Nature and the economy

The results of economic valuation of ecosystem services in Turkmenistan

Technical report

This report was prepared by an Intersectoral technical expert group for identification and valuation of ecosystem services with the support of the joint project of the Ministry of Nature Protection of Turkmenistan, the United Nations Development Program (UNDP) in Turkmenistan and the Global Environmental Facility (GEF) on "Planning of National Biodiversity to support the implementation of the Convention on Biological Diversity (CBD) for the period of 2011-2020" (Reg. ЕК-848 of 1/07/2013). Method of economic valuation was developed with the support rendered by the British company "Metroeconomica Ltd". On the national side the technical support was provided by the National Chief Technical Advisor (NCTA) and the Project Implementation Unit.

Members of the Intersectoral technical expert group:

Aygul Melyayeva	*Ministry of Nature Protection of Turkmenistan*
Amangozel Atayeva	*Ministry of Finance of Turkmenistan*
Meretguly Ezizov	*Fishery Committee of Turkmenistan*
Jora Gundogdyyev	*Ministry of Water Economy of Turkmenistan*
Saparmurat Shalyyev	*Institute of Strategic Planning and Economic Development under the Ministry of Economy and Development of Turkmenistan*
Yusup Seyitgeldyyev	*Institute of Economy and Management*
Murat Nepesov	*Union of Economists of Turkmenistan*

Representatives of the Company "Metroeconomica Ltd":
Anil Markandya
Elena Strukova

Representative of the UNDP Turkmenistan:
Oleg Guchgeldiyev, National Senior Technical Advisor (NSTA), project on "Planning of National Biodiversity to support the implementation of the Convention on Biodiversity for the period of 2011-2020".

Ссылка на документ обязательна в виде: ESVAL 2014. Nature and Economy. Results of ecosystem services valuation in Turkmenistan. Technical report. Ashgabat 2014.

"Today the environment has a direct impact on human lives and well-being all over the world, the implementation of plans for social and economic development, situation in different regions and affects relations between states".

Source: Press conference of the President of Turkmenistan Gurbanguly Berdimuhamedov based on the results of participation in the 65-th UN General Assembly.

Table of Content

1. Summary 5

2. Introduction 9
   2.1. Description of the project 10
   2.2. Description of the conservation plan development process 10

3. Methodology 12
   3.1. Definition of ecosystem services 13
   3.2. Description of the ecosystem approach 15
   3.3. Description of the methodology of rapid assessment and valuation 15
   3.4. Description and the key method of economic valuation of ecosystem services 16

4. Study results. Ecosystem services and their value in Turkmenistan 24
   4.1. Drinking water 26
   4.2. Irrigation water 27
   4.3. Pastures 27
   4.4. Medicinal plants and fat 29
   4.5. Fishing and hunting goods 30
   4.6. Forests and climate change 30
   4.7. Protected areas of Turkmenistan 31
   4.8. Firewood 31

5. Recommendations for biodiversity conservation 33
   5.1. National level 34
   5.2. Sectoral level 34

6. References 37

Annex 1. Method of the quick identification and economic valuation of ecosystem services (summary) 38

Annex 2. The principles of the ecosystem approach (summary) 40

Annex 3. Classification of ecosystem services 42

Annex 4. Table on value of existence of important species in Turkmenistan by method of transfer 44

Annex 5. Description of pasture ecosystems, number of cattle and pasture productivity 45

Table of Content

Figures

Figure 1.	Major ecosystems in Turkmenistan	13
Figure 2.	Examples of ecosystems in Turkmenistan	14
Figure 3.	Carrying out the valuation of ecosystem services in Turkmenistan	17
Figure 4.	The key "keepers" of carbon and air oxidation agents in Turkmenistan	23
Figure 5.	Map of pasture lands in Turkmenistan	47

Charts

Chart 1.	Key ecosystem services in Turkmenistan	7
Chart 2.	Principles of strategic planning and action plan for biodiversity conservation	11
Chart 3.	Process of identification and selection of ecosystem services	15
Chart 4.	Process of gathering information for valuation of ecosystem services	16
Chart 5.	Phases of work implementation for valuation of ecosystem services in Turkmenistan	17
Chart 6.	Ranking ecosystem services in Turkmenistan	25
Chart 7.	Trade in medicinal plants by private sector in welayats	30

Tables

Table 1.	Method of economic valuation of ecosystem services	7
Table 2.	Forage yield of pastures in Turkmenistan by welayat	21
Table 3.	Rational pasture capacity in Turkmenistan (by welayats)	22
Table 4.	Economic valuation of ecosystem services in Turkmenistan (by welayats, thousand manats)	25
Table 5.	Economic valuation of provision of irrigation water in Turkmenistan	26
Table 6.	Market value of the livestock and goods delivered by pastures	28
Table 7.	Calculation of the total value of natural pastures in Turkmenistan based on stock keeping all year round and production output	29
Table 8.	Value of carbon absorption by forests in Turkmenistan	30
Table 9.	Value of carbon absorption by forests in Turkmenistan	32
Table 10.	Area of natural pastures of Turkmenistan by grades	46
Table 11.	Average weight of 1 animal (by the example of Sarjin sheep)	46
Table 12.	Average production output per 1 animal (by the example of Sarjin sheep)	47
Table 13.	Pasture productivity during the all year-round stock keeping	47

Acronyms

BSAP	"Planning of National Biodiversity to support the implementation of the Convention on Biological Diversity". Strategic Plan of Turkmenistan for the period of 2011-2020.
CBD	UN Convention on Biodiversity.
Convention	UN Convention on Biological Diversity.
ESVAL	Identification and economic valuation of ecosystem services, brief title of the study in Turkmenistan (acronym).
GEF	Global Environmental Facility.
Centners	Hundredweight Equals 100 metric kilograms.
IUCN	International Union of Conservation of Nature.
Kg	Kilogram.
m^3	Cubic meters.
NCTA	National Chief Technical Advisor.
NPAs	Nature protection areas including wildlife sanctuaries, nature reserves, parks etc.
PA	Protected areas, including zapovedniks (strictly protected areas), zakazniks (wildlife sanctuaries), parks and other.
SL	Small livestock.

Summary

Raising awareness among decision-makers about the importance of conservation of ecosystem services was one of the objectives of identification and valuation of ecosystem services in Turkmenistan. Development of proposals (activities) and mainstreaming economic instruments in the management of ecosystem services was also the objective of the work performed.

1

With increasing understanding of the dependence of the economy, health, and human existence on the so-called ecosystem (natural) services, there is growing global recognition of the importance of their conservation and sustainable use. Ecosystem services include both – services which bring direct benefits to people, such as food, water, pastures and so on, and non-direct, invisible services which do not bring direct benefits but play an important role in the provision of direct services (e.g. pollination), as well as protecting people from natural and other disasters (e.g. floods, landslides).

The use of the ecosystem approach, when analyzing the whole of ecosystem services and decisions aimed at their conservation becomes more important as a policy tool for sustainable livelihoods. Economic valuation, in turn, helps improve understanding of the importance of certain services and offer economic tools that maintain these services.

The Convention on Biological Diversity signed by Turkmenistan in 1996, offers two out of twenty global strategic goals for conservation of biodiversity related to the use of economic valuation of ecosystem services as a tool for decision-making and general policy development, particularly in economic sectors (Aichi Targets 1 and 2).

Raising awareness among decision-makers about the importance of conservation of ecosystem services was one of the objectives of identification and valuation of ecosystem services in Turkmenistan. Development of proposals (activities) and mainstreaming economic instruments in the management of ecosystem services was also the objective of the work performed.

Experts from Turkmenistan used the "Methodology of the quick identification and valuation of ecosystem services", aimed at the capacity building of local experts on economic valuation through the intensive training, engagement of representatives from all key economic sectors and local people for identification of major ecosystem services in regions and quick valuation of the most important services. As part of the implementation of this method, a 10-day training course with participation of the British company "Metroeconomica Ltd." was conducted, and a technical group of experts from the ministries, educational establishments and NGOs was set up.

During the activities carried out in welayats (regions) of the country, twelve key ecosystem services, including irrigation water, drinking water, tourism and recreation (health resorts), historical and cultural monuments, habitats provided by nature reserves, landscapes of nature reserves, pasture lands, hunting and fishing goods, fruit harvesting (including pistachio nuts), medicinal plants and fat, pollination, climate regulation by forests were identified. Out of the total number, only eight ecosystem services were selected for valuation. The lack of data means for data gathering and accurate assessment and other were the main reasons for this limitation. Therefore, the valuation was carried out without social studies and surveys, only with the involvement and participation of local stakeholders.

The method of economic valuation was approved by leading experts of the company "Metroeconomica Ltd.". Brief methodology presented by the table1includes methods of market value assessment of the services delivered, costs of inputs for provision of services, assessment of provision of the alternatives and other.

Based on the results of the conducted analysis, the total annual value of key ecosystem services in Turkmenistan is estimated at approximately 7.84 billion manats or 2.75 billion USD in 2014. This is equal to 3% of the gross national product (GNP) or 14% of the gross agricultural product.

Pastures are the most valuable ecosystem services (Chart 1). Their value constitutes more than 62% of the total value of natural services, or approximately 4.863 billion manats per year (1.706 billion US dollars). Other important ecosystem services are: irrigation water provision (1.846 billion manats), drinking water (approximately 450 million manats per year), and provision of habitats by the national nature reserves (about

Table 1. Method of economic valuation of ecosystem services.

Ecosystem service	Calculation methodology
Drinking water	Calculation of cost of inputs for water provision
Irrigation water	Calculation of cost of inputs for water provision
Pastures	Calculation of pasture capacity and sustainable use of forage
Firewood	Alternative supply of firewood (market value of the alternative)
Fishing and hunting resources	Calculation of the product market value
Forests (climate change)	Calculation of cost of greenhouse gas emission
Natural medicinal plants	Calculation of the product market value
Nature reserves (protected areas)	Value of habitats (costs for provision of habitats, feed and value of provided lands), value of conservation of important species

Source: Authors.

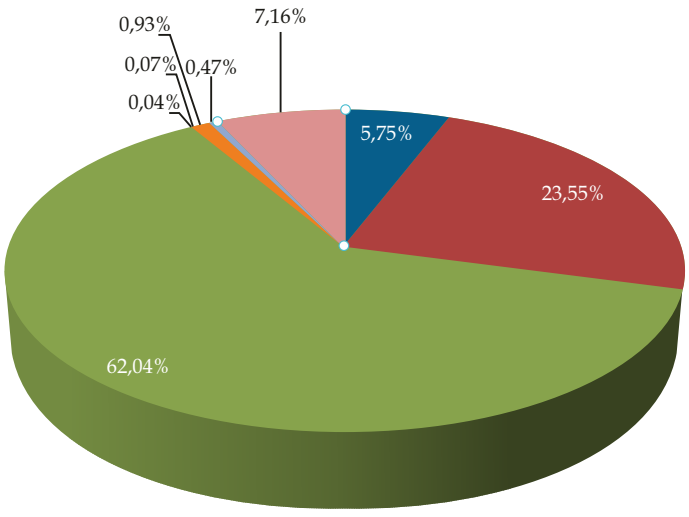
562 million manats per year). It should be taken into account that the latter does not include such important economic services as preservation of water catchment in river basins, provision of pollination services, pastures and value of conservation of wild relatives of cultivated plants. All this can significantly increase the value of nature conservation in nature reserves.

The results of the work performed show economic value and importance of provision of ecosystem services in Turkmenistan. Special attention should be given to pastures as the most valuable natural capital. The analysis revealed the need for development of the mechanisms of sustainable pasture use, development and implementation of new forms of financing for pasture conservation. For example, the money paid for the use of pastures can be allocated for implementation of mechanisms of the

*Based on the results of the conducted analysis, the total annual value of key ecosystem services in Turkmenistan is estimated at approximately **7.84** billion manats or **2.75** billion USD in **2014**. This is equal to **3%** of the gross national product (GNP) or **14%** of the gross agricultural product.*

Chart 1. Key ecosystem services in Turkmenistan.

Drinking water	5,75 %
Irrigation water	23,55 %
Pasture lands	62,04 %
Firewood	0,04 %
Fishing and hunting goods	0,07 %
Forests (climate change)	0,93 %
Natural (medicinal) plants	0,47 %
Nature reserves (protected areas)	7,16 %



sustainable pasture management. The same concerns protected areas. According to the assessment, the services delivered by nature reserves significantly exceed maintenance costs for such services; it shows profitability of "investing" in nature protection activities. To conduct the total inventory of ecosystem services in nature reserves, to use the economic assessment for justification of the new nature reserves and parks could be the areas for future activities, aimed at integration of economic valuation of nature resources into the decision-making process.

Introduction

2.1. Description of the project

2.1. Description of the project 10
2.2. Description of the conservation plan development process 10

2

The project "Planning of National Biodiversity to support implementation of the Convention on Biodiversity. Strategic Plan of Turkmenistan for the period of 2011-2020" was funded by the Global Environmental Facility and implemented jointly by the Ministry of Nature Protection and the UNDP Turkmenistan. The key objective of the project is to identify country's goals for integration of biodiversity conservation and sustainable use in economic sectors dealing with the use of natural resources and mainstreaming these goals into the government planning structures.

The main tasks of the project were the following: the review of the system of biodiversity planning, the development of the new state goals and an update of the Action plan as well as enhancing the national system of implementation of the Action plan on biodiversity conservation.

The project envisaged the implementation of the following important activities: the review and analysis of the system of biodiversity planning, the conduct of economic valuation of ecosystem services, the analysis and development of activities in order to mainstream biodiversity issues into economic sectors.

Within the implementation of international commitments pertaining to the Convention on Biodiversity, the project has prepared the 5th National Report for the Convention and the 2nd National Report for the Cartagena Protocol, and will update the Internet site related to the mediation mechanism of sharing information between the countries - parties to this Convention.

The project also takes a new approach to the co-operation between the UNDP Turkmenistan and the Government. The new approach is aimed at the enhancing expertise and capacity building of the government officials and joint implementation of the project. For the implementation of the project and preparation of the BSAP an intersectoral working group comprising mid-level officials - representatives from eight key ministries was set up. Besides, a technical group for carrying out economic valuation and an intersectoral technical group of IT experts were set up and trained.

2.2. Description of the conservation plan development process

During its implementation, the project was guided by the relevant international practices, adopted by the Convention on Biodiversity, which Turkmenistan acceded to in 1996. Moreover, the project developed a methodology aimed at the integration of biodiversity issues into production sectors of the country in order to mainstream issues of biodiversity conservation into the national, sectoral and local development plans.

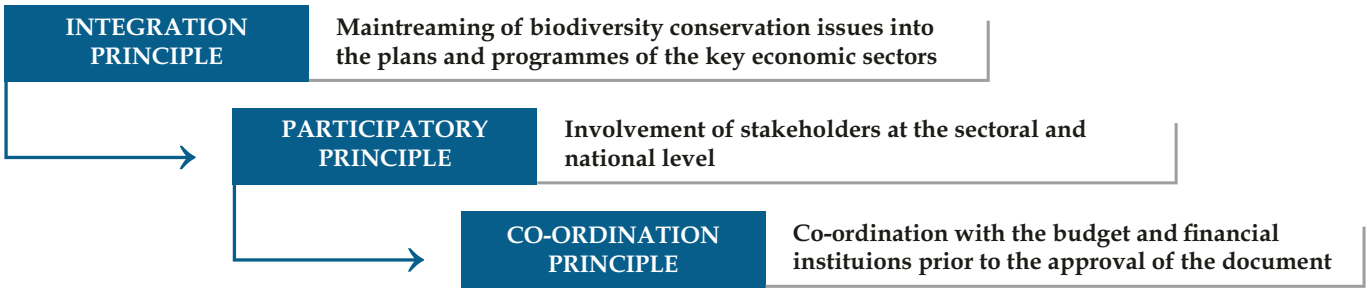
The main principles of this methodology shown in the Chart 2 are as follows:

- ***Integration principle,*** or mainstreaming, during the earliest activities and development planning stage, biodiversity conservation issues into the plans and programs of the key economic sectors that have an impact on nature.
- ***Participatory principle,*** or involvement of all stakeholders at the sectoral level in the development of envisaged activities and increase the ownership of the activities carried out by the sectoral agencies.
- ***Co-ordination principle,*** or approval and co-ordination of conservation activities with the budgetary and

- financial institutions at the early stage with the aim of preparation of robust project activities and financial plans hereto.

Economic valuation of ecosystem services is an important part of the preparation of national strategy and action plan on biodiversity conservation, as ensuring understanding of biodiversity values will lead to broad political support[1] for funding the issues of biodiversity conservation.

Chart 2. Principles of strategic planning and action plan for biodiversity conservation.



All activities of the project are implemented with participation of the relevant government officials and experts from other institutions in order to build their capacity and, subsequently, jointly implement the project objectives.

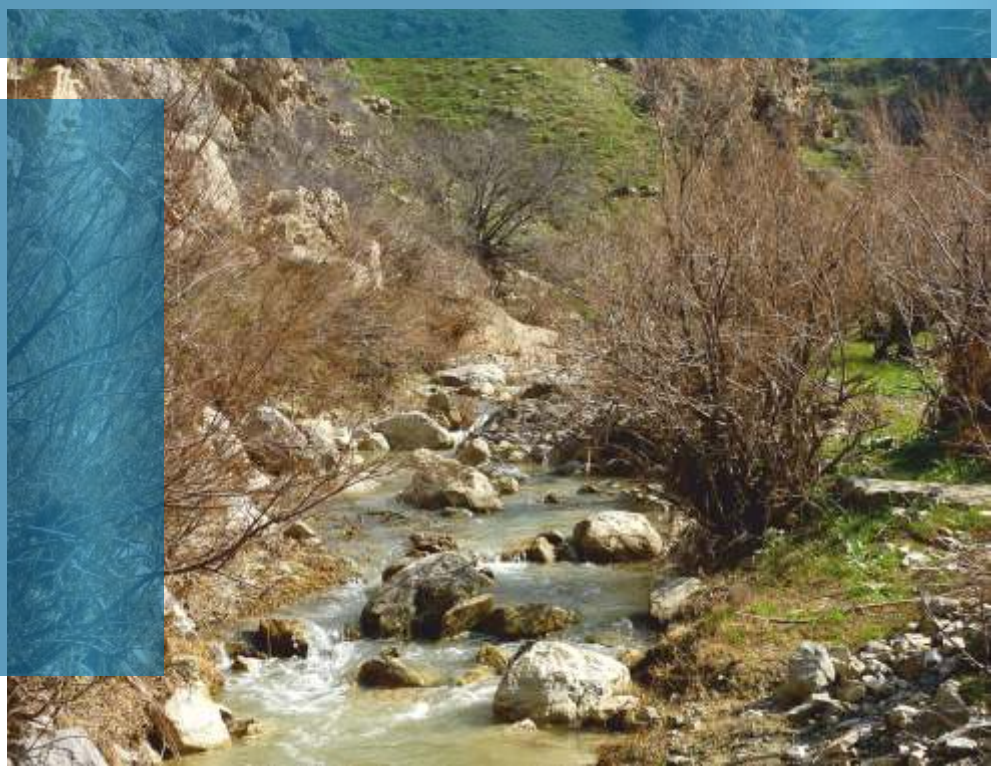
[1] Decision of the CBD, UNEP/CBD/COP/DEC/X/2

Methodology

3.1. Definition of ecosystem services

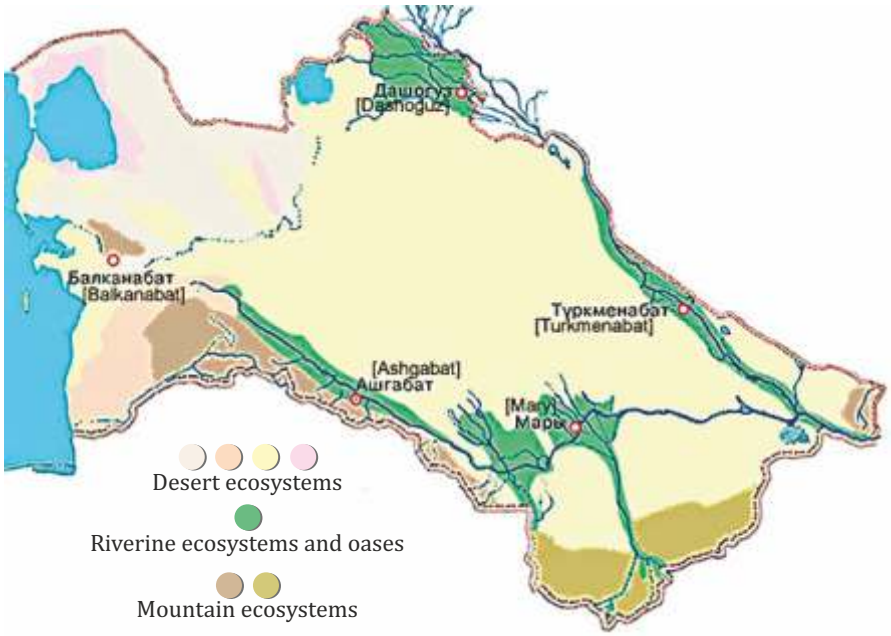
3.1. Definition of ecosystem services 13
3.2. Description of the ecosystem approach 15
3.3. Description of the methodology of rapid assessment and valuation 15
3.4. Description and the key method of economic valuation of ecosystem services 16

3



Sand, clay and gypsum deserts, river valleys, oases and mountains are the main ecosystems of Turkmenistan. Deserts cover the major (more than 80%) area of the country, followed by mountainous ecosystems, then oases and river ecosystems. Marine ecosystems occupy the biggest part of the western borders of the country.

Figure 1. Major ecosystems in Turkmenistan.



Source: http://enrin.grida.no/htmls/turkmen/soe2/english/diagrams/mapeco.htm

"the conditions and processes through which natural ecosystems and species that make them up, sustain and fulfill human life".

Ecosystems are an integral part of human activity and connected to it through ecosystem services. The CBD Convention defines ecosystem services as "benefits that natural ecosystems provide to people". Another definition of ecosystem services is: "the conditions and processes through which natural ecosystems and species that make them up, sustain and fulfill human life".

Ecosystem services may include "provisioning services i.e. provision of beneficial goods", such as wild foods, raw materials, fresh water, plant-derived medicines and others, "regulating services/functions", such as local climate regulation, air quality, carbon sequestration and storage, mitigation of extreme weather phenomena, waste water treatment, prevention of soil erosion and maintenance of soil productivity, pollination, biological control and other services, as well as supporting services (control of habitats for flora and fauna, conservation of genetic diversity), and cultural and aesthetic services, including recreation, tourism, source of inspiration/spiritual values for culture, art and design etc. (See Annex 3. Classification of ecosystem services)

Following consultations at the level of welayats, the following ecosystem services of Turkmenistan were recognized as most important:

- **Irrigation water.**
- **Drinking water.**
- **Tourism and recreation, health resorts, historical and cultural monuments.**
- **Provision of habitats by nature reserves.**
- **Pastures.**

- **Landscapes of nature reserves.**
- **Hunting and fishing goods.**
- **Harvest of fruit, including pistachio nuts.**
- **Medicinal plants, fat.**
- **Pollination.**
- **Climate regulation by forests.**

Only some of these services were selected for economic valuation after the collected data was analyzed.

Figure 2. Examples of ecosystems in Turkmenistan (from left to right): desert ecosystem, mountainous ecosystem and ecosystem of river valleys.

3.2. Description of the ecosystem approach

Ecosystem approach stipulates mainstreaming the issues of restoration or conservation of systematic supply of ecosystem services into the processes of natural resource management or local decision-making. The approach includes stocktaking and maintenance of the process of provision of people with natural services during the decision-making process. Moreover, the approach recognizes a human being as a part of ecosystem.

"The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way".

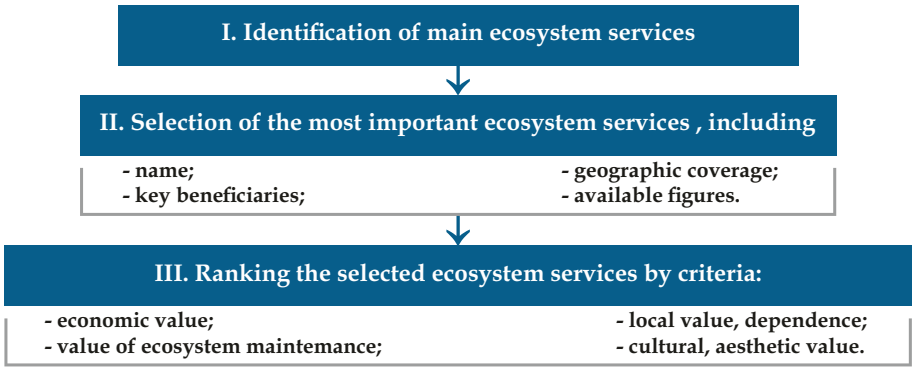
The CBD Convention defines the ecosystem services approach as follows: : "The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way".

The Convention defines several principles of implementation of the ecosystem services approach, including recognition of importance of resource management at the local level (de-centralized management), consideration of the impact on other ecosystems during decision-making, conservation of ecosystems' functioning for provision of ecosystem services and others. These principles are included in the annex 2.

3.3. Description of the methodology of rapid assessment and valuation

The methodology based on participatory assessment was applied for the identification and selection of important ecosystem services. For this, a group of experts from stakeholder organizations conducted a number of methodological workshops for representatives from economic sectors, including nature protection sector, and local governments. The identification and selection process is shown in the .

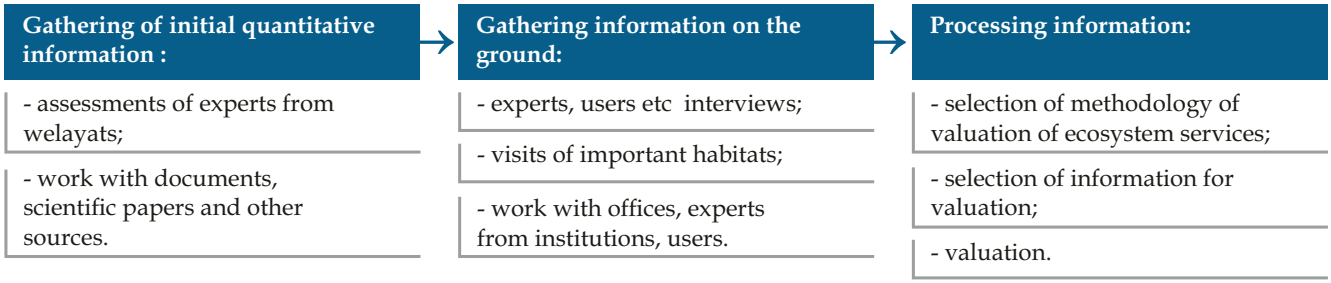
Chart 3. Process of identification and selection of ecosystem services.



In each welayat after a workshop was conducted, the field trips were organized to visit important sites delivering ecosystem services and to gather the data and information. The main information sources were the expert knowledge of the working group participants, the data received from the local sectoral representatives as well as

the information gathered during the field trips by way of interviews, surveys and site visits. The process of gathering information for valuation of ecosystem services is shown in the .

Chart 4. Process of gathering information for valuation of ecosystem services.



3.4. Description and the key method of economic valuation of ecosystem services

General information about valuation

The methodology of "the rapid assessment and valuation of ecosystem services", developed by the technical expert group, was applied for identification of value of ecosystem services. The main features of this method are the following:

- engagement of the broad number of local stakeholders during the stage of identification and valuation of ecosystem services, which enabled identification and selection of the most important ecosystem services with high accuracy;
- involvement of specialists from the ministries, academia and non-governmental sector in the implementation of the activities aimed at the development of the required product;
- capacity building of the local government officials and broad number of stakeholders in the issues of the ecosystem approach, ecosystem services and their valuation.

The main working phases are shown in the. First steps included setting up an intersectoral technical expert team to conduct valuation, which included representatives from the national ministries and agencies dealing with the use of natural resources and ecosystem services, as well as academic institutions and professional agencies. Then an intensive training for 18 institutions, including ministries and agencies, educational establishments and professional agencies was held. A 10-day workshop, organized by the company "Metroeconomica Ltd", pursued the aim of the capacity building at national planning, financial institutions and natural resource management agencies on the issues of the ecosystem approach, methodology of identification and valuation of ecosystem services.

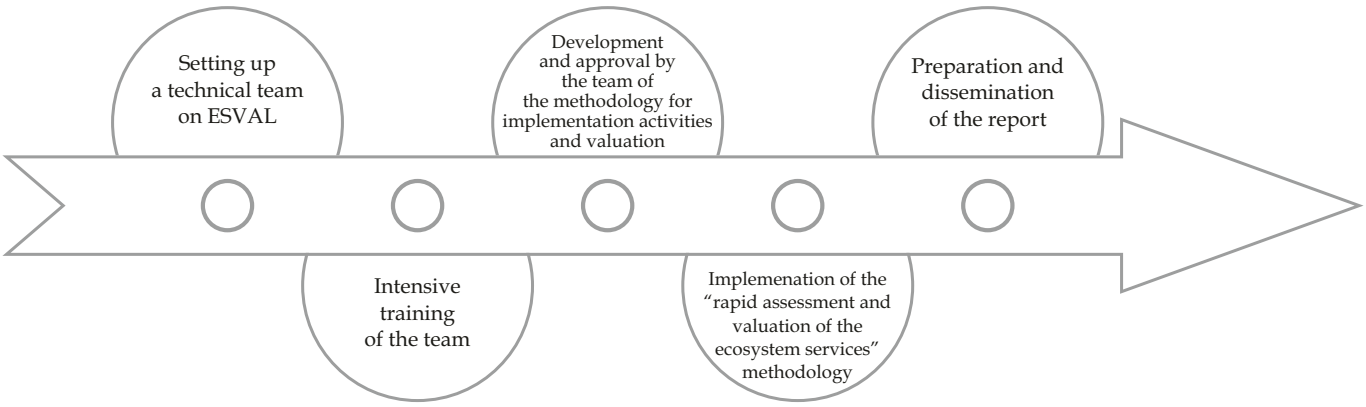
During the training, its participants discussed the "rapid assessment and valuation of the ecosystem services" methodology and details of its implementation. The methodology of rapid assessment and valuation of the ecosystem services is included in the Annex 1. The main elements of this method are: identification and ranking

Figure 3. Carrying out the valuation of ecosystem services in Turkmenistan.

(from right to left and down): participants of training workshops on economic valuation; participants of the working group take interview from the staff of the Hazar State Nature Reserve; the representative of the Ministry of Finance G. Atayeva helps the participants to rank ecosystem services during the stakeholders meeting in Lebap welayat.

(selection) of the ecosystem services, carrying out the economic valuation and analysis of the outcomes. For this purpose, visits were organized to all welayats of the country. During these visits, the working group conducted stakeholder meetings, field trips to the sites delivering the important ecosystem services, fieldwork to collect the missing data. This was followed by working meetings on the ground, economic valuation by team members that was discussed at a later stage with economists from the "Metroeconomica Ltd".

Chart 5. Phases of work implementation for valuation of ecosystem services in Turkmenistan.



Ranking ecosystem services

In order to identify the most important ecosystem services the ranking of ecosystem services by their relevance was performed. Below are the main ranking criteria:

- value of a service for the regional or national economy;
- value of a service for ecosystems maintenance;
- value for the local people, including their dependence on the service;
- cultural and/or aesthetic value.

Economic valuation of ecosystem services identified by the methodology of rapid assessment and valuation was built on the existing methodology developed by the experts from the company "Metroeconomica Ltd." and after the approval by this company was adapted by the working group members. Details of the methodology are provided below.

Drinking and irrigation water

Drinking water provision to meet the needs of people could be calculated on the base of the alternative provision of water resources. Alternative water provision could be calculated by two ways:

- Water provision from other sources by delivering the water by automotive water tanks with carrying capacity of 5 tons. For instance, mountainous villages can be provided with water only this way.
- Water extraction from wells and water treatment. The water extracted from wells usually has mineralization up to 5g/l. Water treatment is calculated based on the technology of back osmosis, that is:
  - Investments in equipment and a well will be approximately $1 per one produced liter. Depreciation period for equipment (pumps, tanks) is 8 years.
  - Replacement period for the water stop is 12 months, other filters - 6 months. Other operational expenditures include salaries, electricity bills and other administrative costs. The plant with the production capacity of 6,000 liters per day was selected for the calculation purposes.

As there is no real market price for water and the alternative water consumption (e.g. for power production) is minimal, the value of irrigation and provision of drinking water was calculated by means of definition of the so-called "shadow pricing". The "shadow pricing" or the value of water resources is based on the costs of water supply to the end user. The costs comprise operational and capital costs for rehabilitation and construction of infrastructure. For the purpose of this study, the calculation of costs for irrigation and drinking water supply by welayats of Turkmenistan in 2010 was used.

Firewood harvesting

Firewood harvesting was assessed by the method of the alternative wood provision. The current use of wood harvested in nature was estimated in cubic meters and multiplied by the market price of wood in each welayat accordingly.

Protected areas

Protected areas (PAs) have a number of ecosystem services which are of paramount importance for nature conservation. These functions include provision of habitat, functions of conservation of protected and migratory species, support to conservation of genetic and biological diversity, support to functioning of river catchment areas and others.

Moreover, many PAs significantly invest in the national socio-economic life. For instance, maintenance/conservation of water catchment areas of many mountainous rivers, support and provision with medicinal plants and pastures (in wildlife sanctuaries), provision of pollination by wild bees the surrounding orchards and agricultural crops – all these regulating functions delivered by the nature reserves play an important role for the support of such economic sectors as agriculture and fishery, as well as the people residing within or in the vicinity of the protected areas.

In this study, identification of the value of national PAs is a result of the assessment of both habitats of important species covered by the Red Book of Turkmenistan, and value of existence of these species.

Habitats for important species

For quick valuation only the most important species of animals included in the red Book of Turkmenistan and the IUCN Red List of species inhabiting the territories of the nature reserves were taken.

The total value of habitats comprises the value of food and value of wildlife conservation from anthropogenic impacts, which can be shown in the following formula:

$$V_{hab} = V_f + V_{pr},$$

where

V_{hab} - total value of habitats,

V_f - value of provision of forage/food,

V_{pr} – value of conservation of wildlife habitat.

Provision of the forage for each of valuable species V_(f)can be presented as the calculation of the alternative provision of food.

$$V_f = S_{pop} \times D_{daily} \times N_{dh} \times P_{alt},$$

where

V_f - value of a service for provision of habitats,

S_{pop} – number of population of species,

D_{daily} –diet (food) required/per day per one animal ,

N_{dh} - number of days of habitation for each animal,

P_{alt} - cost of alternative food.

Value of conservation of wildlife for each of species can be presented as costs required for the maintenance of protection regime for wildlife in the habitats of species, and allotment of lands for habitats. For the former the operational costs of nature reserves for protection of habitats were applied. For the latter the alternative cost of land lease in the amount of 285 manats per hectare per year was applied.

Value of existence

In order to assess the value of existence the method of readiness to pay as well as other methods of indirect assessment were applied. As the studies similar to the current one were never conducted in Turkmenistan before, the method of value transfer was used, when the assessment made in other countries related to similar species of animals was transferred based on the difference between the real GDP per capita and indexation with reference to the year 2013.

Hunting and fishing products, collected herbs and cherries and similar

Products extracted from the nature as a result of hunting, fishing, plants and berries harvesting for food and medical purposes were assessed based on the market value method. For this the following formula could be used:

$$V = Q_{пр} \times P_{рыноч} - Q_{пр} \times C_{доб},$$

where

$Q_{пр}$ – quantity of goods collected, harvested, extracted from the nature,

$P_{рыноч}$ – purchasing price or market price of goods,

$C_{доб}$ - costs associated with extraction, catch or harvest of the unit of goods.

In case when the costs of extraction or catch/collection are not available, either the peer review is applied or the principle of ***50% of the market value of goods.***

Pastures

During the valuation of ecosystems, types of services provided by a certain ecosystem free of charge/gratis and their benefits for people are taken into consideration. Pastures are open ecosystem that provides the possibility for cattle grazing all year round. The basis for the migratory grazing, i.e. the pasture forage, is fully provided to us by the nature.

Table 2. Forage yield of pastures in Turkmenistan by welayat.

Administrative region	Pasture area [thousand hectares]	Forage yield - gross annual average [centners/hectare]	Gross annual average quantity of forage [thousand centners /year]
Balkan welayat	10 291,95	3,66	37 683,66
Ahal welayat	9 065,41	3,03	27 507,19
Mary welayat	7 670,79	3,43	26 292,12
Lebap welayat	7 940,34	2,65	21 015,20
Dashoguz welayat	5 670,68	2,74	15 514,20
Total in Turkmenistan:	40 639,17	3,15	128 012,37

Source: Institute of Deserts, Flora and Fauna of Turkmenistan.

Such service can be valued based on the output of the final products (in our case, these are meat and wool produced by small cattle) as well as n the number of livestock during the pasture grazing all year round. This service can be assessed by comparison with the cost of alternative sources for forage required.

The first approach was taken as a basis for valuation. The market value of the livestock (per head) and that of the major goods (meat and wool produced by the small cattle) were selected as indicators.

The scientific research data provided by the National Institute of Deserts, Flora and Fauna under the Ministry of Nature Protection of Turkmenistan was used for the calculation. Because of compilation and aggregation of data on the seasonal yield of forage crops by pasture types the following picture was received (see).

Based on the available information, the capacity of pastures, their ability to provide grazing for the certain number of livestock without causing irreversible degradation of the vegetation and soil cover had to be calculated. The concept of "permissible load" of cattle grazing was included in the "pasture capacity" concept and it should correspond with the qualitative state of pastures taking into account the vegetative mass consumed by the cattle.

Pastures of Turkmenistan make grazing possible all year round; nevertheless it is an extremely fragile ecosystem which is exposed to natural and anthropogenic degradation. This is why the necessary following assumptions were made.

First assumption:

- All year round pasture grazing of the small cattle allows cutting production costs for livestock production to the minimum.

It means that during valuation of pastures the significance of ecosystem services delivered to us by pastures goes up to the maximum.

Second assumption:

- The impact of cattle grazing on pastures can be both positive and negative. Whereas moderate cattle grazing based on pasture rotation usually contributes to the renewed growth of the pasture vegetation, heavy and protracted loads of pasture grazing especially during the vegetation period inevitably lead to the extinction of the most valuable forage grasses from the grass cover and consequently to pasture degradation and their removal of use.

While maximizing the significance of this ecosystem service, it is extremely important to ensure the future sustainable development of the pastures as an eco-system i.e. to avoid increasing risks of pasture degradation as a result of anthropogenic effect. Pastures being a "live ecological organism" have their own natural degradation.

For determination of pasture capacity we shall rely on the evidence-based and recommended for the conditions of Turkmenistan following rations for the transhumance stock keeping [2]:

- 720 kg – annual ration per head of the livestock, based on daily consumed forage and seasonal duration characteristic for Turkmenistan.
- 810 kg – annual ration per head of the livestock based on the standard structure of the cattle and its turnover.
- 950 kg – annual ration of pasture forage per head of production output of the livestock taking into account an insurance stock (up to 15-17%), based on the arid zone and climate conditions stipulating the yield fluctuations from year to year.

Ration a) is used usually for the calculation of potential capacity of pastures, and should meet the first mentioned assumption, but should be critical in regard to the second assumption. Ration c) agrees most with the second assumption but implies available irrigated lands (apart from pastures) for production of the insurance forage stock. For the solution of our task the ration b) is ideal because it meets both assumptions and takes into account the standard structure and the cattle turnover, which is required during the calculation of the production output.

Second aforementioned assumption also stipulates the use of the indicator "Consumption of pasture forage stocks", not the gross value of stocks. The calculated results of the rational pasture capacity are shown below (see):

Table 3. Rational pasture capacity in Turkmenistan (by welayats).

Natural pastures of Turkmenistan	Area [thousand hectares]	Consumption of the pasture forage per annum [centners /h]	Average quantity of the consumed forage per annum [thousand centners/ year]	Rational pasture capacity [thousand heads of small cattle/year]	Calculated pasture ration [hectares/head]
Mary welayat	7 670,79	1,26	12 994,65	1 604,28	6,42
Balkan welayat	10 291,95	1,28	11 622,25	1 434,85	6,32
Dashoguz welayat	5 670,68	1,85	14 194,07	1 752,35	4,38
Lebap welayat	7 940,34	1,18	9 351,26	1 154,48	6,88
Ahal welayat	9 065,41	1,01	5 706,61	704,52	8,05
Total in Turkmenistan:	40 639,17	1,33	53 868,86	6 650,48	6,11

Note: Consumption of the pasture forage, based on biodiversity conservation and pasture sustainability.
Source: Authors' calculations.

Climate regulation by forests

Climate regulation is assessed by the calculation of purified and captured carbon with the use of carbon price at the International Climate Exchange for trade in greenhouse gas emissions. For this purpose, the quantity of forests in hectares is calculated, and then an average biomass per a hectare of forest is determined, followed by the calculation of captured gases, according to the available scientific estimates.

Then the value of carbon sequestration is assessed on the base of prices of Chicago Climate Exchange or European Climate Exchange.

Figure 4. The key "keepers" of carbon and air oxidation agents in Turkmenistan.

(left to right, up to down): the riverside tugay forests; wetlands; mountainous forests; the trees planted under the government programmes.

Study results

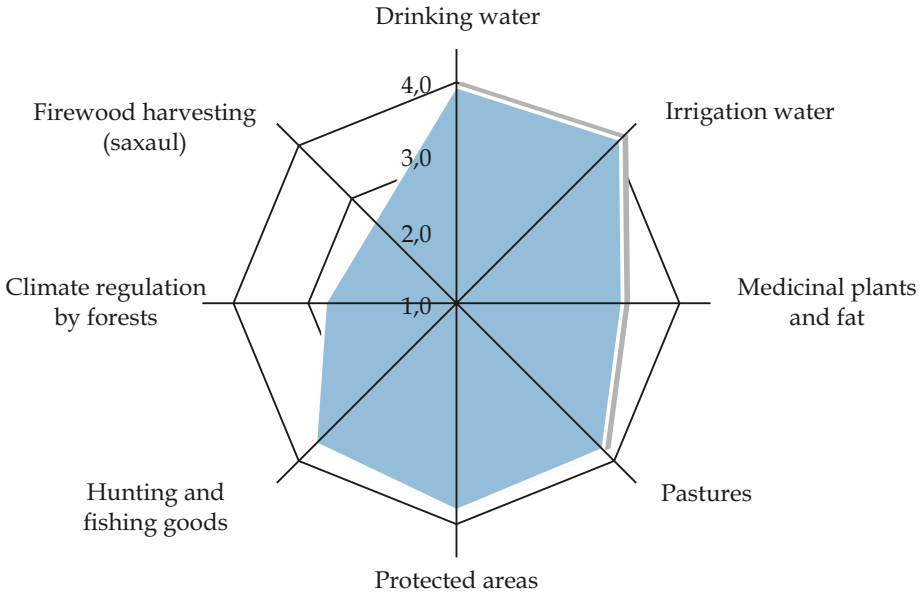
Ecosystem services and their value in Turkmenistan

4.1. Drinking water 26
4.2. Irrigation water 27
4.3. Pastures 27
4.4. Medicinal plants and fat 29
4.5. Fishing and hunting goods 30
4.6. Forests and climate change 30
4.7. Protected areas of Turkmenistan 31
4.8. Firewood 31

4

The results of the conducted valuation revealed the most important ecosystem services of Turkmenistan. During the work with stakeholders the ranking of ecosystem services by their relevance was carried out. The summarized results are shown in the Chart 6.

Chart 6. Ranking ecosystem services in Turkmenistan.



"In Turkmenistan, the irrigation and drinking water, pastures, protected areas and wildlife goods are the most important ecosystem services, whereas the firewood and climate regulation by forests were deemed less important."

Table 4. Economic valuation of ecosystem services in Turkmenistan *(by welayats, thousand manats).*

Service/Welayat	Ahal	Balkan	Dashoguz	Lebap	Mary	Total in Turkmenistan
Drinking water	66,374	64,795	120,340	103,441	95,756	450,706
Irrigation water	181,029	24,263	168,094	734,864	737,829	1,846,079
Pastures	515,249	1,049,372	1,281,580	1,173,285	844,324	4,863,810
Firewood	801	1,099	318	318	562	3,097
Fishing and hunting goods	698	3,538	262	588	210	5,297
Forests (climate change)	14,625	14,625	14,625	14,625	14,625	73,124
Natural (medicinal) plants	1,087	257	117	34,975	262	36,698
Protected areas	68,743	170,346	109,667	81,819	82,598	561,569
TOTAL	848,604	1,328,296	1,695,002	2,143,915	1,776,166	7,840,380

Source: Authors' calculations. NB: Data rounded off, possible discrepancy in sums.
Source: Authors' calculations.

As the Chart 6 shows the irrigation and drinking water, pastures, protected areas and wildlife goods are the most important ecosystem services, whereas the firewood and climate regulation by forests were deemed less important.

The results of economic valuation of ecosystem services in Turkmenistan presented in the Table 4. It shows the value of delivered ecosystem (natural) services in Turkmenistan, which is more than 7.84 billion manats or about 2.75 billion USD per year. This is approximately 12% of the gross national product (GNP) of the agriculture or 2.8% of the national GNP[2].

4.1. Drinking water

Provision of drinking water is one of the main functions of ecosystems in Turkmenistan. Turkmenistan has one of the highest rates of water consumption per capita which can be attributed to the high level of agricultural production, high water consumption by types of agricultural crop and use of fresh water in agriculture. A limited quantity of renewable water resources makes the provision of clean drinking water by existing water sources and its conservation a goal of paramount importance.

The main sources of drinking water are:

- Water supplied by the transboundary rivers Amudarya, Murgab, Tejen and others.
- Water supplied by small rivers and springs in the mountains of Kopetdag, Balkan, Koytendag.
- Underground aquifers.

Although the majority of water sources in Turkmenistan originates in other countries and they are transboundary by nature, some sources originate within the country namely in the northern slopes of Kopetdag, slopes of Balkan mountains and North-Western end of the Pamir-Tyanshan ridge. The total number of rivers and streams is about 2,972 with the total length of around 167 km.

Table 5. Economic valuation of provision of irrigation water in Turkmenistan *(thousand manats per year).*

Service/Welayat	Ahal	Balkan	Dashoguz	Lebap	Mary	Total in Turkmenistan
Irrigation water	**181 029**	**24 263**	**168 094**	**734 864**	**737 829**	**1 846 079**

Source: Authors' calculation.

Economic valuation of provision of fresh drinking water in Turkmenistan is more than 1.84 millions manats per year. This result was achieved due to the "shadow pricing" method, i.e. by estimates of service costs for provision of irrigated water in 2010. The distribution of results by welayats are presented in the Table 5.

[2] Data on the GNP taken from http://data.worldbank.org

4.2. Irrigation water

The total amount of water resources in Turkmenistan during the year of average water content is estimated as 25 cubic kilometers. Twenty two billion cubic meters or 88% of the total surface water runoff is supplied by Amudarya River. The remaining part is supplied by the Murgab River – 1.631 billion m^3 (6.5%), Tejen River – 0.869 billion m^3 (3.5%), Etrek, Sumbar and Chandyr rivers – 0.354 billion m^3 (1.4%) and small rivers – 0.15 billion $м^3$ (0.6%). The Karakum River plays an important part in accumulation and distribution of water resources. Currently its length is more than 1300 km. The total area, irrigated by the Karakum River, is approximately 2 million hectares. The annual gross water intake of the Karakum River according to the set limits is 11.6 billion m^3. The total intake from the underground aquifers fluctuates year by year within the limits of 470-650 million m^3/year. Total proven groundwater reserves in Turkmenistan are 3.4 million m^3/day, explored – 6 million m^3/day and projected reserves – 9 million m^3/day.

The structure of water consumption with regard to the categories of water users is as follows: 91.2% of the total amount is consumed by the agriculture, 6.3% - by the industry, 1.9% - by municipal/communal services, 0.1% - by fishery and 0.6% - by others.

Economic valuation of the irrigation water provision is more than 1,846 billion manats per year.

Economic valuation of the irrigation water provision is more than 1,846 billion manats per year.

4.3. Pastures

Valuation of pastures is based upon the number of the small cattle and its productivity (see Annex 5). The market value of the small cattle and production output (meat and wool) is the essence of pasture valuation i.e. valuation of assets in the form of pastures the nature provides us with.

On the base of the agricultural global market analysis, the average market price for mutton and lambs wool was determined as follows:

6,69 USD per 1 kg of mutton – weighted average cost of mutton[4];

0,477 USD per 1 kg of lambs wool exported from Turkmenistan[5].

After the study of the domestic agricultural market was completed, the average market price of 1 sheep was determined as 340 Turkmen manats that is equivalent to 119.29 USD.

The calculation of the annual market value of the livestock and production output is presented in the Table 6.

The principle of the best and most effective use of the subject of valuation is at the core of valuation. In our case, the pasture ecosystem is the subject of valuation. As opposed to a classical item of the real estate, natural pastures are vulnerable to degradation – both natural and anthropogenic. This is why the moderate grazing, based on pasture rotation, was in the center of attention as it contributes to the renewed growth of pasture vegetation i.e. biodiversity conservation.

[3] Here and further in the text, materials of the working report of the working group member Jora Gundogdiyev are used.
[4] According to the data of procurement prices on mutton in EU countries for January 2014 – source: http://www.farmit.ru/ekonomika/rynok-myasa/tseny-na-baraninu-es
[5] According to good exchange, fixed in recent times – source - http://rustm.net/catalog/article/2156.html

Table 6. Market value of the livestock and goods delivered by pastures.

Welayat	Number of the small cattle - sheep [thousand heads]	Market value of the small cattle - sheep [1000 US$/year]	Market price of mutton [1000 US$/year]	Market price of lamb wool [1000 US$/year]
Mary	1 604,28	191 387,59	393 403,24	3 322,10
Balkan	1 434,85	171 174,61	351 854,80	2 971,24
Dashoguz	1 752,35	209 052,86	429 714,75	3 628,73
Lebap	1 154,48	137 727,10	283 102,39	2 390,66
Ahal	704,52	84 048,00	172 763,31	1 458,90
Total in Turkmenistan	6 650,48	793 390,15	1 630 838,49	13 771,65

Source: Authors' calculations. Number of sheep based on the sustainable pasture use and the natural indicators of productivity without additional investments.

The value of the ecosystem service provided by pastures in general in Turkmenistan is 2.438 billion USD per year; it is shown in the Table 7.

As mentioned before, all year round pasture grazing of the small cattle allows reducing production costs for the livestock to the minimum. According to the peer review, operational costs constitute about 10% of the total production cost. The operational costs also include water supply for the livestock keeping in pastures.

Therefore, the value of pasture ecosystems of Turkmenistan taking into consideration the costs of maintenance, grazing and water supply as well as issues of biodiversity conservation can be determined at the level of 2,438 – 40% = 1,780 billion US dollars per year.

As far as the water supply of pastures is concerned, it is a complex issue as the inventory database related to pasture water sources is lacking. The study of relevant materials and opinions allows making the following assumption: all available natural and artificial water sources are able, nevertheless, to meet the water demand provided the moderate grazing takes place, although they [water sources] need certain means for their maintenance. According to the analysis of available information on valuation of desert pastures, it might be assumed that the level of costs for water supply is in the region of 30% of the production output value.

Hence, the aggregated costs constitute 40% of the production output value. These costs are deducted from the market value of produced goods.

Therefore, the value of pasture ecosystems of Turkmenistan taking into consideration the costs of maintenance, grazing and water supply as well as issues of biodiversity conservation can be determined at the level of 2,438 – 40% = 1,780 billion US dollars per year.

The annual ration per head of the livestock could have been reduced and maximum grazing during the spring and summer seasons could have been applied resulting in almost two-fold increase of the pasture capacity. However, under this scenario it would have been a "one-off" value obtained, not annual, because only a part of the ecosystem service (spring and summer seasons and during the rest of the year out-of-the system supplementary feeding) will be used, and, secondly, the risk of pasture degradation will drastically increase. This will result in an annual production loss.

Table 7. Calculation of the total value of natural pastures in Turkmenistan based on stock keeping all year round and production output.

Natural pastures	Pasture area [thousands hectares]	Estimated value of pastures based on stock keeping all year round and production output [thousand US$/year]	Value of 1 hectare of pasture [US$/year]
Mary welayat	7 670,79	588 112,93 $	57,14 $
Balkan welayat	10 291,95	526 000,65 $	58,02 $
Dashoguz welayat	5 670,68	642 396,35 $	83,75 $
Lebap welayat	7 940,34	423 220,15 $	53,30 $
Ahal welayat	9 065,41	258 270,21 $	45,54 $
Total in Turkmenistan	40 639,17	2 438 000,29 $	59,99 $

Source: Authors' calculations.

4.4. Medicinal plants and fat

"In Turkmenistan, medicinal plants, fat and fruit used in Turkmenistan amount to the total of ***36,548,198*** manats."

This ecosystem service is characteristic for all regions of the country; 199 species of medicinal plants and fruit are utilized by both private and state sectors. The state sector is responsible for a bigger share in resulting economic efficiency. It can be explained by a broad scale utilization of the licorice root in Lebap welayat. The medicinal plant "BUÝON/Licorice" in Turkmenabat produces the concentrate, syrup and dried licorice root, which are exported abroad. In 2013, the revenue of 34.8 million manats was received as a result of harvesting and realization of the licorice root only.

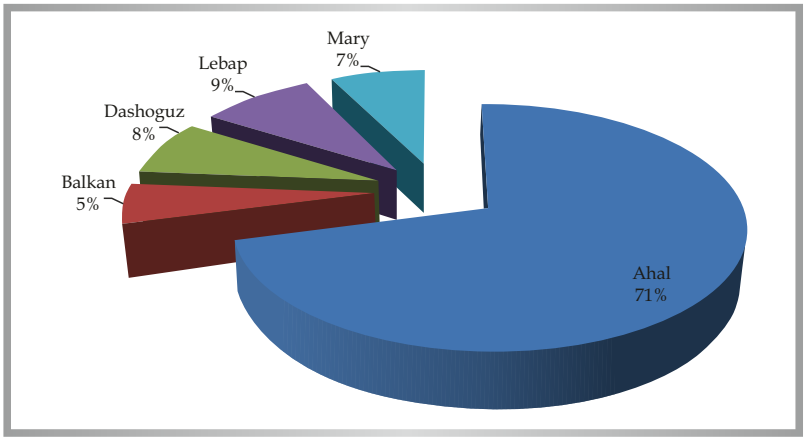
The survey of traders at the regional and district markets was conducted in order to valuate medicinal plants and herbs delivered by nature and benefited by the private sector. As a result, it was discovered that people, i.e. private sector in Turkmenistan as a whole, generate from this type of ecosystem services more than 1,533 million manats, 70.9% of which falls on the Ahal welayat, 5.5% - Balkan, 7.6% - Dashoguz, 8.7% - Lebap, and 7.3% - Mary welayats (see Chart 7).

Therefore, medicinal plants, fat and fruit used in Turkmenistan amount to the total of 36,548,198 manats. This valuation does not reflect the real situation in full, as due to the lack of time and means it lacks the data about collection and realization of medicinal herbs and fruits in government and private pharmacies as well as harvesting and utilization of medicinal plants by the population for private purposes – not for sale.

4.5. Fishing and hunting goods

Fish resources are the important part of the food basket of the country's population. The main user of these ecosystem services is the Fishery Committee that is responsible for fishing in rivers, water basins, lakes and the Caspian Sea through the regional/welayat branches of "Turkmenbalyk"(Turkmenfish) Association. The total value of fishing is approximately 15 million manats per year, or more than 5 million US dollars in real purchasing prices. The main share of all revenues coming from fishing falls to the Caspian Sea and is about 70% of the total value.

Chart 7. Trade in medicinal plants by private sector in welayats.



Hunting is not a significant livelihood apart from the small number of villages situated in the coastal zone of the Caspian Sea and in the Karakum desert. Hunting is a recreational activity for the majority of people. According to the official records of the Union of Hunters and Fishermen, the amateur hunters receive ecosystem services in the amount of more than 170 thousand manats on an annual basis.

Source: Authors' calculations.

4.6. Forests and climate change

In Turkmenistan, forests enjoy an exceptional protection status; they are under the strict protection of state and with the exception of rare cases, cannot be cut for local consumption. Moreover, the state support to the afforestation programmes (planting forest zones and 'green' belts around towns) and state approach to afforestation impact in a positive way the carbon sequestration and air purification.

Table 8. Value of carbon sequestration by forests in Turkmenistan.

Forest types	Forest area, hectares	Assessed input in carbon absorption, manats per year
Mountainous	146,000	23,053,604
Desert	3,958,000	41,664,916
Riverside	26,000	7,991,916
Planted forests	105,000	139,888
Protective "green" belts surrounding agricultural areas	26,000	273,696
Total in Turkmenistan	4,261,000	73,124,020

Source: forests areas – Forestry programme of Turkmenistan, Sequestration value- Authors' calculations.

The study conducted valuation of the forest biomass and then applied the assessment of the captured carbon from the point of view of existing transfers of purchased carbon emissions in international markets. The results, presented in the table 8, show that the annual benefit from carbon absorption by forests in Turkmenistan is more than 73 million manats, or around 25.5 million US dollars. This includes mountainous, desert, riverside forests and planted forests, and protective forests surrounding agricultural areas.

4.7. Protected areas of Turkmenistan

Protected areas occupy approximately 4% of the territory of Turkmenistan and serve as important wildlife habitats. Their main ecosystem functions are the provision of habitats for the nationally and globally important species of flora and fauna, support to the existence of such species by provision of land area and protection of species. Valuation did not encompass such values of protected areas as the value of existence of such sites for local people, carbon sequestration and absorption by plants (apart from the forests), and provision of habitats for migrating animal species. Due to the limited timeframe and funding, the value of such important from the economic point of view ecosystem services, as provision of conservation of river water catchment areas (provision of fresh drinking water by rivers) and agricultural services (maintenance of soil enrichment, provision of pollination by wild bees and pastures within the wildlife sanctuaries), was not assessed as well. These services are most important from the points of view of both economic value and local development.

Economic valuation of ecosystem services in protected areas has shown that the total value of above-mentioned ecosystem services in nature reserves of Turkmenistan is 562 million manats, or more than 197 million US dollars per year (see Table 9).

4.8. Firewood

Firewood harvesting is an insignificant ecosystem service, as more than 95% of population of the country has access to gas and electric power. The main users of this service are pasture settlements and villages located in the Karakum desert, as well as a small population of so-called cultural zones (arable land areas) who is using the firewood (mainly saxaul/Haloxylon) for cooking on the open fire. Economic valuation of the firewood used by shepherds in pastures by method of provision of the alternative fuel (firewood) has shown the value of this service at the level slightly exceeding 3 million manats (or more than 1 million US dollars) per year. Valuation of the use of saxaul/Haloxylon as firewood for cooking purposes in desert villages, lacking access to natural gas and for cooking purposes in towns and villages, was not performed.

Table 9. Economic value of ecosystem services of the protected areas of Turkmenistan *(in thousand manats).*

	Ahal	Balkan	Dashoguz	Lebap	Mary	Total
Provision of habitats, thousand manats per year						
Food for main animal species	12,501	69,928	8,995	3,240	31,040	122,691
Existence of main species	15,088	12,760	15,964	27,370	20,401	183,524
Costs for conservation of species	1,208	1,314	642	2,067	828	6,061
Land resources	32,427	81,915	78,584	31,375	24,988	249,291
TOTAL value, per year	61,225	165,917	104,186	64,054	77,259	561,568

Source: Authors' calculations.

Recommendations for biodiversity conservation

5.1. National level

5.1. National level 34
5.2. Sectoral level 34

5

1 Incorporation of ecosystem services and use of natural resources into the national system of the analysis and reporting will enable raising awareness among decision-makers about the state of the use of natural resources. It will also help bringing the national reporting up to the current level of global standards. Incorporation of the analysis of the use of natural resources will also help tracking the situation concerning the load for resources and develop measures, aimed at reducing this load.

One of the first steps can be an introduction of the ***system of Environmental-Economic Accounting (SEEA)*** developed by the UN Statistical Commission and approved at its 43rd session in 2012. The system based on the Central Accounting Framework that was approved by the UN as the first ever international standard on environmental-economic accounting, and a series of subsystems, which are connected to the Central Accounting Framework and support specific topics for the analysis of nature resources and accounting. For instance, the subsystem SEEA-Water (water resources) is aimed at the analysis of the use of water resources, their accessibility for population, efficiency of investments into the water sector and all relevant issues. Subsystem SEEA-Energy (power) is aimed at the analysis and reporting on the whole range of issues related to the sustainable use of energy resources.

2 In 2010 the World Bank initiated a WAVES (Wealth Accounting and Valuation of Ecosystem Services) Programme, which is dealing with the implementation of the system of natural accounts at the government level in the countries with various levels of development. Currently 65 countries are signatories to the Memorandum, which calls upon the countries to transfer to the state statistical system, reflecting the use of natural resources that enhances the implementation and incorporates ecosystem services and other natural goods, which are not used in the economy and are difficult to measure in the system of reporting and analysis. Several countries, including Columbia, Botswana, Philippines and Indonesia, approved the initiative at the highest level and are working on the implementation of this reporting system.

5.2. Sectoral level

Agriculture

Raising awareness about the value of ecosystem services leads to the development of efficient policy for conservation and sustainable use of key ecosystems and their resources with the aim of receiving the maximum of direct and indirect benefits. This is especially relevant for agriculture, which is the largest economic sector depending on ecosystem services and affecting the state of the nature.

3 The special attention in the agriculture should be paid to the use of water resources and important ecosystem services, such as pollination, plant protection and soil rehabilitation. For the former, the complete impact analysis of direct and indirect benefits of the use of water resources during the land cultivation should be conducted within the implementation of projects related to the water resource use. High indirect benefits delivered by rivers also call for awareness raising campaigns about these benefits not only among the water sector officials but also among local population and local governments. In case of other ecosystem services, the more complete analysis of the sectoral dependence on such important services as pollination,

[6] http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/projects_and_initiatives/biodiversity-finance-initiative/
[7] www.wavespartnership.org/
[8] http://www.wavespartnership.org/en/frequently-asked-queAббююostions-natural-capital-accounting-nca?active=6

3 soil rehabilitation, and provision of natural (live) pesticides for plant protection will be required. Such analysis should result in the programme on sustainable agricultural production which will address the important ecosystem services and implement evidence-based tools and mechanisms in the production processes.

4 National livestock breeding is one of the beneficiaries of the benefits delivered by natural resources. In this connection, conservation of natural pasture productivity should become a key target during the development of this economic sector. Proposed measures include ***inter alia the use of evidence-based rations for grazing of the small cattle in pastures,*** while the standard capacity of the pastures should become the main criterion for the migratory stock grazing; it will contribute to conservation of biodiversity of the pasture ecosystem. Use of pasture rotation, including optimization of the seasonal use of pastures depending on the types of pastures will facilitate the maintenance of pasture productivity at the sustainable level. Eventually, carrying out the geo-botanical studies for the evaluation of the forage stock in pastures (pasture evaluation) on a regular basis (once in 10-15 years at least) will contribute to the development and implementation of the long-term strategy for sustainable livestock breeding.

Protected areas

Environmental sector of the country does not deliver tangible benefits to economic development, however it provides support to the economic sectors which generate revenues (e.g. agriculture) and contributes to the safe livelihoods (e.g. provision of water resources or medicinal plants). Protected areas could contribute to the agricultural production development, conservation of safe water use and etc. by the way of conserving the important habitats, species and genetic biodiversity and providing such services as pollination by wild bees, maintenance of the water catchment areas in river basins and so on. Therefore, raising awareness and understanding about such 'invisible' functions of protected areas among decision-makers should become an integral part of the policies of nature protection agencies.

5 Awareness raising among government officials and decision-makers at the national and local level on values of provision of ecosystem services and the relevance of the ecosystem approach for the development planning and implementation can be achieved through the setting up and maintenance of the Inventory of ecosystem services of the protected areas of Turkmenistan. Full inventory of ecosystem services will also help to identify the most important territories for the economic development and supporting livelihoods of the country. It will facilitate justification for the increase of funding of protected areas and will eventually lead to the sustainability of conservation of ecosystem services, essential for human activity.

6 Moreover, performing the further analysis of ecosystem services of wild forests, parks and other nature areas surrounding agricultural, water and other areas and facilities will help to develop measures for conservation and sustainable use of these ecosystem services. The follow-up measures could include the preparation of justification and implementation of measures towards expansion of the current protected areas, establishment of the new protected areas and territories with various protection regimes for sustainable provision of nature services.

7 Conservation of wild relatives of plants and animals in the natural habitat is a prerequisite for the sustainable agricultural management, maintenance of the national genetic fund and introduction of the most effective types of the flora and fauna. Development of measures for conservation, reproduction and unhindered migration within protected areas and beyond will facilitate conservation and increase of genetic diversity of Turkmenistan's nature.

8 In order to enhance conservation of nature goods and services and address the issues of biodiversity conservation, the UNDP introduced the Biodiversity Finance Initiative (BIOFIN). The Initiative is aimed at rendering assistance to the governments in preparation of the clear feasibility study for increase of investments in the sustainable and fair management, protection and restoration of biodiversity and ecosystems[8].

The Initiative proposes a methodological model for its implementation at the national level, which includes the following:

- analysis of integration of biodiversity and ecosystem services into sectoral development;
- analysis of financial flows for the management of biodiversity and ecosystem services;
- development and facilitation of implementation of national plans on mobilizing the resources for conservation of biodiversity and ecosystem services.

The market of natural medicinal resources

9 The natural medicinal resources are an important part of provision of population with environmentally friendly medicine. The use of the natural medicines in Turkmenistan is traditional; therefore, the conservation of habitats delivering natural medicinal resources should become an integral part of the work of nature protection agencies, local governments and producers of medicinal drugs.

10 Currently, there is a need to facilitate conditions for efficient use of the licorice, namely construction of the plant with state-of-the art laboratories and highly skilled experts on production of glycyrrhizin acid, which will increase the revenue ten or even hundred times more as compared to the current revenue.

[9] http://www.cbd.int/doc/meetings/fin/rmws-2014-04/other/rmws-2014-04-workbook-biofin-ru.pdf
[10] http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/projects_and_initiatives/biodiversity-finance-initiative/

References

1. N.T.Nechayeva, V.N.Nikolayev, V.A.Smetanina. Recommendations on improvement of pasture use in Turkmenistan. Ashgabat, Academy of Sciences of Turkmen SSR, Institute of Deserts, 1977 (Restricted).

2. V.N.Nikolayev. Pastures in Turkmenistan (integrated assessment of natural, biological and economic aspects) – Dissertation for the post-doctoral degree (agricultural sciences) Ashgabat, Academy of Sciences of Turkmen SSR, Institute of Deserts, 1974.

3. Desert Problems and Desertification in Central Asia: The Researches of the Desert Institute / Editor: Agajan G. Babaev. – Berlin; Heidelberg; New York; Barcelona; Hong Kong; London; Milan; Paris; Singapore; Tokyo: © Springer, 1999. ISBN 3-540-65647-2 / V.N. Nikolayev, V.V. Nikolayev, M.D.Nepesov. Modeling of the development of desert-pasture livestock breeding, pp. 125-133.

4. Richardson Leslie, Loomis John.2009. The total economic value of threatened, endangered and rare species: An updated meta-analysis. Ecological Economics 68 (2009), p. 1535-1548.

5. TEEB (2010) – The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature. A synthesis of the approach, conclusions and recommendations of TEEB.

6. "Türkmenistanyň Milli tokaý maksatnamasy". Türkmen döwlet neşirýat gullugy. Aşgabat 2012ý.

7. M.V.Nikolayev. Evaluation of desert pastures in Kazanjyk district within the State land register– Review. Ashgabat: Turkmen Institute of Scientific Information, 1990.

8. Maps drawn by experts from the National Institute of Deserts, Flora and Fauna and Public geo-ecologic laboratory (Turkmenistan).

9. Feasibility study of the development of water economy of Turkmenistan until 2030.

10. Programme of development of water economy of Turkmenistan for the period until 2030. System of water economy developed by the Institute "Turkmensuwylymtaslama", 2010.

11. Statistical annual review of Turkmenistan, 2013 r. National Statistics Committee "Turkmenmillihasabat".

12. Similar projects implemented lately by the Institute "Turkmensuwylymtaslama".

6

Annex

Method of the quick identification and economic valuation of ecosystem services
(summary)

1

The method was developed within the project of the Ministry of Nature Protection, UN Development Program and Global Environmental Facility on "Planning of National Biodiversity to support implementation of the Convention on Biodiversity for the period of 2011-2020".

The aim of the method was to quickly identify the most important ecosystem services by a broad number of stakeholders with the use of interactive methods and also through awareness raising and capacity building among the decision-makers at both local and national level.

The work performed according to the method is based on three phases.

1. During the **preparatory phase** the capacity for implementation of the activities is built. The phase includes:

- The organization of a technical group at the national level. The working group comprises technical specialists from the key national agencies dealing with conservation and/or use of natural resources in Turkmenistan. Academia, representatives from non-governmental sector working in the field of the economics of ecosystem services and nature use could also be invited to work within such group.
- Carrying out an intensive training for group experts on ecosystem approach and economic analysis of ecosystem services. Other representatives of stakeholders could be involved in the training with the purpose of national capacity building in the relevant field, for instance, representatives of scientific and educational establishments.
- Approval by the group of a working plan on identification of ecosystem services and their valuation.

2. During **the data gathering phase** the technical group visits national welayats/regions, where it implements the activities and undertakes identification of important ecosystem services and gathers information for the assessment. The activities include the following:

- Consultations with a broad number of local stakeholders. The invitees include representatives from the agricultural sector, service on land resources, livestock breeding, industry, water economy, nature protection sector, forestry, transport, tourism, department of statistics, socio-economic development and finance, education and fishery and local governance. The consultations are aimed at:
  - Explanation about the ecosystem approach, ecosystem services, their importance and valuation methods
  - Identification of major ecosystem services of the welayat, their ranking by economic relevance, social development and other criteria
  - Assessment of information and other sources availability
  - Gathering information and data by visiting sites related to the provision of major ecosystem services, interviewing organizations for obtaining the data and valuation.
  - Final selection of ecosystem services for economic valuation, including assessment methodology and subsequent analysis, through the consultations of the working group.

3. The phase of valuation and analysis comprises processing of information and carrying out an analysis of the obtained data, as well as economic valuation of ecosystem services and drafting the report. This includes:

- Processing of information, the main sources of which are the expertise of the technical group members; information obtained from the local representatives of various sectors – attendees of the workshops and information obtained during the field trips through interviews, surveys and site visits.
- The analysis was conducted based on individual assessments of the group members according to the represented sectors, followed by the results presented by the technical group members.
- Each group member drafts the narrative of the report including the description of the methodology of economic valuation, results of the assessment, and possible policy issues and follow-up activities based on the obtained results.

Annex

The principles of the ecosystem approach
(summary)

Source: http://www.cbd.int/ecosystem/principles.shtml

2

- Management objectives are a matter ***of social*** choice.
- Management should be ***decentralized*** if possible.
- Eco-system management bodies should take into account and ***analyze*** effects (actual or potential) that their activities have ***on other ecosystems.***
- Having recognized the possibility of the positive management results, it is necessary, however, ***to understand the ecosystem functioning and its management in the economic context.*** Any such management programme should reduce market distortions that adversely affect biodiversity; provide incentives to support biodiversity conservation and sustainable use; costs and benefits ought to be internalized, if possible, within the focal ecosystem.
- One of the priority tasks of the ecosystem approach is conservation of ecosystem functions and structures that supply services.
- Ecosystem management should recognize and respect ecosystem limits.
- Ecosystem approach should operate at an appropriate scale, ***spatially and temporally.***
- Objectives of the ecosystem management should be ***the long-term,*** considering lagged effects
- Ecosystem management should accept change as ***inherent and inevitable.***
- Ecosystem approach should provide due balance between biodiversity conservation and use and their integration.
- Ecosystem approach should bring ***all knowledge to bear,*** including scientific evidence, knowledge, innovations and practices of indigenous people and local communities.
- To address the ecosystem approach the necessary expertise should be drawn upon and the relevant stakeholders at all levels should be involved.

Annex

Classification of ecosystem services

Source: TEEB (2010) – The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature. A synthesis of the approach, conclusions and recommendations of TEEB.

3

Provisioning services are ecosystem services that describe the material or energy outputs from ecosystems. They include food, water and other resources.

Food: Ecosystems provide the conditions for growing food – in wild habitats and in managed agro-ecosystems.

Raw materials: Ecosystems provide a great diversity of materials for construction and fuel.

Fresh water: Ecosystems provide surface and groundwater.

Medicinal resources: Many plants are used as traditional medicines and as input for the pharmaceutical industry.

Regulating services are the services that ecosystems provide by acting as regulators e.g. regulating the quality of air and soil or by providing flood and disease control.

Local climate and air quality regulation: Trees provide shade and remove pollutants from the atmosphere. Forests influence rainfall.

Carbon sequestration and storage: As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away at their tissues.

Moderation of extreme events: Ecosystems and living organisms create buffers against natural hazards such as floods, storms and landslides.

Waste-water treatment: Micro-organisms in soil and in wetlands decompose human and animal waste, as well as many pollutants.

Erosion prevention and maintenance of soil fertility: Soil erosion is a key factor in the process of land degradation and desertification.

Pollination: Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee (Klein et al, 2007).

Biological control: Ecosystem are important for regulating pests and vector borne diseases.

Habitat or supporting services underpin almost all other services. Ecosystems provide living spaces for plants and animals, they also maintain a diversity of different breeds of plants and animals.

Habitats for species: Habitats provide everything that an individual plant or animal needs to survive. Migratory species need habitats along their migrating routes.

Maintenance of genetic diversity: Genetic diversity distinguishes different breeds or races, providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock.

Cultural services include the non-material benefits people obtain from contact with ecosystems. They include aesthetic, spiritual and psychological benefits.

Recreation and mental and physical health: The role of natural landscapes and urban green space for maintaining mental and physical health is increasingly being recognized.

Tourism: Nature tourism provides considerable economic benefits and is a vital source of income for many countries.

Aesthetic appreciation and inspiration for culture, art and design: Language, knowledge and appreciation of natural environment have been intimately related throughout human history.

Spiritual experience and sense of place: Nature is a common element of all major religions; natural landscapes also form local identity and sense of belonging.

Annex

Table on value of existence of important species in Turkmenistan by method of transfer

Importance of species	Readiness to pay, by family per year in the origin country	Payment type and year of valuation	Transferred value of the readiness to pay, by family per year [Turkmenistan]
Markhoor **Capra falconeri Wagner, 1839	16.99 $	per year (2006)	3.36 $
Bezoar goat *Capra aegagrus Erxleben, 1777	16.99 $	per year (2006)	3.36 $
Argali, urial **Ovis vignei Blyth, 1841	16.99 $	per year (2006)	3.36 $
Caracal lynx *Caracal caracal Screber, 1776	21.59 $	per year (2006)	4.27 $
Black stork *Ciconia nigra Linnaeus, 1758	43.69 $	per year (2006)	8.63 $
Houbara bustard - **Chlamydotis undulata Jacquin, 1784	11.38 $	per year (2006)	2.25 $
Goatfish *Porphyrio porphyrio (Linnaeus, 1758)	11.38 $	per year (2006)	2.25 $
Black francolin *Francolinus francolinus Linnaeus, 1766	11.38 $	per year (2006)	2.25 $
Golden eagle *Aquila chrysaetos Linnaeus, 1758	21.21 $	per year (2006)	4.19 $
Saker falcon **Falco cherrug Gray, 1834	32.27 $	one-off (2006)	6.38 $
Snake eagle *Circaetus gallicus (Gmelin, 1788)	32.27 $	one-off (2006)	6.38 $
Caspian seal **Phoca caspica Gmelin, 1788	165.80 $	one-off (2006)	13.39 $

Source: Adapted from Richardson, L. et al. (2009).

4

Annex

Description of pasture ecosystems, number of cattle and pasture productivity

5

Geographic situation of Turkmenistan stipulates that the essential part of its area is covered by natural pastures (approximately 83.3%). Flatland pastures of sand, clay and gypsum deserts and river valley pastures occupy the central, western and eastern parts of the country. Piedmont loess pastures of the lower, medium and high mountain zones and pastures of mountainous river valleys are situated in the southern part along the piedmont of the Kopetdag mountains.

Vegetation cover of Turkmenistan given the vast spacious flatland areas and vertical zonation in mountains is quite diversified. According to the scientific data, in Turkmenistan there are 2,969 species of wild-growing flowering plants, belonging to more than 800 genus and 109 families. The overwhelming majority of the plants growing in the flatlands and mountains of the country are of the certain forage value for animals. Natural and climatic conditions provide for both all year round cattle grazing and pasture stock keeping for the small cattle.

Natural pastures, therefore, become the most valuable ecosystem service for Turkmenistan. The following pasture grades are included in the pasture ecosystem of Turkmenistan (see table 10):

Table 10. Area of natural pastures of Turkmenistan by grades.

Grades of pastures in Turkmenistan	Area [thousand hectares]	Share in pasture ecosystem
Flatland pastures of sand desert	11 953,94	29,41%
Mountainous pastures of lower, middle, upper mountain vertical zonation and pastures of mountain river valleys	10 993,18	27,05%
Pastures of piedmont - loess (ephemeral) desert	6 103,83	15,02%
Flatland pastures of gypsum desert	5 216,92	12,84%
Flatland pastures of clay desert	4 276,73	10,52%
Flatland pastures as a combination of sand, gypsum and clay deserts	2 019,98	4,97%
Flatland pastures of river valleys	74,59	0,18%
Total in Turkmenistan	40 639,17	100%

Source. Own calculations of authors. The area of forests – Forestry program of Turkmenistan.

All pastures are classified. Each class divides into types according to the vegetation. In Turkmenistan there are more than 100 types of pastures.

Number of the livestock and pasture productivity

After the pasture capacity, that is the annual average number of sheep, was identified, then the pasture productivity can be calculated on its base. There are various current methods for calculation of pasture productivity, based on their [pastures] seasonal use and other factors. Our calculations are based on the following reference data.

Table 11. Average weight of 1 animal (by the example of Sarjin sheep).

	Cattle share [average]	Average weight [kg]
Ram	27,50%	95,00
Ewe	72,50%	67,50
Average per 1 animal:		75,06

Source: http://www.ya-fermer.ru/porody-ovec-tonkorunnye-ovcy-polutonkorunnye-ovcy-shubnye-i-smushkovye-ovcy-myaso-salnye-ovcy.

Table 12. Average production output per 1 animal (by the example of Sarjin sheep).

Production output	Minimum [%]	Maximum [%]	Average
Meat	70,10%	64,60%	67,35%
Lambswool	Minimum [kg]	Maximum [kg]	
Ram	4,50	7,30	5,90
Ewe	3,00	4,50	3,75
Average per 1 animal			4,34

Source: http://www.okade.ru/ovcevodstvo-i-kozovodstvo/3308-struktura-stada-chast-1.html.

The figures of meat and lambs' wool production in physical terms were obtained as a result of the calculation (see table 12).

Table 13. Pasture productivity during the all year-round stock keeping.

Welayat	Pasture area [thousand hectares]	Number of small cattle - sheep [thousand heads]	Production of meat [thousand tons]	Production of lambs' wool [thousand tons]
Mary	7 670,79	1 604,28	58 800,14	6 964,57
Balkan	10 291,95	1 434,85	52 590,09	6 229,03
Dashoguz	5 670,68	1 752,35	64 227,45	7 607,41
Lebap	7 940,34	1 154,48	42 313,99	5 011,87
Ahal	9 065,41	704,52	25 822,12	3 058,50
Total in Turkmenistan	40 639,17	6 650,48	243 753,79	28 871,38

Note: Production of lambs' wool and meat is competitive and has potential as export-oriented. Rams have a stable market price in domestic markets.

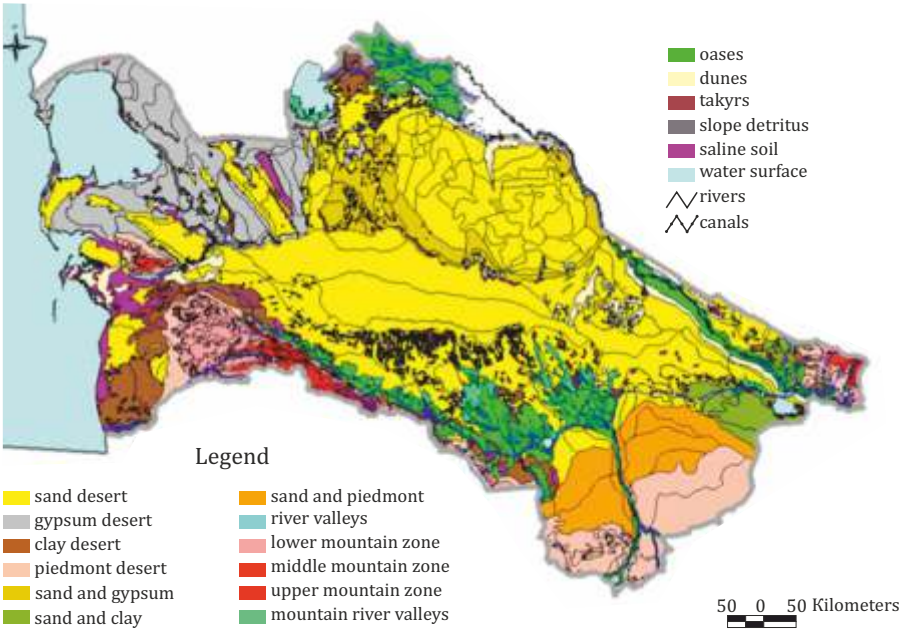


Figure 5. Map of pasture lands in Turkmenistan.

Empowered lives.
Resilient nations.

United Nations Development Programme in Turkmenistan
UN Building 40, str. 1995
Ashgabat, 744004, Turkmenistan
Tel.: (+993 12) 42 52 50
Fax: (+993 12) 42 53 17/88

www.undp.tm