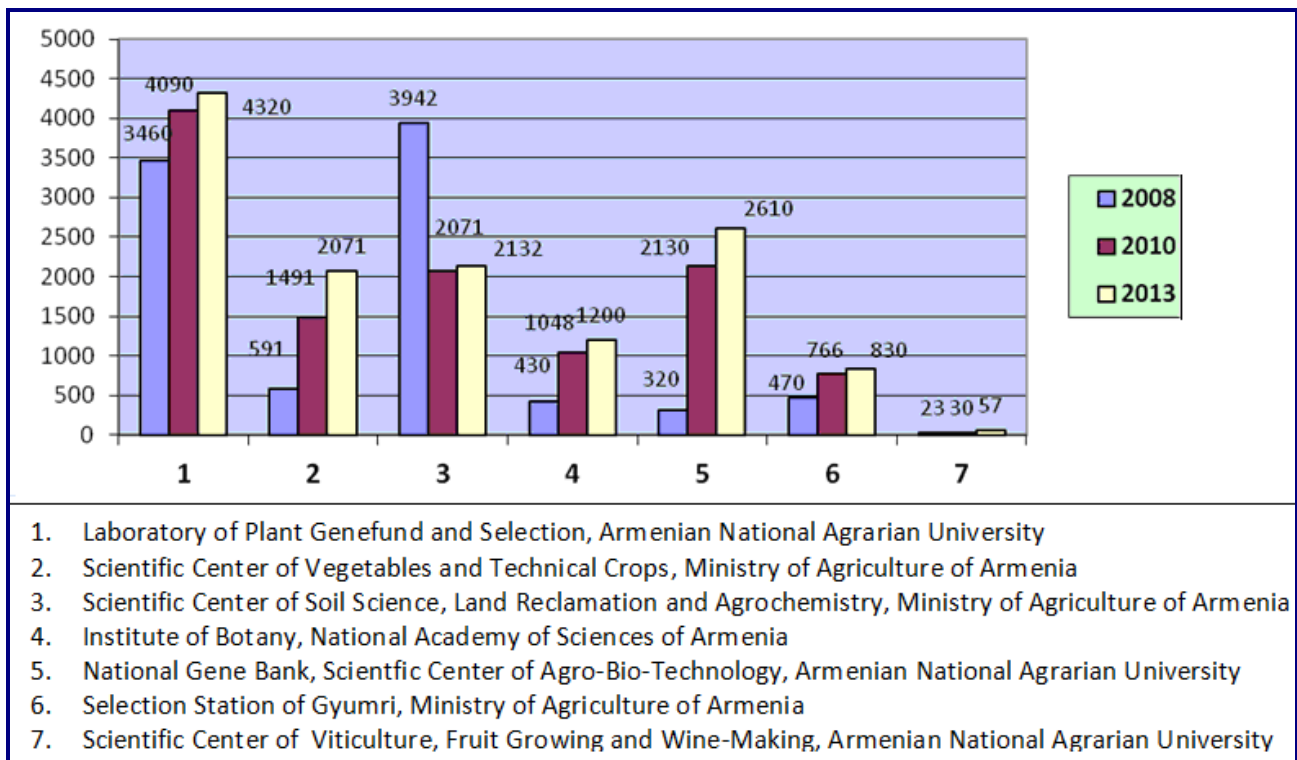


Figure 17. The numbers of specimens stored in the seed collections of scientific institutions of Armenia

In the National Genebank of plant genetic resources for food and agriculture during 2008-2013 the number of accessions has increased 8 times thanks to accessions exchange with other institutions, organization of field studies and collections as well as implementation of a policy on cooperation with foreign genetic banks. In the Genebank the agricultural crops and their wild relatives are stored, which are the priority for the country. The priority is given to the crops of local origin (Figure 18).

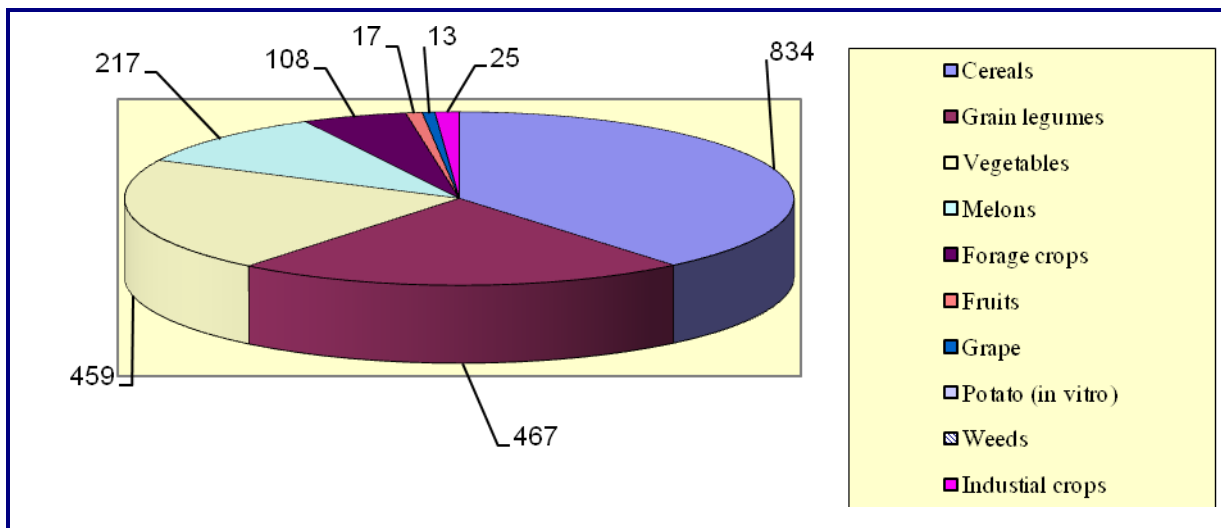


Figure 18. The number of specimens of the National Genetic Bank by the groups of cultivated plants

In the Laboratory of Plant Gene Pool and Breeding of the ANAU 4320 accessions of amphidybrids produced in the Laboratory and varieties of cultivated plants are stored, including wild wheat, barley, rye, aegilops, wild vegetables (beet, carrot, onion, spinach, lettuce, asparagus, rhubarb, horse radish and others), spicy herbs (coriander, parsley, hoary cress, citron and others) and legumes (pea, lentil, bitter vetch, clover, alfalfa). (Figure 19).

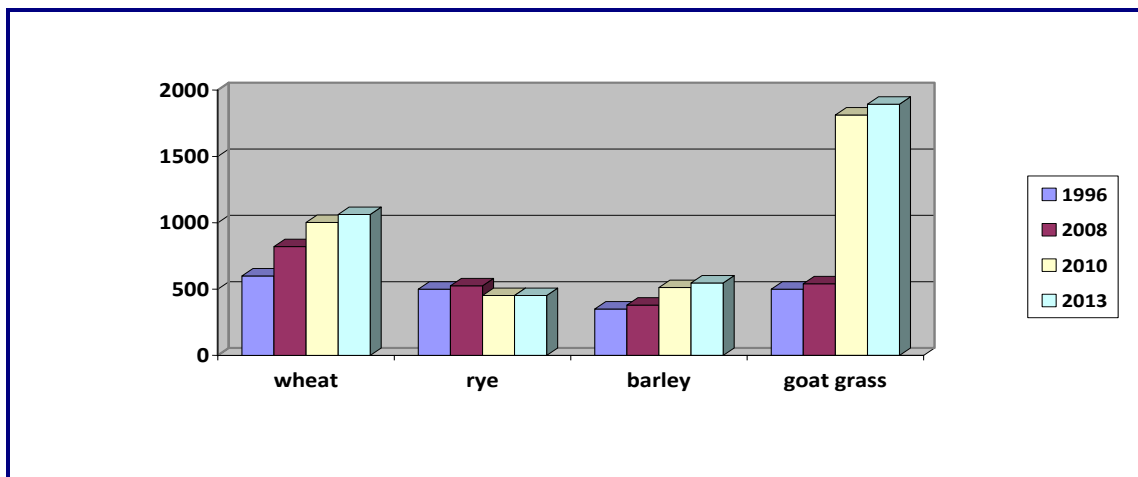


Figure 19. The number of specimens in the collection of the Laboratorum of Plant Genofund and Selection by the main crops and years.

In 2005 the Genetic Bank of Seeds was established in the Institute of Botany of the NAS RA, with the main objective to create a seed collection of the flora species of Armenia and ensure ex-situ conservation of the rare species and those under the threat of extinction. Since 2011 the collection of seeds has been continued in the frames of the Millennium Seed Bank Project (MSBP) together with the Royal Botanic Gardens, Kew, Great Britain and with support of the Botanical Garden & Botanical Museum Berlin-Dahlem. At present the seed collection includes 2464 specimens belonging to 552 species from 51 families and 251 genera. The most represented families are *Fabaceae* (22 genera, 64 species, 1377 specimens) and *Poaceae* (29 genera, 64 species, 588 specimens).

In 2012 in the frames of the project Reproduction of Crop Collections of Regional Priority financed by the Global Crop Diversity Trust the important species of wheat, barley and aegilops of Armenian origin were sent to ICARDA, CIMMYT and the Svalbard Global Seed Vault established on the island of Spitsbergen, which should ensure viability of seeds for a longer period of time. Thus, in this seed bank of global significance Armenia is represented by the specimens of 176 unique species.

Since 2007 being a Party of the International Treaty on Plant Genetic Resources Armenia has joined its Multilateral System on exchange and free access of specimens by providing 2496 specimens. Specimens included in the Multilateral System are registered in the EURISCO – a web catalogue of ex-situ specimens under the European Cooperative Program for Plant Genetic Resources.

Since 2011 in the frames of the project Apricot Genetic Resources Conservation and Utilization financed by the UN Food and Agriculture Organizations a collection orchard of apricot was established, which includes 82 Armenian and 12 imported foreign varieties of apricot having the highest demand in the European market. The aim of establishment of the apricot collection orchard is to conserve the unique genetic fund of apricot in Armenia, at the same time to enable efficient utilization of the apricot genetic resources of local origin and of foreign genetic resources.

Collections of living plants are represented in botanical gardens and arboreta. At present in the botanical gardens and arboreta of Armenia about 6000 plant species are grown and conserved, including 5000 in the Yerevan Botanical Garden, where there are about 1200 tree-bush species and about 2000 species of flowering plants growing on open ground and about 1000 tropical and sub-tropical species growing in a green-house condition. The dendrarium of the Yerevan Botanical Garden has been established mainly by the ecological-geographical principle with the exposition collections of dendrofloras of the Caucasus and Crimea, Eurosiberia, East Asia and Far East and Northern America.

In the living collections the exposition of the native flora of Armenia with about 800 species is of special importance.

Ex-situ conservation of animals is implemented in the Yerevan Zoo, where a number of threatened species reproduce successfully, such as Armenian mouflon, Bezoar goat, brown bear and others.

WWF-Armenia is implemented a project on reintroduction of the Caucasian red deer in Armenia. In the frames of the project it is planned to establish a red deer breeding center in Dilijan National Park with further release of animals to nature.

2.2.5 Reforestation and afforestation activities

According to the official data during 2009-2013 in “Hayantar” SNCO and SPNAs (Dilijan and Arevik National Parks) reforestation and afforestation activities have been implemented on the territory of 1756,5 ha (Figure 20). Such a low indicator is attributed to limited financial resources allocated from the state budget for reforestation and afforestation activities. At the same time it should be mentioned that the activities implemented in the frames of the projects financed by international organizations make a significant proportion in the volumes of reforestation and afforestation works.

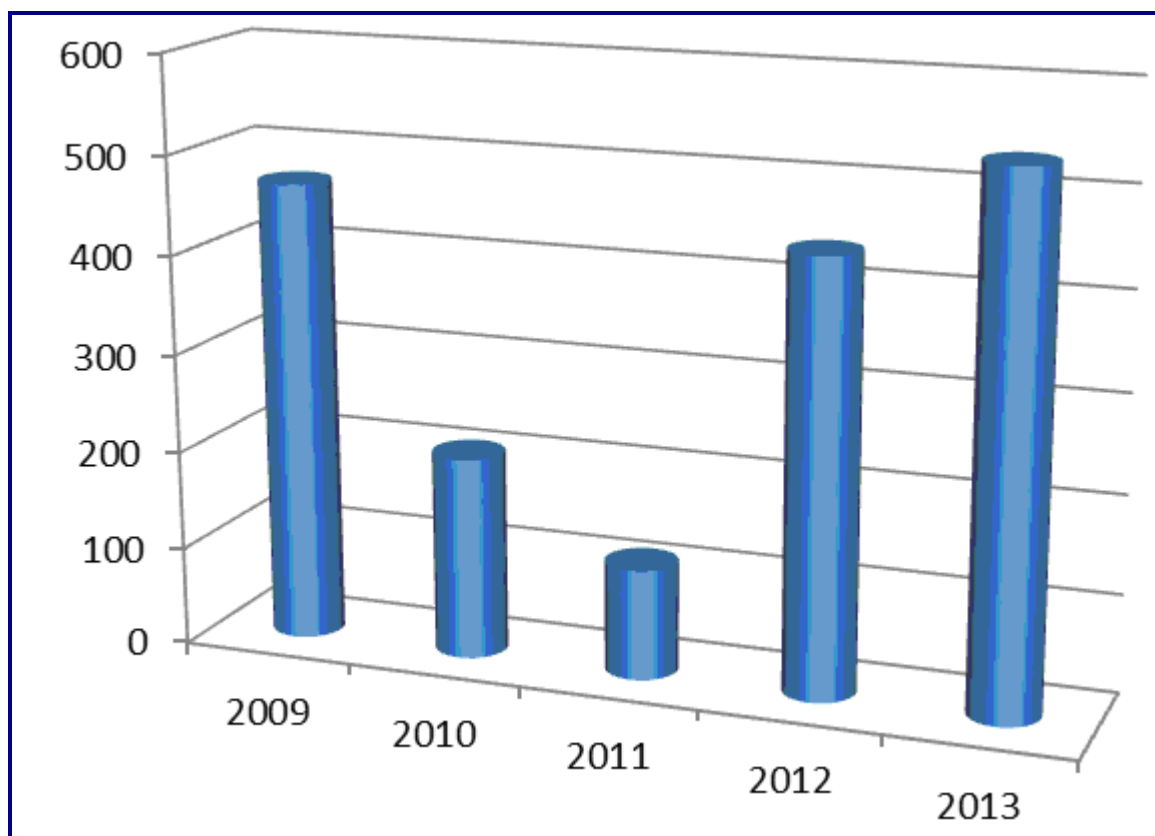


Figure 20. The volumes of reforestation and afforestation works (in ha) implemented during 2009-2013

Thus, according to the RA Ministry of Agriculture, in 2010 the works on afforestation without state financing with support of international projects were implemented on the territory of 150 ha. In addition, a territory of 25 ha was afforested in the vicinities of Artik town with financing from the *Forest Development and Rehabilitation Fund*. A territory of the same size was afforested in Syunik Region in the frames of the UNDP project *Adaptation to Climate Change Impacts in Mountain Forest Ecosystems of Armenia*. In addition, afforestation activities have been continued on 329.5 ha of the sites established during the previous years, forest maintenance works have been implemented on the territory of 2 178 ha and a nursery with the territory of 5.335 ha has been established.

With the financial support of the Partnership Fund established in the frames of the program on the Growth of Food Production by the Government of Japan in different regions of Armenia (Lori, Tavush, Syunik, Kotayk, Shirak and Aragatsotn) and Yerevan city during four years the works on afforestation and fencing have been implemented on the territory of about 1300 ha.

In 2011 about 20 ha within the area, damaged by fire in 2006, was reforested by Kapan Forest Enterprise of “Hayantar” SNCO with support of the UNDP. About 7 thousand seedlings of juniper and oak were planted.

In 2009-2010 forest cultures were established on the territory of 240 ha of Gugark Forest Enterprise (Lori Region) in the frames of the WWF project financed by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU) and the KfW Development Bank.

In 2013 the ATP Foundation established 32.4 ha of forests in Lori Region by planting 128 thousand seedlings. To date more than 3,500,000 trees in 800 locations of Armenia have been planted by support of ATP Foundation.

In 2014 it is envisaged to carry out reforestation activities on the territory of 35 in Tavush, Shirak and Gegharkunik Regions. In Kotayk Region on the territory of about 100 ha the works on sanitary design will be implemented. It is envisaged by the *Forest Development and Rehabilitation Fund* of the Republic of Armenia to finalize the program on afforestation of 51 ha in Erebuni Forest District on Yerevan Forest Enterprise. It is implemented with use of new technologies to avoid possible landslides. During the previous year the works on establishment of a water pipe-line and fencing have been implemented.

According to the official web-site of the Government of Armenia, the works on forest rehabilitation should be continued in the regions of Armenia also during 2015.

Development of nurseries is necessary for expansion of the volumes of reforestation and afforestation works, establishment of anti-erosion forest belts and improved effectiveness of implemented activities. Thus, with support of the Food and Agriculture Organization (FAO) in Kotayk Region a project on afforestation and reforestation has been implemented with establishment of a modern nursery in Hrazdan Forest Enterprise of “Hayantar” SNCO. The nursery is for growing planting material with close root system. The planting material is already grown there including tree species of pine, ash, maple and others.

In 2013-2014 in the frames of the project funded by WWF-Switzerland on the territory of the Institute of Botany of NAS RA a nursery of threatened forest species was established, where there are about 22 forest species including 8 valuable and threatened species. Planting material from the nursery later will be used for rehabilitation of forest habitats of threatened flora and fauna species.

2.3 The role of international cooperation and international programs in biodiversity conservation

The Republic of Armenia is a party of 22 international treaties and protocols in the environmental field and the RA Ministry of Nature Protection implements substantial works on fulfillment of their provisions.

During 2011-2013 the cooperation with global and regional international structures has been continued including the UN Environmental Programme (UNEP), UN Development Programme (UNDP), Organization for Economic Co-operation and Development (OECD), European Union (EU), Regional Environmental Center for the Caucasus (RECC), Global Environmental Facility (GEF), German Development Bank (KfW), World Wide Fund for Nature (WWF), Caucasus Nature

Fund (CNF) and a number of foreign states in the field of development, negotiation, approval, coordination and implementation of international projects.

In the field of biodiversity conservation efficient cooperation is underway with the Federal Republic of Germany, in particular with the German Ministry for Economic Cooperation and Development (BMZ) and the KfW Development Bank. The mentioned structures together with the WWF and CI have established the Caucasus Nature Fund with the aim to support effective protection of SPNAs in the Caucasus Ecoregion, with particular focus on:

- Management of national parks, reserves and sanctuaries,
- Protection of landscapes and natural resources,
- Strengthening cooperation between managing bodies and other organizations dealing with environmental management,
- Supporting organizations, legal authorities and agencies dealing with the functions compliant with the objectives of the Fund.

In the frames of the grant agreements between the Caucasus Nature Fund and the RA Ministry of Nature Protection made in 2011 and 2013, financial support has been provided to the Khosrov Forest State Reserve, Shikahogh State Reserve, Arevik National Park, Arpi Lake National Park and Dilijan National Park SNCOs. In 2013 the total financial support of the CNF made 182.8 mln AMD.

During 2011-2013 the most active cooperation in the environmental field has been with the Islamic Republic of Iran. In 2012 a Memorandum of Understanding was signed on “Establishment of a Park on Friendship and Peace” on the common border of Iran and Armenia, for which the mapping materials of the areas adjacent to Arevik National Park were provided to the Iranian side.

In the frames of regional cooperation Armenia along with the other Caucasian countries (Georgia, Azerbaijan, Russia, Turkey and Iran) has active participation in implementation of the Ecoregional Conservation Plan for the Caucasus. The first version of the Plan was developed in 2006 by the efforts of WWF and participation of about 150 experts from six countries. In 2012 the plan was revised and updated. The activities of the Plan are envisaged for implementation till 2025 and their majority refers to all six countries of the ecoregion as they reflect similar problems in the field of biodiversity conservation. Some other activities are envisaged for implementation by separate countries.

For Armenia the most important activities are those aimed at protection and sustainable use of forest ecosystems, development and implementation of forest restoration activities with engagement of local communities, establishment of a new SPNA and a number of ecological corridors in the southern Armenia, protection and sustainable use of freshwater ecosystems as well as conservation of the most important species and their habitats.

In order to achieve the targets of the Convention on Biological Diversity and implement the activities in the above mentioned and other similar plans, during 2009-2013 a number of projects have been implemented in Armenia with the focus on improvement of ecosystems and biodiversity. Of them the followings can be mentioned.

ENPI FLEG: The program is funded by the European Union (EU) and the Austrian Development Cooperation (ADA). Implementation of the program is led by the WB, working in partnership with the International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF).

The first phase of the program “Improving Forest Law Enforcement and Governance in the European Neighborhood Policy East Countries and Russia” (ENPI FLEG 1) was implemented during 2008-2012. It was aimed at putting in place improved forest governance arrangements

through effective implementation of the main priorities set out in the St. Petersburg Ministerial Declaration and Indicative Plan of Actions for the Europe and North Asia Forest Law Enforcement and Governance (ENA-FLEG) process. It supported governments, civil society, and the private sector in participating countries (including Armenia) in the development of sound and sustainable forest management practices, including reduction of the incidence of illegal forestry activities.

Some of the results of program implementation include a number of publications and awareness raising activities, assessment of 2 forest sanctuaries in the structure of “Hayantar” SNCO in terms of legal use of forest resources with proposals on improvement of management and law enforcement, preliminary GIS mapping of Gyulagarak and Ijevan-Hazelnut Sanctuaries, development of draft charters and draft governmental decision on the revision of the boundaries and approval of charters of Gyulagarak and Ijevan-Arjatkhlenti Sanctuaries, development and implementation of two pilot projects on alternative forest use by communities aimed at local livelihood improvement and sustainable use of forest resources in Koghb and Dsegh communities, capacity building in forest legislation issues through publication of a manual on forest legislation and implementation of trainings, feasibility study for establishment of a forest protected area in juniper open woodlands in Tavush Region, Northern Armenia and others.

The second phase of the project “European Neighborhood and Partnership Instrument East Countries Forest Law Enforcement and Governance II Program” (ENPI FLEG 2) is under implementation (2013-2016). It is aimed to support the participating countries strengthen forest governance through enhancing their forest policy, legislation and institutional arrangements, and implementing sustainable forest management models on a pilot basis. The program in Armenia is mainly focused on the works supporting legal and institutional review and reforms, building human resource capacity to address FLEG issues, public awareness and public monitoring of the forests, strengthening sustainable forest management through activities with model forest units such as forest protected areas and activities on sustainable use of forest resources with involvement of adjacent communities as well as improving the FLEG planning and monitoring at the national, regional (local) and international levels.

EU ENRTP Caucasus - Increasing the resilience of forest ecosystems against climate change in the South Caucasus Countries through forest transformation (2011-2015): The project is funded by the EU and implemented by WWF in the Southern Caucasus countries (Armenia, Georgia, Azerbaijan).

The objective of the project is to increase the resilience of forest ecosystems in the Southern Caucasus against climate change impacts and to improve biodiversity and livelihoods of local populations. In the result of the project implementation 150 ha of monoculture forest stands will be transformed to forest stands highly resilient to climate change, the potential of forest stands to enhance the livelihoods of neighboring communities will be increased, forest administration staff will be more aware on climate change and motivated to develop strategies for making forests more resilient.

Forest Landscape Restoration in Northern Armenia (2012-2015): The project is funded by WWF-Switzerland and implemented by WWF-Armenia. The project objective is restoration of the natural habitat of critically endangered plant and animal species through reforestation as well as income generation for the local population. It includes restoration of 70 hectares of mountain forest adjacent to Trchkan waterfall near Mets Parni community in Lori Region as well as establishment of a nursery for rehabilitation of threatened forest species on the territory of the Institute of Botany of the NAS RA in Yerevan. The income of local population will increase through involvement in different phases of project implementation.

Mitigating Impacts of Climate Change through the Restoration of Forest Landscapes in the Southern Caucasus (2008-2011): The project was financed by the Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU) of the Federal Republic of Germany through KfW Development Bank. It was implemented by WWF-Armenia in cooperation with “Hayantar” SNCO and ATP Foundation in Lori Region of Armenia.

The objectives of the project were to rehabilitate forest ecosystems in selected pilot areas (630 ha in Lori Region) for increased carbon storage and enhance resilience against climate change as well as to put selected ecosystems under sustainable management regimes as well as improve local powers for the implementation of afforestation/forest rehabilitation and application of sustainable forest management schemes. In the result of project implementation about 630 ha of area was afforested in Lori Region, the awareness of local population was raised about the challenges of climate change impact as well as preconditions were established for further implementation of community forest rehabilitation projects.

Adaptation to Climate Change Impacts in Mountain Forest Ecosystems of Armenia (2009-2013): The project was financed by the United National Development Program (UNDP) with co-financing by the RA Government.

The project was aimed at strengthening national capacities to ensure adaptation of the south-eastern forests of Armenia to the expected climate change impacts. The main outcomes of the project implementation included capacity building on systematic adaptive management, implementation of selective adaptation measures for their further replication including development and implementation of measures to ensure the resilience and adaptation of forest ecosystems, such as restoration of 15 ha of degraded forests in Syunik Forest Enterprise and restoration of 20 ha of fire-damaged juniper stands in Kapan Forest Enterprise.

Sustainable Biodiversity Management in the South Caucasus (2008-2016): The project is funded by BMZ and implemented by GIZ. The aim of the project is to integrate the mechanisms of economically efficient and sustainable use of natural resources in the state, private and civil society sectors as an influential means to conserve these resources. In the frames of the project technical support has been provided to the “State Forest Monitoring Center” SNCO and “Hayantar” SNCO as well as the activities on forest rehabilitation have been implemented on a territory of about 20 ha and on support to regrowth through coppicing - on a territory of 350 ha.

Sustainable management of pastures and forest in Armenia to demonstrate climate change mitigation and adaptation benefits and dividends for local communities (2013 – 2016): The project is funded by the European Union and the UNDP. It is implemented in Gegharkunik Region of Armenia. The aim of the project is to adopt sustainable and environmentally friendly models of natural resource management with consideration of negative impacts of climate change on mountainous ecosystems of Armenia so that to ensure the integrity of ecosystems and continuous provision of services by them including carbon sequestration and storage, also introduction of a rangeland management system including restoration of 2000 ha of meadows and 60 ha of forest areas.

Support to the Caucasus Protected Areas Initiative: Open Program for Armenia (2009-2012): The project was implemented in the frames of financial cooperation of Germany with Armenia and was funded by KfW.

The main objectives of the project included:(1) support to sustainable socio-economic development in the region, and (2) improvement of nature conservation in southern Syunik Region. This was associated with understanding of nature protection issues by the society and managing structures and change of an attitude towards them. In the result of implemented activities the feasibility of establishment of a biosphere reserve in southern Armenia according to the UNESCO requirements

has been studied. It should include Shikahogh State Reserve, Plane Grove and Khustup State Sanctuaries, the administrative territories of 5 self-governing communities (Tsav, Nerqin Hand, Srashen, Shikahogh and Chakaten) and some selected areas in Chakaten forest area of Kapan Forest District of “Hayantar” SNCO. Establishment of the mentioned biosphere reserve is planned for the second phase of the project.

Developing the Protected Area System of Armenia (2011-2014): The project is funded by the GEF and implemented by the UNDP. The aim of the project is to conserve globally significant biodiversity in Armenia and catalyze the expansion of sanctuaries to provide better representation of ecosystems within Armenia’s current protected area system as well as enable active conservation of biodiversity. The project focus is on two main issues: (1) rationalization of the protected areas system through improving the regulatory and institutional framework relevant to establishment and functioning of sanctuaries, and (2) institutional capacity building by piloting a number of SPNA management tools, which are mainly absent in the current SPNA management system of Armenia.

The main outcomes of the project include improvement of legislation, development of methodological guidelines on “Establishment of institutional relations for clarification of the roles and responsibilities in the sanctuary management system”, implementation of works on mapping, study and description of the boundaries for establishment of the planned Khustup and Gnishik protected areas as well as expansion of the existing Zangezur Sanctuary, establishment of Khustup Sanctuary and expansion of Zangezur Sanctuary by the decision of the RA Government, development of management and business plans for Gnishik Protected Landscape, development of the state and local educational programs for sanctuary managers and local communities and trainings and some other important activities.

Reintroduction of the Caucasian Red Deer in Armenia (2013-2020): WWF-Armenia with the RA Ministry of Nature Protection and with the financial support of WWF-Germany and Orange Armenia as well as the fundraising support of Prometey Bank implements a project on reintroducing the Caucasian Red Deer in Armenia with the main goal to set up a viable breeding group of the species in Dilijan National Park.

The project activities include establishment of a breeding center in Dilijan National Park, purchase and transportation of 4 male and 11 female individuals of red deer to Armenia, training of the breeding center staff, keeping and breeding of animals with their further release to nature and monitoring.

Biodiversity Protection and Community Development: Implementing Ecoregional Conservation Plan Targets in South Armenia (2007-2011): The project was funded by the Norwegian Ministry of Foreign Affairs and implemented by WWF.

The overall objective of the project was to help ensure effective protection of biodiversity and sustainable management of natural resources in southern Armenia, providing an operational model that can contribute to the development, prosperity and peace in the Caucasus region. The project activities on biodiversity conservation have been implemented in parallel with the works on local community development through strengthening protection regime of the main protected areas in southern Armenia and capacity building (Khosrov Forest and Shikahogh State Reserves, Arevik National Park), the works on establishment of wildlife corridors, awareness raising in local communities and provision of alternative livelihoods to local communities.

Protected Areas for a Living Planet (2007-2011): The project was funded by the MAVA foundation and implemented by WWF in 5 countries of the Caucasus Ecoregion – Armenia, Azerbaijan, Georgia, Russia and Turkey. It contributed to implementation of the Program of Works on Protected Areas (PoWPA) in the frames of the Convention on Biological Diversity through

implementation of various activities related to the specially protected nature areas. They included prioritization of the PoWPA activities according to the national needs, legislative and institutional gap analysis with development of respective proposals, management effectiveness assessment of the SPNA system and capacity needs assessment with consequent development of an action plan, financial needs assessment and development of a sustainable financing plan, communications activities and others.

Ecoregional Conservation Programme in the Southern Caucasus Region: Establishment of Protected Areas in Armenia's Javakhq (Ashotsk) Region (2007-2014): The project is implemented by the Ministry of Nature Protection and WWF within the Ecoregional Conservation Program in the Southern Caucasus Region - a part of the Caucasus Initiative launched by the German Federal Ministry of Economic Cooperation and Development (BMZ). The project promotes Shirak-Javakhq transboundary cooperation as one more area of cooperation between Armenia and Georgia for conservation of the unique biodiversity of the Caucasus Ecoregion.

The project is aimed at conservation of the biodiversity of the Javakheti-Shirak plateau in Armenia and, at the same time, at enhancement of sustainable rural development in the northern Shirak region through establishment of the Arpi Lake National Park and implementation of a support zone program.

Some of the project results registered so far include establishment of the first in the region transboundary park between Armenia and Georgia (Arpi Lake National Park in Armenia established in 2010 and Javakheti National Park in Georgia), development of a draft management plan of Arpi Lake National Park (approved by the Government of Armenia) and the support zone program, which is being implemented in numerous communities of the national park support zone.

Enhancing the Integrity of the East Lesser Caucasus Corridor through the Establishment of Gnishik Community Managed Protected Area (Armenia)" (2011-2014): The project was funded by the Critical Ecosystem Partnership Fund (CEPF) and implemented by WWF-Armenia. The project was aimed at integration of ecological corridors and their expansion, as well as protection of globally significant species through establishment of Gnishik community-managed protected area in southern Armenia.

The main activities of the project included participatory planning of a protected area (its establishment and development required active engagement of local communities), enforcement of protection regime, development of tourism related infrastructure, and provision of alternative livelihoods for communities located in the support zone of the protected area.

Implementation of the project activities should result in development of the system of protected areas to include currently under-represented ecosystems (mountain meadows, sub-alpine and alpine mountains) and associated biodiversity. The project investments were focused on improvement of the management of community areas to promote landscape connectivity and to reduce poverty.

Conservation of Leopard in the Southern Caucasus (Armenia, Georgia & Azerbaijan) (2002-2016): The main objective of this project being implemented by WWF is to ensure the increase of the Caucasian leopard (*Panthera pardus*) population (which is at the edge of extinction) as an indicator of improved conservation, strengthened environmental management and stabilized ecosystem processes. The main target areas are in southern Armenia (from Khosrov Forest State Reserve to Arevik National Park).

Support Development of Biodiversity Conservation Policies and Practices in Mountain Regions of the South Caucasus (2011-2014)": This regional project is implemented by the Regional Environmental Center for the Caucasus (RECC) with the financial support of the Norwegian Ministry of Foreign Affairs.

The major goal of the project is to build capacity of local communities and authorities to address biodiversity loss in forest ecosystems of mountain regions of the Southern Caucasus in order to improve participatory biodiversity management. To achieve the goal it was envisaged to raise awareness and knowledge of local communities, local authorities in mountain regions and decision-makers at national level on values of forest ecosystems and biodiversity, the benefits of conservation and sustainable use as well as to increase their willingness to protect biodiversity. It was also planned to introduce practices of participatory biodiversity management planning at local level and demonstrate their practical application through implementation of pilot projects on restoration of degraded forest ecosystems and respective enhancement of their values.

Identification and Implementation of Adaptation Response to Climate Change Impact for Conservation and Sustainable Use of Agro-Biodiversity in Arid and Semi-Arid Ecosystems of South Caucasus (2011 - 2014): The project is funded by the European Union and implemented by the RECC.

The objectives of the project is to promote agro-biodiversity conservation and adaptation to climate change through introduction of supportive policy framework at national and local level as well as to improve institutional and individual capacity for sustaining agro-biodiversity in arid and semi-arid ecosystems and increasing livelihood level in face of climate change.

Fostering Community Forest Policy and Practice in Mountain Regions of the Caucasus (2009-2012): The project was funded by the European Union and implemented by the RECC.

The project was focused on development of respective institutional, legal and technical set-up for community forest management, on awareness raising among local communities, community structures and local authorities on sustainable forest management and capacity-building. To achieve the above mentioned the project implementation included increased awareness of population and improved knowledge of communities on forest management.

Social problems of population are definitely solved through involvement of community population in forest rehabilitation activities aimed at biodiversity conservation in the degraded forest areas adjacent to communities, prevention of natural calamities (soil erosion, risk of desertification, landslides and others) and mitigation of climate change implications. The positive impact and transparency of the project were partially ensured through provision of knowledge on natural resource management and awareness raising on sustainable forest management in communities as well as through participation of population in the project implementation.

Economic Valuation of Ecosystem Services in Armenia (2011-2013): The project was implemented in the frames of the joint global Poverty-Environment Initiative of the UN Environment Programme and the UN Development Programme. It was aimed to contribute to poverty reduction and improved well-being of poor and vulnerable groups through mainstreaming environmental issues into national development processes. The Qaraberd gold mine in Qaraberd community was selected as a pilot site for valuation of ecosystem services, where the studies of main ecosystems and ecosystem services were conducted with economic valuation of the area under various scenarios, namely mine exploitation and an alternative scenario without main exploitation. In parallel, the RA Ministry of Nature Protection was supported to incorporate the approaches and respective provisions on ecosystem services in a new framework law on environment.

Enhancing Local Capacity and Regional Cooperation for Climate Change Adaptation and Biodiversity Conservation in the South Caucasus (2011-2013): The project was funded by the European Union and implemented by the Caucasus Environmental NGO Network (CENN) and the International Non-Governmental Organization Mercy Corps.

The aim of the project was to prevent and manage the negative impacts and risks of climate change as well as to protect the livelihoods of the most threatened local communities, local

biodiversity and ecosystems in the target trans-boundary areas of Kura River. Lori Region was selected as a target area and based on respective studies and analyses, the activities aimed at adaptation were prioritized and a strategy was developed.

In addition to the above mentioned projects in Armenia a number of international projects are implemented to support biodiversity conservation and sustainable management of ecosystems. Some of them are mentioned below.

Community Agricultural Resources Management and Competitiveness (2011-2016): The project is funded by the World Bank. The main objective of the project is to improve the productivity and sustainability of pastures in selected communities. The indicators of achieving the mentioned objective include: a) growth of live-stock productivity measured by the milk production and the average daily increase of the weight of animals; b) improved efficiency of the management of community pastures; c) growth of farmers' income from live-stock breeding; and d) growth of the index on pasture management productivity. In the course of project implementation the activities on sustainable pasture management have been implemented in 67 communities, out of 55 planned communities in 54 the consumer cooperatives "Union of Pasture Users" have been established and in 49 communities the plans on pasture management and live-stock breeding development have been developed in a participatory approach. The efficiency of community pasture management, measured by increase of the community budgets, has been improved by 55%.

Integrated Erosion Control in Mountainous Regions of the South Caucasus (2014-2016): The project is aimed at soil erosion and degradation control by conserving biodiversity through implementation of coordinated activities. It is envisaged to study and evaluate soil erosion and risks in Aragatsotn and Shirak Regions and based on that develop an action plan to promote rehabilitation and effective use of soils. The project will deal not only with implementation of technical activities, but also with legislative and institutional improvements and new technical solutions.

The project in Armenia is planned for implementation during 2014-2016 by joint efforts of GIZ/ADA and the RA Government.

The Republic of Armenia as a full-fledged subject of international relations, has ratified a number of international environmental treaties (conventions and their protocols), which promote environmental protection and biodiversity conservation and by this has taken commitments to ensure the safe and stable natural environment. Along with some international conventions to which Armenia has joined rather long ago, in 2010 the RA National Assembly ratified the Convention on the Conservation of Migratory Species of Wild Animals.

The activities implemented in the frames of environmental conventions are coordinated by the RA Ministry of Nature Protection with involvement of NGOs, scientific structures and the civil society.

The RA Government in 2011 adopted the decision #1594-N on "Adoption of a list of activities aimed at fulfillment of the commitments by the Republic of Armenia based on a number of international environmental conventions", which is a five-year action plan (2012-2016) on fulfillment of commitments of international environmental conventions. Its aim is to ensure coordinated implementation of respective activities derived from 15 environmental conventions. The following conventions are in the lists of the mentioned decision:

- The UN Convention on Biological Diversity: 4 activities including establishment of new SNPAs for protection of biodiversity and valuable ecosystems, analysis of national legislation and development of respective legal acts for establishment of a biosphere reserve in Armenia.

- The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat: 5 activities including development of a national program and action plan on conservation and use of wetlands of Armenia, mapping and development of a management plan for Khor Virap State Sanctuary, assessment of biological and socio-economic values of wetlands of Armenia.
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): 1 activity on development of periodic reports on implementation of the convention and their submission to the Secretariat.
- The CE Convention on the Conservation of European Wildlife and Natural Habitats (Bern): 3 activities including implementation of works on establishment of the Emerald network of potential sites of special environmental interest in Armenia, dissemination of information regarding the need to protect wild flora and fauna species as well as threatened natural habitats, in particular through establishment of the Emerald network.
- The Bonn Convention on the Conservation of Migratory Species of Wild Animals: 4 activities including analysis of the species occurring on the territory of Armenia, which are included in the Appendices I and II of the Convention, development of proposals on inclusion of new species in the list, development of a draft protocol decision of the RA Government on “Adoption of the concept of migratory species of wild animals on the territory of Armenia and the national action plan”, establishment of an information and mapping database on ecological peculiarities and distribution of migratory species of wild animals occurring on the territory of Armenia.

Information on the progress in implementation of the works envisaged by this decision is compiled and submitted to the RA Ministry of Foreign Affairs in the form of reports.

2.4 Mainstreaming biodiversity considerations in the sectoral and intersectoral strategies, plans and programs

Based on peculiarities of the current state of country development the RA Government made the decision #442-N (27 March 2014) on adoption of the “Strategic plan of perspective development of the RA in 2014-2025”, which was developed with consideration of the developments attributed to the global financial-economic crisis and new realities. The plan is aimed at establishment of a strategic coordinated framework for development of the policies in various sectors and branches, which ensure country development, through consolidation of national capacities and consideration of existing experience and current conditions as well as global development challenges.

It is mentioned in the Plan that during 2009-2011 the developments in the environmental sector of the RA were mainly in the frames of the priorities of sustainable development and in accordance with the Second National Environmental Action Programme adopted by the RA Government. Safeguarding of a balanced nature protection environment through running a resource-efficient economy was taken as a cornerstone of the environmental component of sustainable development.

During the coming years an objective will be set up that along with the efforts of the RA Government aimed at high rates of economic growth, the environmental risks should be reduced, in particular the biodiversity conservation risks, which are conditioned by the impact of a number of branches, mainly agriculture, forest economy, industry, energy production sector and urban development. In particular, the above mentioned refers to the following risks:

1. The environmental risks conditioned by the growth of international prices of metals given the increasing rates of the mining sector expansion.
2. Illegal loggings conditioned by the growth of the price for natural gas.

3. Overuse of water resources conditioned by intensive development of sub-branches, which use underground water resources and by climate change.
4. Increasing risk of desertification.

Regarding the last risk factor the plan emphasizes development and implementation of respective economic and control mechanisms to safeguard the target use of lands and to prevent the current negative trends of the change of land status and degradation, including through development of a differentiated tax system, which should promote the target and sustainable use of agricultural lands, including arable lands and pastures, as well as protection of the soil organic layer. To promote reclamation of degraded lands it is envisaged to activate international cooperation including through the newly developing global financial support mechanisms under the UN Framework Convention on Climate Change (Green Climate Fund, Reducing Emissions From Deforestation and Forest Degradation/REDD+ and Adaptation Fund).

The National Forest Programme will be revised and implemented with the aim of forest rehabilitation and afforestation in the forests and forest lands of the country as well as of enhancing qualitative features of the forests and establishment of new forests. The mechanisms on control of illegal loggings will be improved in parallel with afforestation and forest rehabilitation activities.

Respective economic-legislative mechanisms to promote introduction of “green” innovations according to decisions of the United Nations Conference on Sustainable Development (Rio+20) will be developed, including through the state and international support, as well as the criteria for assessment of ecosystem services will be developed. In order to ensure improvement of the environmental monitoring system the integrated approaches and criteria for monitoring will be defined for collection of reliable information on the state of environment and consolidation of statistical information from other sources.

The works on improvement of the SPNAs management system will be continued, which implies improvement of legislation and expansion of the network of SPNAs, establishment of a biosphere reserve on the basis of Shikahogh State Reserve, development of a bioresource monitoring and stock-taking system, safeguarding sustainable management and development of mechanisms for community involvement. Special studies will be conducted to identify new passes in the karst caves of Vayq (Mozrov and Arj) and for their protection and use for tourism purposes.

“The Strategic Plan of Perspective Development of the RA for 2014-2025” clearly defines the frames of sectoral policies and to some extent strengthens the basis for development of inter-sectoral relations. However, the biodiversity problems and the ways of their solution are not directly reflected in this document.

The concept of green economy, which has been widely applied in many countries during the last decade, is based on the provisions that nature protection is a key and undeniable condition for country development and viability of humanity, whereas the economy and social sectors should be considered as derivative components and adjust to natural environment and the terms of its protection.

The principles of green economy testify that it is not only in harmony with, but also is based on ecosystem approach, which has accepted an entire ecosystem with its components as an object for protection. Given this modern approach, incorporation of environmental considerations in development programs and strategies of the other sectors and branches of economy becomes more important. The main sectors having impact on ecosystems and biodiversity in Armenia, which are the agriculture, forest economy, industry and energy production sector should adopt this approach and make their policies compliant with the environmental policy. However, it can be stated that at present the steps in this direction are not sufficient, which is proved by information presented below.

“The strategy of sustainable development of the village and agriculture of the Republic of Armenia in 2010-2020 and the list of activities to ensure implementation of the strategy of sustainable development of the village and agriculture of the Republic of Armenia in 2010-2020” was approved by the decision #1476-N of the RA Government in 2010. It defines the main directions of the state agrarian policy and the measures on their implementation. Environmental protection and conservation of natural landscapes, agrotourism and development of organic agriculture are in the list of sub-targets derived from the main target on modernization of agriculture and increase of competitiveness.

Degradation of natural pastures and intensification of secondary salination and desertification processes in the irrigated lands of the Ararat valley are among the main threats to ecosystems and biodiversity attributed to agricultural developments. The activities on mitigating the impact of two mentioned threats are included in the above-mentioned strategy and their implementation has already started.

To ensure reliable protection of plant genetic resources the strategy on agriculture development emphasizes the need for the following activities:

- Development and implementation of the program on conservation and sustainable use of genetic resources of agricultural crops of Armenia and their wild relatives with support of the RA Government and donor organizations and together with the Ministry of Nature Protection of the Republic of Armenia.
- Capacity building in terms of necessary equipment and technical means for the organizations having collections of genetic resources.
- Creation of field collections of local and selected varieties of fruits and grape through rehabilitation of collection orchards, acquisition of specimens of Armenian origin from the genetic banks of other countries and establishment of new orchards.
- Expand possibilities for maintenance and reproduction through biotechnologies (in vitro) of the plants with vegetative propagation
- Promote improvement of habitat management (in-situ) of plant genetic resources through inventory of their distribution, plant communities and their species composition, clarification of distribution zones, stock-taking and monitoring.
- Development and implementation of projects on on-farm protection of the plant genetic resources.
- Ensure duplication of unique genetic resources and their storage in a genetic bank of a foreign country to reduce the risks of secure maintenance.

At the same time the RA Ministry of Nature Protection is a co-implementer of the following activities of the action plan aimed at implementation of the main provisions of the strategy:

- Implementation of activities to prevent degradation (worsening) and desertification of agricultural lands and especially pastures.
- Development and implementation of a methodology on receipt and provision of data on land monitoring.
- Development and implementation of a program on protection and balanced use of agricultural crops and their wild relatives in Armenia.
- Implementation of measures on reduction of vulnerability of agriculture conditioned by the climate change.

It is obvious that the works implemented since 2010 in the frames of the mentioned activities have been mainly aimed at assessment and prevention of climate change impact on agricultural sector; they are implemented mainly in the frames of international projects.

Biodiversity considerations are better addressed in the phase of the project **Community Agricultural Resources Management and Competitiveness (CARMC)**, which will be implemented by the World Bank support. The CARMC 2 project is in line with the targets of objectives the RA Government regarding agricultural sector, which include sustainable agricultural development, more effective food security and increased community incomes as stated in the Strategy of Sustainable Agricultural Development. By the project it is envisaged to have environmental impact assessment for all planned major activities as stipulated by the RA legislation. To prevent possible plant cover deterioration, instability of slopes, erosion, landscape degradation as well as soil and water pollution during the construction works planned by the project, it is necessary to ensure the quality working schemes for construction with properly planned territorial and time-frame procedures. The latter along with continuous monitoring of activities will ensure implementation of all needed activities aimed at stability of slopes, natural or artificial rehabilitation of plant cover and harmony with landscape.

In the **sector of forest economy** significant progress has been registered connected with development of forest management plans for almost all forest enterprises of the country during 2006-2011 (at present forest management plans are present for about 90% of forest enterprises). In the RA Forest Code forest management planning is stated as the basis for implementation of forestry measures and forest use. Management plans are developed according to the Instruction on Development of Forest Management Plans adopted by the RA Government. They should be periodically (once in 10 years) revised to plan the volumes, location and time-frames of complex measures on forest conservation, protection and use for further implementation.

Inventory of the forest fund, study of qualitative and quantitative features and of species and age composition, analysis of ecological state of forests as well as planning of activities on forest rehabilitation, conservation, protection and use are in the list of the planned complex measures implemented for running of the state forest economy. Considering those requirements the developed forest management plans include a description of biodiversity of the given area and forest conservation measures based on the purpose of forests. However, in the forest management plans no special conservation measures are planned for the forest areas, which have the richest and most unique biodiversity or provide essential ecosystem services.

Strengthening and improvement of cooperation with local communities will be needed for implementation of the Program on Establishment of New Forest Belts nearby Lake Sevan (decision #1441-N of the RA Government from 15 November 2012). The main aim of the program is to restore ecological balance of Lake Sevan and its catchment basin, for which the expansion of forested areas within the lake catchment basin is also a necessary condition. In the frames of the program it is planned to establish new forests totally on 1113.2 ha on the territories of Sevan National Park and community areas as well as to rehabilitate Vardenis nursery on the territory of 13.7 ha. The financing of the program during 2014-2023 is planned to get from charitable foundations and international organizations. Afforestation on community lands will be done in the areas not suitable for agriculture, for which close contacts should be established between the community authorities and representatives of environmental structures.

In 2014 the project Public Monitoring of Forests of Armenia started in the frames of the ENPI-FLEG 2 project. The aim of the project is to identify illegal activities in the forests of Armenia with their registration, compilation and presentation to the public. For public monitoring of forests on the territory of Armenia local groups of activists will be established by "Geoinfo" Scientific-Application Center" organization with representation of NGOs, environmental organizations and local population.

In the **industrial sector**, given development of mining industry, mitigation of the risks is a priority for solution of ecosystem and biodiversity related problems. The impact of mining on environment and particularly biodiversity is presented in section 1.4.1.1. A complex ecosystem approach with

involvement of specialists from various fields is required to solve these problems. There are few examples of coordinated works between stakeholder structures in this field as mitigation and elimination of the main geocological implications of open mining (degradation of landscapes, disturbance of soil and plant cover, fragmentation and elimination of biodiversity habitats, storage of hazardous wastes and contamination of water resources) is not considered a priority by mining companies. In fact only two companies – “Vallex Group” CJSC in Teghut and “Lydian International” Limited in Amulsar are taking steps on protection of separate species of biodiversity on the areas under exploitation.

Prior to commencement of the main mining activities in Teghut copper-molybdenum mine “Vallex Group” has implemented an inventory of biodiversity of the area with identification of a number of plant and animal species registered in the Red Book of Armenia and international red lists as well as endemic species; the majority of them has been mainly registered from the mine adjacent areas. The steps on protection of populations of these species have been taken, for example, collection of the species bulbs and seeds from the planned mine territory and their planting/seeding in new ecologically similar areas. The company implements also activities on establishment of new forest ecosystems instead of the forests to be logged during the mining activities (section 1.4.1.1).

“Lydian International” Limited, which is commencing its activities in Amulsar, also prior to the main mining activities has implemented studies of the flora and fauna in the respective mine area and adjacent territories. On the mentioned territory, mainly on the mine adjacent areas, some species registered in the Red Book of Armenia, the IUCN Red List and appendices of the Bern Convention as well as endemic species have been identified. At present scientific research is ongoing to assess the effectiveness of various methods (seed collection and seeding, transfer of living plants to new habitats, clonal reproduction and others).

Both for Teghut and Amulsar the most vulnerable areas and main threats have been assessed. Respective proposals have been developed to minimize the damage to be caused to biodiversity, in particular on monitoring of the area as well as establishment of a community owned sanctuary.

Unfortunately, the same cannot be said about the other mining companies, which in the best case implement only inventory of biodiversity in the areas subject to mining. At the same time, usually such inventories are formal; they are implemented in the frames of environmental impact assessment during a very short period and often with just one visit of specialists to the area.

In the strategies and programs of the **hydropower production sector** there are no measures on mitigation of the threats to water and littoral terrestrial ecosystems and biodiversity. The only encouraging fact is that the protocol decision #30 of the RA Government (4 August 2011) revoked the “Sevan Lake Basin” section of the annex on the scheme of development of small hydropower plants approved by the item 9 of the protocol decision #3 by the RA Government (22 January 2009) on Approval of the Scheme of Development of Small Hydropower Plants. As a result, no new small hydropower plants will be constructed on the rivers flowing into the lake. However, the SHPPs already functioning in the basin of Lake Sevan as well as on the other rivers with limited water resources continue destruction of water fauna and threaten the natural state of river ecosystems (section 1.4.1.5).

PART 3.

THE OUTCOMES OF IMPLEMENTATION OF THE AICHI BIODIVERSITY TARGETS IN ARMENIA

The mission of the Strategic Plan 2011-2020 adopted in 2010 under the Convention on Biological Diversity is to take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication.

However, the wild nature cannot be seen as a complex of ecosystem services, it is valuable in itself. From this point of view the cornerstone of the new Plan is the provision that biodiversity is a basis for ecosystem functioning and human well-being. Biodiversity provides for food security and human health, it ensures clean air and water, it contributes to local livelihoods and economic development and it is essential for the achievement of the Millennium Development Goals, including poverty reduction.

During the recent five years environmental actions in Armenia have been implemented with consideration of fundamental provisions and activities stipulated in a number of strategic documents, which contribute to biodiversity conservation and sustainable use. Some of them are mentioned below:

- The Program on Sustainable Development of Armenia for 2008-2012;
- The Second National Environmental Action Plan for 2008-2012;
- The State Strategy and National Action Plan on Development of Specially Protected Nature Areas of Armenia for 2002-2010;
- The National Forest Program of the Republic of Armenia for 2006-2015.

Though all the above mentioned strategic documents have been developed before the Strategic Plan for Biodiversity 2010-2020 and the Aichi Biodiversity Targets, however they all include activities and measures derived from the principles and aims of the Convention on Biological Diversity. The activities and measures have been implemented in accordance with the territorial and time-frame criteria stipulated in the programs. Considering the above stated circumstance, an overview and analysis of the outcomes of the biodiversity related activities implemented in Armenia during 2009-2013, which are in line with the Aichi Biodiversity Targets, is presented below.

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Monetary valuation of biodiversity is still in the preliminary stages and done in the frames of some international projects (see section 1.5). Awareness raising of different sectors of society on importance of biodiversity and ESs is done through trainings, round-tables, workshops, publications, mass media materials and others.

Since 2002 by the RA MoNP initiative and support of the OSCE Office in Yerevan 15 Public environmental information centers (Aarhus Centers) have been established in Armenia. The mission of the centers is to establish links between state bodies and public organizations and other stakeholders (local self-governing bodies, business sector, scientists, mass media) as well as other necessary mechanisms to ensure dissemination of ecological information and public participation in discussions on environmental issues.

Initiated by the Faculty of Law of the Yerevan State University and supported by the OSCE Office in Yerevan since 2008 the Scientific-Educational Center of Environmental Law has been functioning on the basis of the Faculty of Law. It provides training courses for the university, other institutions of higher education, NGOs, journalists, environmental inspection and judges on the topics of national environmental legislation and environmental conventions.

Public hearings are also the way to provide information and raise awareness. Concerned public organizations and citizens actively participate in public hearings, the information on their outcomes is made available through mass media and web-sites of the Aarhus centers.

The State Museum of Nature of Armenia has an important awareness raising and ecoeducational mission. It has been functioning since 1952 and it is unique in the Southern Caucasus by its type and collection. The main objective of the museum is to promote environmental upbringing, education and awareness raising. Various exhibitions and awareness raising, cognitive and educational events are periodically organized in the museum. Annually, the museum is visited by about 24000 visitors and about 500 excursions are organized. Since 2012 the Shirak Branch of the State Museum of Nature of Armenia has been functioning in the Visitor Center of Arpi Lake National Park.

The Strategic Program of Perspective Development of the RA for 2014-2025, which is a logical continuation of the Sustainable Development Program, implies also better opportunities for partnership and participatory monitoring. According to the Memorandum of Understanding signed between the RA Government and the Civil Cooperation Network (CCN) in 2013, the CCN will represent the interests of the wide public in the processes of program implementation, monitoring and assessment as well as its revision if needed. Involvement of the CCN in development of the policies implemented by the state management bodies and assessment, monitoring and control over decision-making as well as in respective public awareness raising activities is important for effective implementation of the program. For that the state will support activities aimed at development of civil public participation and the steps on its regulation.

Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

Among the first steps to reach this target is to stipulate in the national legislation the concept of ecosystem services, their classification and a methodology of their monetary valuation. It is obvious that assessment of ecosystem services enables adoption of more effective, cost-efficient and fair environmental solutions by responsible persons as well as justification of respective selected activities or options.

In 2013 the RA Government adopted the Concept on Establishment of Innovative Financial-Economic Mechanisms in the Field of Environment (protocol decision #16 of the RA Government dated 25 April 2013) as well as the Action Plan based on the Concept (protocol decision N 47 of the RA Government dated 14 November 2013). In the list of activities proposed by these documents (which are subject to implementation till 2018) adoption of the RA Law on Ecosystem Services is considered as a preferable option. It will define the subject to be regulated by the law, main concepts and other fundamental provisions. In Armenia a methodology or methodological bases for economic evaluation of natural capital and for the ES economic or monetary valuation should be established along with development of respective human resources or specialized potential for their application.

At present the draft RA Law on Ecological Policy is under development, which emphasizes the provisions related to ecosystem services.

Upon having respective legislative foundation established and monetary valuation of biodiversity and ESs completed, it is necessary to revise national and local strategies and development plans, in particular the plans of socio-economic development of regions as well as the management plans of SPNAs and forest enterprises to incorporate the calculations on benefits provided by ESs.

Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

In Armenia, no subsidies harmful to biodiversity are applied. Regarding positive incentives for biodiversity conservation and sustainable use, it is necessary to develop and introduce legislative and economic mechanisms on payments for ecosystem services as well as on compensation and encouragement to support development of the system of SNPAs in Armenia. The mechanisms of compensation should be aimed at land owners in the process of expansion of the boundaries of existing SNPAs as well as during establishment of new SNPAs and ecological corridors. Introduction of encouragement mechanisms will contribute to increased performance by the staff of the entities dealing with the management of SNPAs as well as to more effective participation of stakeholders in participatory management of SNPAs. These provisions are included in the draft State Strategy and National Action Plan on Development of the Specially Protected Nature Areas of Armenia.

Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

The impacts of overuse or unsustainable use of biological resources on ecological stability and biodiversity deterioration are presented in section 1.4.2. This extremely important and wide target includes almost all sectors of economic activity from industry and agriculture to public health and tourism.

In July 2014 the RA National Assembly adopted the RA Law on Environmental Impact Assessment and Expertise, which clearly defines the rights and responsibilities of entrepreneurs in the processes of environmental impact assessment and expertise as well as the objects subject to environmental impact assessment and expertise during the planning and implementation of the entrepreneurial activity. The objects include also "... flora and fauna, their species composition and habitats, use of flora and fauna objects, use of living modified organisms, presence of animals and plants registered in the Red Book of Animals and the Red Book of Plants of the Republic of Armenia". Application of the law, which envisages environmental and health impact assessment and expertise will enable to avoid the risks of unsustainable use of resources in the very preliminary stages of entrepreneurial activity.

To achieve this target it is necessary to establish interministerial structures to coordinate the issues of natural resource use during initial stages of development of the plans and strategies. It is also necessary to adopt an integrated policy on natural resource use.

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

In Armenia the reduced rate of loss of forest ecosystems, as biodiversity habitats, is conditioned by the reduced volumes of loggings, restoration of forest areas and implementation of afforestation activities (see section 2.2.5). Regarding prevention of degradation and fragmentation of habitats,

the regional project “Promotion of Ecocorridors in the Southern Caucasus” (implemented by WWF and funded by KfW Development Bank) started in 2014 is important with its aim of creating favorable conditions in the Caucasus ecoregion (Armenia, Georgia, Azerbaijan) for establishment of four large ecological corridors. Thanks to these corridors in Armenia it will be possible to eliminate fragmentation between the populations of key biodiversity species and their habitats, to establish spacial links between a number of SPNAs, which will definitely contribute to prevention of further degradation of ecosystems. By safeguarding biological sustainability of SPNAs, the project will provide financial resources in the selected ecological corridors to support application of ecologically sound land use practices. This will contribute to biodiversity conservation in the country without reducing the income of rural population.

Thanks to increased water level aimed at elimination/reduction of ecosystem degradation in Lake Sevan, the fish populations as well as the bird fauna connected with the lake ecosystem have started to rehabilitate (see sections 1.3.1.5 and 1.3.4). Every year an Action Plan on Rehabilitation, Protection, Reproduction, Natural Development and Use of Lake Sevan Ecosystems is adopted by the RA Government, which includes the activities on replenishment of fish stock (reproduction of valuable and rare fish species), stock-taking of fauna resources in the catchment basin of Lake Sevan and setting up the allowable quotas of use.

Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

This target mainly refers to marine ecosystems, which do not exist in Armenia. The target is important for Armenia first of all in relation with conservation and rehabilitation of the Lake Sevan ecosystem and its biological resources. Though different programs on conservation of the Lake Sevan ecosystem and its biological resources are developed, approved and implemented in the country, however, the status of Lake Sevan is far from being satisfactory. Recovery of the Lake Sevan ecosystem requires implementation without exception of political solutions regarding requirements on increase of water level and the RA Law on Lake Sevan. Besides, development and piloting of sectoral plans and programs on any water ecosystem in the country should be done at the state level with consideration of their all potential ecological implications.

The mentioned refers also to a pilot project “Recovery of populations of endemic species (gegharkuni and summer bakhtak) in Lake Sevan” started in 2013. By the project it is planned through cooperation between the state and private sectors to establish new fish-breeding farms (net cages) on the surface of the lake for reproduction and reintroduction of a part of the reproduced endemic fish species. In 2013 by the order of the RA President a Council on Rehabilitation of Ishkhan Stock and Development of Fish-Breeding in Lake Sevan was established. The RA Government approved also a complex program on ishkhani rehabilitation and fish breeding development in Lake Sevan, its preliminary results will be summarized in 2014.

Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

Sustainable forest management, which implies maintenance of all ecosystem services provided by forest ecosystems, to some extent is stipulated in forest management plans of forest enterprises of Armenia, which have been developed and are being implemented in about 90% of forest enterprises under “Hayantar” SNCO. Management of forest areas (totally 110.270 ha) in the structure of specially protected nature areas is done according to respective management plans and charters.

Numerous measures aimed at forest conservation are envisaged by forest legislation of the Republic of Armenia, though it is not sufficient for conservation of entire biodiversity of forest ecosystems. At present biodiversity conservation is extremely urgent and important, including in mature and overmature forests. At international level these issues are dealt through identification, designation and conservation of high conservation value forests (HCVF) according to the Forest Stewardship Council (FSC) forest management designation. If any forest area has high conservation value, then the need of its guaranteed conservation during forest management is obvious. However, this has never been a target for forest enterprises and on contrary less exploited forests have been considered the main reserve for wood harvesting. The long-year experience shows that to ensure conservation of entire forest biodiversity it is necessary to exclude about 20% in each forest area from intensive exploitation. At present, the works on sustainable forest management and designation of high conservation value forests in Armenia are commencing. They are planned for implementation in the frames of the projects European Neighborhood and Partnership Instrument East Countries Forest Law Enforcement and Governance II Program (ENPI FLEG 2, 2013 - 2016) and Mainstreaming Sustainable Land and Forest Management in Dry Mountain Landscapes of North-Eastern Armenia (GEF/UNDP, 2014 – 2017).

At present the activities on sustainable pasture management are limited by development and implementation of community pasture management plans in some regions of Armenia. Thus, in the frames of the project Community Agricultural Resources Management and Competitiveness for 49 communities the Plans on Pasture Management and Live-Stock Breeding Development have been developed in a participatory approach and activities on sustainable pasture management have been implemented in 67 communities.

Natural resource use in the field of aquaculture is almost not managed, though the trends of fish breeding development in Armenia in recent years are obvious. At present there are 250 functioning fish breeding farms on the territory of Armenia, mainly located in Armavir and Ararat Regions. In 2012 the annual fish production made about 9000 tons. Only in 2010-2011 the volumes of fish production in fish breeding farms increased by 23% and made 7095 tons (the majority is *Salmonidae* species). However, no works are implemented in the fish breeding farms to promote genetic diversity of fish species; selection of species for breeding is based only on market demand. It is necessary also to implement awareness raising activities in the fish farms functioning nearby Lake Sevan to prevent penetration of alien species into natural ecosystems.

Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

Monitoring of the quality of surface waters in the Republic of Armenia is done in 39 most risky rivers (out of 393 large rivers with the length of more than 10 km), 5 risky reservoirs – Akhuryan, Arpi Lake, Aparan, Azat and Kechut Reservoirs (out of 78 reservoirs) and 2 lakes (Sevan Lake and Yerevan Lake).

According to the data of the “Environmental Impact Monitoring Center” SNCO in 2012 the concentration of organic substances in Lake Sevan was high with exceeding the norms of maximum allowable concentration by a factor of 1.1.-1.3 (maximum allowable concentration is 30 mg/m³). The presence of organic substances in the lake water and the growth of concentrations of total phosphorus, nitrite and ammonium ions are probably conditioned by the fact that due to water level increase the bushes and remnants of logged trees in littoral areas remain under water and their gradual decomposition results in increased concentrations of the mentioned substances. To mitigate this process in parallel to water level increase the works are implemented to clean the areas planned to be covered by water as well as on cleaning water-covered areas from forest remnants. In the period of 2005-2013 in total 1612 ha of forest has been cleaned including 1374 ha

with allocations from the state budget. Accelerated recovery of fish stock is also an important issue as in the lake there is a huge reserve of nutrients, which will significantly contribute to the lake eutrophication if not used and result in irreversible decline of water quality. To replenish the fish stock of Lake Sevan in the period of 2007-2013 at the expenses of state budget more than 2,022,000 young fish have been released to the lake, including 1,292,000 young fish of summer bakhtak and gehharkuni fish subspecies over the recent four years.

To prevent the inflow of wastewaters coming from the large towns and communities located in the basin of Lake Sevan the works on rehabilitation of the sewage networks in the towns Gavar, Martuni, Vardenis, Sevan and Jermuk have been implemented. Water cleaning plants have been constructed in Gavar, Martuni and Vardenis, which have been functional since 2013. Appropriate functioning of such infrastructures significantly reduces the inflow of organic substances to the lake basin.

The data on pollution of water objects of Armenia with inorganic substances and their causes are presented in section 1.4.

Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

The scales of introduction of alien plant and animal species to the territory of Armenia are presented in detail in section 1.4.4. However, there is no appropriate understanding at different levels, including decision-makers, of the need to prevent introduction of alien species and possible steps to be taken. To some extent only introduction of quarantine species is controlled at customs and the pathways of agricultural crops. It is necessary to continue scientific research of all groups of invasive alien organisms, develop comprehensive lists of the most harmful species and assess potential risks conditioned by them. Based on that it will be possible to develop and implement measures to prevent their introduction and/or eradicate them or limit their dissemination.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11: By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

In recent years the total surface of SPNAs in Armenia has increased by 76.3 thousand ha and at present the total area covered by SPNAs makes about 387 thousand ha or about 13% of the territory of the country.

In the frames of Armenian-German cooperation during 2010 – 2013 about 400 mln AMD additional extra-budgetary funds have been allocated by the Caucasus Nature Fund to specially protected nature areas (Khosrov Forest, Shikahogh and Erebuni State Reserve, Arevik, Arpi Lake and Dilijan National Parks) for improvement of conservation effectiveness and technical capacity building.

In 2013 the project Support to Protected Areas in Armenia (project budget 8,25 mln EURO, duration 5 years) funded by the KfW Development Bank started with the aim to establish a biosphere reserve in Syunik Region. The project objectives include:

- Safeguarding sustainable management of natural resources and protected areas;
- Improvement of socio-economic situation in adjacent communities; and

- Implementation of preparatory works on establishment of a biosphere reserve according to the UNESCO criteria.

The activities aimed at development of SNPAs need to be continued based on ecosystem approach in biodiversity conservation and on the Strategy and Action Plan on Development of Specially Protected Nature Areas of the Republic of Armenia developed in 2013-2014, which has been submitted for approval by the RA Government.

More details on this target are presented in section 2.2.

Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Numerous measures have been implemented in Armenia to achieve this target, including conservation and rehabilitation of habitats of such species, strengthened control over special threats (illegal hunting, climate change), in-situ and ex-situ conservation. Special action plans on rehabilitation of the main threatened species (including Armenian mouflon, Caucasian leopard, Sevan ishkhan and others) have been developed and at present are being implemented. However, it is necessary to expand such activities based on reliable information for selection of the threatened and declining species, which can be taken from the Red Book of Armenia (2010) (see sections 2.2 and 2.3).

Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

This target is important for Armenia considering the richness of biodiversity in Armenia in terms of wild relatives of cultivated plants and farmed animals as well as of local varieties of plants and animal breeds. Funded by the state and donor organizations a number of scientific-research projects aimed at research of genetic resources, their use in the selection process, their ex-situ and in-situ conservation are implemented. Some of them are mentioned below:

- “Study, assessment, reproduction and enrichment of ex-situ collections of the plant genetic resources, improvement of documentation system and pre-selection activities” (2012-2014);
- “Study of the collections of the global genetic fund of Solanaceae cultivated plants” (2010 – 2012);
- “Reproduction of collections of cultivated plant of regional priority” (2011-2012);
- “Study of some valuable native varieties of grape and their clones” (2012-2014);
- “Acquisition, regeneration, description, documentation and conservation of genetic resources of cultivated plants of local origin and their wild relatives” (2012 – 2014);
- “Conservation and use of apricot genetic resources” (2011 – 2014).

In the above mentioned projects the used methods on conservation and study of biodiversity imply participation of land owners in conservation measures and application of guidelines and methodologies on collection of specimens developed by international organizations. Ecosystem approach and the concept of involving all stakeholders in conservation and use of genetic resources are well applied in the projects financed by the Federal Ministry for Economic Cooperation and Development of Germany (BMZ), the German KfW Development Bank and the German Agency for International Cooperation (GIZ). Strategies and methodologies are developed on the basis of the mentioned principles; they will serve to decision-making in the environmental field.

Detailed information on this target is presented in section 2.2.4.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable

Among water ecosystems of Armenia Lake Sevan with its catchment basin is of high importance as almost the whole population of the country depends on ecosystem services provided by the lake (supply of water for drinking and irrigation, supply of food, regulation of climate, supply of energetic resources, recreation, aesthetic and spiritual values).

Lake Sevan is the largest upland freshwater lake in the Southern Caucasus. Before decline of water level (1933) the lake was on the altitude of 1915,57 m above sea level with the water volume of 58.5 km³ and the surface area of 1416 km². Twenty eight rivers and small rivers flow into the lake. The total area of river watersheds makes 2780 km (making 76.2% of the lake catchment basin. Only one river – the River Hrazdan flows out of the lake.

Lake Sevan is known for its unique fish fauna; in the nearest past 3 endemic species of fish have been occurring in the lake – Sevan ishkhan with its four sub-species, khramulya and barbell. In the result of intensive water use for development of economy and energy production sector of Armenia, inefficient use of water resources (the lake level has dropped by about 20,2 m) and overuse of commercial fish species the balance of lake ecosystem has been significantly disturbed and the lake biotypes of some endemic species (two sub-species of Sevan ishkhan) have become extinct due to drying of their spawning grounds.

Considering the importance of Lake Sevan for socio-economic development of the country multi-faceted measures on ecosystem conservation in Lake Sevan and its catchment basin, restoration of its ecological balance and harmonic natural development of biodiversity as well as sustainable use of natural resources have been implemented and are being implemented by the Government of the Republic of Armenia. In the period of 2003-2010 in the result of taken steps the lake level has increased by 384 cm, which is a prerequisite for restoration of water ecosystem and biodiversity. The lake fish fauna and bird fauna have also started to rehabilitate (see respective section).

In the significant proportion of communities located in the basin of Lake Sevan the problem of irrigation water supply and animal watering has been solved. However, the rivers flowing into the lake are used as the main source of irrigation and their majority is getting dry during summer months due to unsystematic and uncontrolled irrigation. This is significantly detrimental for the species, which use rivers as spawning grounds, in particular Sevan khramulya, summer bakhtak and Sevan barbell, which lose the habitats and conditions required for reproduction.

For conservation, restoration and sustainable use of the lake and its catchment basin in 2010 the RA Government approved the “Schedule of measures developed according to the workplan for 2009 of the Council on Lake Sevan Problems adjacent to the President of the Republic of Armenia and submitted by the Council on Lake Sevan problems adjacent to the President of the Republic of Armenia”, according to which 43 measures are being implemented, including development of a number of legislative acts to regulate the field, promotion of biodiversity reproduction as well as implementation of complex programs on water supply, sewage network development and wastewater treatment in large settlements of the Lake Sevan basin and others.

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification

According to the data of the Report on the Global Forest Resources Assessment implemented by the UN Food and Agriculture Organization in 2010, the accumulated carbon stock in the biomass of the living forests of Armenia (above the ground and underground parts) makes 48 tons per ha. At the same time the carbon stock accumulated in the entire forest biomass in the period of 1991-2010 has reduced from 17 mln tons to 13 mln tons, which can be attributed to intensive loggings in Armenia over the mentioned period. Conservation and rehabilitation of wetlands in the Lake Sevan basin and other regions of Armenia is also important for increase of ecosystem resilience and increased contribution of biodiversity in carbon sequestration.

At present a number of pilot projects are implemented in Armenia aimed at adaptation of natural ecosystems to climate change and improvement of carbon sequestration capacity of ecosystems (see section 2.3). It is necessary to expand such activities with involvement of more ecosystems in different regions. It is also urgent to study and assess all ecosystems in the country in terms of their capacity on carbon sequestration and accumulation as well as to develop and implement national programs on rehabilitation of the most important ecosystems.

Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

This target should be reflected in the NBSAP-2 to start from its initial phases on development of respective national legislation, human and technical capacity building, establishment of institutional structures.

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Target 17: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

The revision and updating of the National Biodiversity Strategy and Action Plan started in May 2014 with financial support of GEF/WB. Its development will be finalized in the first semester of 2015.

Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

Armenia is a monoethnic country. By 2011 statistical data 98% of the country population is of Armenian nationality. Therefore, this target refers only to involvement of local communities in the processes of implementation of the Convention and to use of their traditional knowledge and experience. Participation of local communities in this field is mainly aimed at identification of possibilities for establishment of community forests, development of management and business plans for the community SPNAs, safeguarding prerequisites for establishment of community-manages SPNAs. In this respect the draft RA Law on Making Changes in the Law of the Republic of Armenia on Specially Protected Nature Areas (2014) and the Draft Strategy and National Action Plan on Development of Specially Protected Nature Areas of the Republic of Armenia (2014) provide new opportunities for introduction of new categories of protected areas in the system of SPNAs, in particular the “protected landscape” (category 5 by the IUCN), which can contribute to active participation of communities in environmental processes as the local self-governing bodies will have an important role in the management of those SPNAs. It should be mentioned that in

spite of the fact that the above-mentioned law has not been still approved by the RA National Assembly, however the community councils of several communities in Vayots Dzor Region of Armenia have made a decision on establishment of a community-managed “protected landscape” SPNA on the lands within their administrative borders . In 2013 the drafts of the support zone economic development plan of Gnishik Protected Landscape and the management plan of Gnishik Protected Landscape were developed in the frames of the CEPF funded project implemented by WWF-Armenia. As a result, in the context of participatory democracy the conditions for development of alternative livelihoods in communities will be ensured aimed at regulated and sustainable use of biological resources.

Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

In order to get reliable information for identification, analysis and assessment of the status of biodiversity and its changes it is necessary to implement continuous studies and monitoring, which depends on availability of respective specialists, structures, methodologies, material-technical and financial resources. Active studies of the status of biodiversity, trends and consequences of its loss have been continued in Armenia in the last 5 years, which is testified by various data presented in sections 1.3 and 1.4. However, it is necessary to pay more attention at valuation of biodiversity and ecosystem services especially in the system of the SPNAs. At present in the frames of different projects (see sections 1.5 and 2.3) certain activities on piloting of valuation methods, their application for some SPNAs and introduction in the normative framework of Armenia are implemented.

The results of economic valuation of ecosystem services provided by SPNAs can serve as an information base for solution of a wide array of administrative problems. Through those studies it is envisaged to figure out the proportion of SPNAs in the GDP of Armenia, the input of their biodiversity and ESs in various aspects of socio-economic development of the country as well as scientifically justify and define financial resources required for protected areas.

Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties

In Armenia in order to reduce the negative impact on environment and ensure efficient use of natural resources, in addition to financial resources allocated from the state budget annually, a system of economic mechanisms is functioning on the basis of the RA Law on Environmental and Nature Use Fees. It has significantly increased the incomes to the state budget of the country from environmental and nature use fees as well as in some cases the scales of impact on environment have been reduced. Thus, in 2013 the incomes to the state budget from environmental and nature use fees increased about 2,7 times in comparison with 2009.

The incomes to the state budget from environmental and nature use fees establish favorable conditions for mobilization of financial resources for implementation of programs and measures to tackle environmental problems in the country as well as for increased financing.

In recent years, the problems of target use of environmental and nature use fees have been tackled in Armenia through the following:

1. Respective amendment of the RA Law on the RA Budget System (which entered into force in 2011) has stated that “The expenses envisaged by the annual state budget for environmental

programs for each year cannot be less than the sum of actual incomes from environmental and nature use fees of the budget two years ago”.

2. Expansion of the limits of enforcement of the RA Law on Target Use of Environmental Fees Paid by Companies. In the frames of the law enforcement the environmental fees paid by large mining companies are allocated to affected communities to finance environmental and public health measures. In the frames of implementation of the RA state budget during 2004-2012, the amount of subventions allocated for implementation of environmental programs in 2004 was 131.4 thousand AMD and in 2012 it reached 277.1 thousand AMD. At the same time since 2012 twenty six communities have been using the right to get respective subventions for implementation of environmental programs.
3. Establishment of environmental funds, in particular:
 - In 2004 by the decision #891-N of the RA Government (10.08.2004) the Forest Rehabilitation and Development Fund was established with the main aim to support rehabilitation of forests in Armenia and create favorable conditions for development of forests in Armenia.
 - Since 2005 the Fund on Environmental Protection has been functioning with accumulation of respective guaranteed amounts for implementation of works on reclamation, leveling, landscaping, planting and construction works in the areas damaged due to mining activities. As of 01.04.2013 more than 422.5 mln AMD has been already accumulated in the fund.
 - Since 2005 the Target Environmental Fund has been functioning, which is an extra-budgetary account. In the period of 2005-2012 thanks to voluntary contributions, donations and fund-raising by legal and physical persons of the Republic of Armenia more than 300 mln AMD has been transferred to the fund, which has been used for implementation of a number of important environmental programs and measures.
 - In 2011 by the decision #517-N of the RA Government (28.04.2011) the Foundation on Lake Sevan Restoration, Protection and Development was established with the aim to support mobilization of necessary resources for restoration, reproduction, protection, natural development and use of Lake Sevan as the strategic reserve of freshwaters in the Republic of Armenia as well as for securing water cleanness.

The mentioned activities at national level allow mobilization of necessary financial resources for tackling environmental problems, including biodiversity conservation. At the same time, different structures in Armenia (RA ministries, institutions of higher education, international organizations) implement numerous projects (see section 2.3), which either are fully aimed at biodiversity and ecosystem conservation and improvement of management or have such a component. During 2010-2013 the Caucasus Nature Fund has allocated about 400 mln AMD of extrabudgetary additional funds to specially protected nature areas, including 53.6 mln AMD in 2010, 92.8 mln AMD in 2011, 91.4 mln AMD in 2012 and 182.7 mln AMD in 2013. The projects implemented in SPNAs of Armenia with respective financing are presented in the table below.

Table 17. Projects implemented during 2009-2013 under the RA Ministry of Nature Protection with foreign financial support

N	Project title	Total project budget	Project duration	Donor organization
1.	Identification of the Emerald Network of potential areas of special conservation interest in the Republic of Armenia	34 000 EURO	2009-2011	Council of Europe (CE), European Commission (EC)
2.	Developing the Protected Area System of Armenia	950 000 USD	2010-2013	GEF/UNDP

N	Project title	Total project budget	Project duration	Donor organization
3.	Catalyzing Financial Sustainability of Armenia's Protected Areas System	850 000 USD	2010-2013	GEF/UNDP
4.	"Khosrov State Reserve" grant agreement	285 045 EURO for 3 years (+30 000 EURO for audit)	2010-2012	Caucasus Nature Fund
5.	"Zikatar State Sanctuary" grant agreement	8 887 500 AMD	2010	Caucasus Nature Fund
6.	"Arevik National Park" grant agreement	150 000 EURO for 3 years (+30 000 EURO for audit)	2011-2013	Caucasus Nature Fund
7	"Shikahogh State Reserve" grant agreement	180 000 EURO (+30 000 EURO for audit)	2011-2013	Caucasus Nature Fund
8.	"Reserve-Park Complex" grant agreement	15 000 EURO (+30 000 EURO for audit)	2011	Caucasus Nature Fund
9.	"Dilijan National Park" grant agreement	45 000 EURO	2011-2012	Caucasus Nature Fund

In conclusion it can be stated that the Aichi Biodiversity Targets have been implemented in Armenia at state level with active participation of civil society and the outcomes of their implementation during 2009-2013 in general have had a positive impact in terms of solving biodiversity problems.

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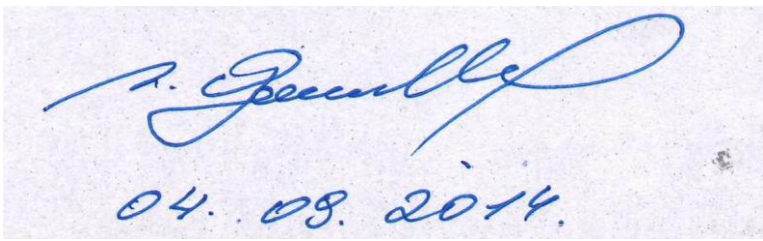
Thus, by analysing the information on the status and trends of biodiversity in Armenia and threats as well as by summarizing the outcomes of implementation of the Aichi Targets on biodiversity conservation and sustainable use it is possible to identify the most significant problems, which are linked with different fields and require urgent solutions. They include the followings:

- In the field of economy: assessment of potential direct and indirect economic incomes from biodiversity and ESs, integration of monetary values of biodiversity in a system of macroeconomic indicators of the country.
- In the field of management: integration of biodiversity considerations in the activities implemented jointly by the state and business structures, non-governmental organizations, local population and civil society through promotion of cooperation.
- In the field of legislation: integration of the ideas and concepts on biodiversity and ecosystem approach in all respective legislative normative documents, support to establishment of solid legislative foundations for biodiversity conservation.
- In the field of science: use of the best available scientific information in decision-making, identification of national biodiversity indicators, establishment of biodiversity data-bases, implementation of monitoring.
- In the field of education, upbringing and awareness: integration of biodiversity (as the key component of biosphere) conservation concepts in the field of ecological upbringing, formal and informal education and awareness raising of population.

Appendix 1

Information concerning the reporting Party and preparation of the Fifth National Report

Reporting Party

Party to the Convention	Republic of Armenia
National Coordination Center	
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Date of report submission	
04.08.2014.	

Preparation of the Fifth National Report

The Project “Preparation of the fifth national report to the UN Convention on Biological Diversity and Revision of the Biodiversity Strategy and Action Plan of the Republic of Armenia” funded by the GEF/WB started in May 2014. The project client is the RA Ministry of Nature Protection, namely the “Environmental Project Implementation Unit” State Institution and the project implementer is the “Biodiversity and Landscape Conservation Union” NGO.

The Fifth National Report prepared in the frames of the mentioned project is an information source, which enables to analyze and assess the progress of implementation of the Strategic Plan for Biodiversity Conservation and Sustainable use for 2011-2020 as well as to plan biodiversity conservation measures for adoption of justified administrative decisions.

The Fifth National Report of the Republic of Armenia to the Convention on Biological Diversity has been prepared with consideration of the Guidelines for the Fifth National Report developed by the Secretariat of the Convention as well as of the Resource Manual for the Fifth National Report, which is a complementary and supportive document. Based on the requirements of these documents the Report consists of three main parts, which include information on the status and trends of biodiversity, threats to biodiversity and their implications for human well-being, implementation of the National Biodiversity Strategy and Action Plan, as well as the outcomes of implementation of the Aichi Biodiversity Targets in Armenia.

For preparation of the Fifth National Report the works on collection, analysis and drawing conclusions of the up-to-date information on the status of biodiversity in Armenia, identification and analysis of the current trends of biodiversity changes, causes of the threats and related problems of population during 2009-2013 have been implemented. This information will enable implementation of the second phase of the project, which is the development of a realistic strategy and action plan on biodiversity conservation and sustainable use for the period till 2020.

During the preparation of the draft Fifth National Report effective participation of all stakeholders has been ensured through organization of a round-table and a national level workshop with participation of relevant stakeholders.

During the round-table aimed at discussion of the structure and contents of the Fifth National Report in the results of discussions with stakeholders the preliminary outlines of materials (derived from national needs and international requirements) to be included in the report have been defined.

The workshop on presentation of the draft Fifth National Report has been organized in Lori Region of Armenia with participation of representatives from stakeholder ministries, regional structures, international organizations, NGOs, scientific and educational institutions and broadcast of respective information on the regional TV. The opinions and proposals from the workshop have been taken into consideration for development of the final draft of the report.

The following national experts and consultants have been involved in a working group established for report preparation:

- Zh. Vardanyan, Doctor of Biological Sciences, “Biodiversity and Landscape Conservation Union” NGO President, Project Manager
- T. Danielyan, Candidate of Biological Sciences, “Biodiversity and Landscape Conservation Union” NGO Vice President, Working Group Leader
- G. Fayvush, Doctor of Biological Sciences, “Biodiversity and Landscape Conservation Union” NGO

- Ghukasyan, Candidate of Biological Sciences, “Biodiversity and Landscape Conservation Union” NGO
- S. Nanagulyan, Doctor of Biological Sciences, Yerevan State University
- Gabrielyan, Doctor of Biological Sciences, Scientific Center of Zoology and Hydroecology of the NAS RA
- H. Khachatryan, Candidate of Biological Sciences, Scientific Center of Zoology and Hydroecology of the NAS RA
- M. Kalashyan, Candidate of Biological Sciences, Scientific Center of Zoology and Hydroecology of the NAS RA
- H. Ghulijanyan, Candidate of Biological Sciences, “Zikatar” Environmental Center under the RA Ministry of Nature Protection
- M. Hovhannisyan, Doctor of Biological Sciences, Institute of Botany of the NAS RA
- S. Galstyan, WWF-Armenia
- Avagyan, Candidate of Biological Sciences, Armenian State Agrarian University
- Gevorgyan, Candidate of Biological Sciences, Yerevan State University
- Asatryan, Candidate of Biological Sciences, Institute of Botany of the NAS RA
- Z. Tarkhanyan, “Biodiversity and Landscape Conservation Union” NGO
- Y. Khanamiryan, “Biodiversity and Landscape Conservation Union” NGO

In addition, M. Arakelyan (Doctor of Biological Sciences, Yerevan State University), K. Mavelyan (Candidate of Biological Sciences, WWF-Armenia), M. Ghasabyan (Candidate of Biological Sciences, Armenian Society for the Protection of Birds NGO) and L. Balyan (Armenian Society for the Protection of Birds NGO) have also actively participated in report preparation, for which we express our sincere acknowledgements.

The experts and consultants have used the following sources of information for report preparation:

- RA official bulletins
- Material published by the RA Ministry of Nature Protection, RA Ministry of Agriculture, respective institutes of the RA National Academy of Sciences, Yerevan State University, Armenian State Agrarian University, different scientific centers and public organizations
- Reports and statements published by state structures and international projects
- “Environment and Bioresources in the RA”, statistical bulletins for 2009-2012
- Scientific monographs and articles
- Websites: www.mnp.am, www.minagro.am, www.arlis.am, www.armstat.am, www.cbd.int, www.panda.org/armenia, www.hayantar.am, www.undp.am, www.nature-ic.com, www.forest-monitoring.am

The RA Ministry of Nature Protection expresses gratitude to representatives of all state and public organizations and individuals, who participated in preparation of the Fifth National Report to the Convention on Biological Diversity.

Appendix 2. Main features of different vegetation types

<i>Vegetation type</i>	<i>Altitude, m a.s.l.</i>	<i>Area, km²</i>	<i>Number of species/endemics</i>	<i>Edificators</i>	<i>Endemics</i>
Semi-desert, including sandy deserts and saline bodies ("solonchaks")	400-1250	4550	1400/16	Artemisia fragrans, Capparis spinosa, Rhamnus pallasii, Kochia prostrata, Athraphaxis spinosa, Anisantha tectorum, Poa bulbosa, Centaurea squarrosa, Stipa capillata, Tanacetum chiliophyllum, Lepidium vesicarium, Euphorbia marschalliana, Thaenatherum crinitum, Calligonum polygonoides, Seidlitzia florida, Salsola ericoides, Halocnemum strobilaceum, Halostachys caspica, etc.	Allium schchianae, Centaurea alexandri, Centaurea arpensis, Cousinia daralaghezica, Isatis buschiorum, Allochrusa takhtadjanii, Bufonia takhtajanii, Astragalus holophyllum, Papaver roseolum, Cotoneaster armenus, Verbascum gabrielianae, Scorzonera gorovanica, Papaver gorovanicum, etc.
Steppes and meadow-steppes	1200-2200	8000	1600/46	Stipa tirsia, Stipa pulcherrima, Stipa lessingiana, Festuca valesiaca, Xeranthemum squarosum, Koeleria cristata, Bothriochloa ischaemum, etc.	Centaurea fajvuscii, Centaurea hajastana, Centaurea takhtajanii, Rhaponticoides tamaniana, Centaurea vavilovii, Cousinia fedorovii, Cousinia takhtajanii, Scorzonera aragatzi, Tragopogon armeniacus, Isatis sevangensis, Merendera greuteri, Onobrychis takhtajanii, Alcea grossheimii, Polygala urartu, etc.
Open arid forests	600-2200	2000	900/35	Quercus araxina, Pistacia mutica, Paliurus spina-christi, Juniperus polycarpus, Juniperus foetidissima, Juniperus oblonga, Rosa spinosissima, Spiraea crenata, Rhamnus pallasii, Punica granatum, Amygdalus fenzliana, etc.	Smyrniopsis armena, Centaurea alexandri, Centaurea arpensis, Cousinia takhtajanii, Dianthus grossheimii, Amygdalus nairica, Cotoneaster armenus, Crataegus armena, Pyrus browiczii, Pyrus chosrovica, Pyrus daralaghezi, Pyrus gergerana, Rosa zangezura, etc.
Forests	550-2400	3340	870/23	Quercus macranthera, Quercus iberica, Fagus orientalis, Carpinus betulus, Carpinus	Psephellus debeadicus, Psephellus zangezuri, Colchicum goharae, Merendera mirzoevae,

<i>Vegetation type</i>	<i>Altitude, m a.s.l.</i>	<i>Area, km²</i>	<i>Number of species/endemics</i>	<i>Edificators</i>	<i>Endemics</i>
				orientalis, Pinus kochiana, Taxus baccata, Platanus orientalis, etc.	Pyrus complexa, Pyrus elata, Pyrus megrica, Rosa sosnovskyana, Rubus takhtadjanii, Linaria zangezura, etc.
Wetlands' vegetation (Water-marsh vegetation)	400-3800	1774	630/3	Phragmites australis, Typha latifolia, Juncus acutus, Cyperus fuscus, Hippuris vulgaris, Caltha polypetala, Deschampsia caespitosa, Glyceria plicata, Potamogeton natans, Groenlandia densa, Polygonum amphibium, Nymphoides peltatum, Nymphaea alba	Sonchus araraticus, Sonchus sosnowskyi, Linum barsegianii
Sub-alpine and alpine meadows	2200-4000	4000	1100/24	Dactylis glomerata, Phleum pratense, Agrostis lazica, Hordeum violaceum, Bromopsis variegata, Festuca varia, Anemone fasciculata, Doronicum oblongifolium, Cephalaria gigantea, Scabiosa caucasica, Taraxacum stevenii, Campanula tridentata, Pedicularis crassirostris, Carex tristis, etc.	Symphytum hajastanum, Colchicum ninae, Erodium sosnowskianum, Ornithogalum gabrielianae, Gladiolus hajastanicus, Papaver gabrielianae, Bromopsis zangezura, Poa greuteri, Trisetum geghamense, Alchemilla heteroschista, Alchemilla sevangensis, Alchemilla smirnovii, Verbascum sevanense, Agrostis trichantha, etc.
Petrophilous vegetation	400-4000	800	1100/27	Cerasus incana, Sempervivum transcausicum, Nepeta mussinii, Astragalus microcephalus, Cystopteris fragilis, Cotoneaster integerrimus, Ephedra procera, Thalictrum minus, Saxifraga cartilaginea, Alopecurus tuscheticus, Campanula aucheri, Coluteocarpus vesicaria, Potentilla gelida, etc.	Allium struzlianum, Allium vasilevskajae, Seseli leptocladum, Sameraria odontophora, Thlaspi zangezuricum, Silene chustupica, Astragalus agasii, Astragalus sangezuricus, Ribes achurianii, Hypericum eleonoraе, Acantholimon gabrielianae, Scrophularia olgae, Scrophularia takhtajanii, etc.

Appendix 3. Distribution of some animal taxa by landscape belts of Armenia

<i>Taxa</i>	<i>Landscapes</i>				
	<i>Semi-desert</i>	<i>Mountain steppe</i>	<i>Mountain meadows</i>	<i>Forest</i>	<i>Intrazonal and azonal landscapes (incl. wetlands)</i>
Type Mollusks (Mollusca)	59	81	49	95	50
Type Arthropods (Arthropoda)	1628	911	459	2117	736
Class Arachnids (Arachnida)	97	126	12	85	12
Order Spiders (Aranei)	92	124	12	85	12
Order Scorpions (Scorpiones)	3	1	-	-	-
Order Solpugida (Solifugae)	2	1	-	-	-
Class Insects (Insecta)	1531	785	447	2032	724
Order Dragonflies (Odonata)	-	-	-	-	60
Order Orthopterans (Orthoptera)	70	94	12	40	12
Order Homopterans (Homoptera)	30	40	4	7	2
Order Beetles (Coleoptera)	1027	284	250	1504	586
Order Hymenopterans (Hymenoptera)	255	231	61	133	24
Order Butterflies and Moths (Lepidoptera)	149	136	120	348	40
Total Invertebrates	1687	992	508	2212	786
Type Chordates, Subtype Vertebrates (Chordata: Vertebrata)					
Class Amphibians (Amphibia)	4	4	3	6	7
Class Reptiles (Reptilia)	30	32	10	25	5
Class Birds (Aves)	23	19	12	42	213
Class Mammals (Mammalia)	44	41	33	17	30
Total Vertebrates	101	96	58	90	255

Appendix 4. Species richness of highest taxa of Armenia fauna

Taxa	Number of species/ number of Armenian endemics
Invertebrates (Invertebrata), incl.:	
Type Flat worms (Plathelminthes)	300
Type Roundworms (Nemathelminthes)	500
Type Annelid worms (Annelida)	200
Type Mollusks (Mollusca)	155/6
Type Arthropods (Arthropoda), incl.:	
Class Crustaceans (Crustacea)	
Order Copepods (Copepoda)	20
Order Cladocera	20
Order (Amphipoda)	2
Order (Ostracoda)	9
Order Ten-legged crustaceans (Decapoda)	4
Order isopods (Isopoda)	20
Supertype Myriapods (Myriapoda)	400
Class Arachnids (Arachnida), incl.:	
Order Spiders (Aranei)	600/18
Superorder Ticks (Acari), ալ դ թվ ու մ`	
Order Parasitiformes	571/42
Order Acariformes	350/18
Order Scorpions (Scorpiones)	3
Other Arachnids	50
Class Insects (Insecta)	
Order Dragonflies (Odonata)	60
Order Orthopterans (Orthoptera)	146/13
Order Homopterans (Homoptera)	
Suborder Scale insects (Coccoidea)	140/22
Other Homopterans	400
Order Hemipterans (Hemiptera)	500
Order Beetles (Coleoptera)	4400/286
Order Hymenopterans (Hymenoptera), incl.:	
Superfamily Bees (Apoidea)	195
Family Ants (Formicidae)	116/5
Family Encyrtidae	170/20
Family Braconidae	245/14
Other Hymenopterans	1500
Order Butterflies and Moths (Lepidoptera), incl.:	
Suborder Butterflies (Rhopalocera)	253/6
Family Geometer moths (Geometridae)	321/19
Other Lepidopterans	2500
Order Dipterans (Diptera), incl.:	
Family Black flies (Simuliidae)	49/10
Family Horseflies (Tabanidae)	80
Family Mosquitoes (Culicidae)	20
Family Gallflies (Cecidomiidae)	55
Other Dipterans	1000
Other Insects	800
Other Invertebrates	1000
Total Invertebrates	~17200/479

Taxa	Number of species/ number of Armenian endemics
Type Chordates, Subtype Vertebrates (Chordata: Vertebrata)	
Class Fish (Osteichthyes)	39/3
Class Amphibians (Amphibia)	7/0
Class Reptiles (Reptilia)	53/6
Class Birds (Aves)	357/1
Class Mammals (Mammalia)	93/6
Total Vertebrates	549/16
Total Animals	~17750/495

Appendix 5. Map of the Specially Protected Nature Areas of Armenia

