

HANDBOOK

ECOSYSTEM SERVICES, METHODS OF VALUATION AND APPLICATION IN TURKMENISTAN

The document is prepared 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 implementation of the Convention on Biological Diversity (CBD) for the period 2011-2020" (Reg. EK-848 of 1/07/2013). Methodology is based on the documents and case studies used during the training course on "Identification and valuation of ecosystem services" held in Awaza, Turkmenbashy in December 2014.

The methodology is aimed at the experts from government institutions, representatives of educational establishments and other specialists dealing with or interested in economic valuation of ecosystem services and goods.

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"In the context of the implementation of sustainable development goals we believe that the major attention should be focused on the convergence of the objective economic interests of states with the need to maintain an environmental balance on an adequate level and prevention of environmental damage. This in turn calls for application of state-of-the-art ecological techniques and development of innovative solutions in the nature protection area. High environmental performance of the global economic space becomes, therefore, a synonym of its effectiveness."

Statement of the President of Turkmenistan at the 68-th Session of the UN General Assembly (New-York, 30 September 2013).

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LIST OF ACRONYMS

BSAP – Strategy and Action plan on biodiversity conservation.

ESVAL – Economic valuation of ecosystem services in Turkmenistan.

GNI – Gross national income.

MVT – Method of value transfer.

UN – United Nations.

UNDP – UN Development Program.

INTRODUCTION

This handbook presents methodology for valuation of ecosystem services in Turkmenistan. Preparation of the document was a part of the agreement between the company Metroeconomica LTD and the UN Development Program aimed at ensuring capacity building of the country in the area of planning of biodiversity conservation within the framework of implementation of commitments under the Convention on Biological Diversity signed by Turkmenistan in 1996.

The document contains the main definitions on ecosystem services and methods of their economic valuation. The ecosystem services are listed in the document according to the following areas:

- agricultural lands;
- protected nature areas (nature reserves);
- forests;
- coastal area of the Caspian Sea;
- wetlands;
- grasslands.

The major ecosystem services provided by the relevant areas and methods of economic valuation of these services are summarized in monetary terms for each case. The list of activities with specific actions to be implemented in order to define the cost/make valuation is included in the end of each table. The annex includes methods of carrying out field researches based on case studies of valuation of fishing.

DEFINITION OF ECOSYSTEM SERVICES

Ecosystem services are a part of ecosystems' functioning. The word "ecosystem" derives from Greek words oikos — habitation, abode and systema — this combination can be defined as integration, environmental system, the whole complex of jointly co-habiting organisms and conditions for their existence, which are in regular interconnection and create a system of interdependent biotic and abiotic phenomena and processes[1]. These are living organisms co-existing in abiocen[2].

Ecosystem services can be defined as benefits that people get from nature. The global initiative on "The Economics of Ecosystems and Biodiversity (TEEB)" defines the following types of ecosystem services[3]:

- **Provisioning services or** "Services for provision of beneficial goods" – beneficial products and materials that people get from ecosystems. For instance, foodstuff, raw materials, fresh water, medicinal plants.

  - **Foodstuff** comes as a result of agricultural activity as well as the result of harvesting of nature goods.
  - **Raw materials** for construction, heating and other purposes, for example, vegetable oil.
  - Ecosystems provide conditions for **fresh water** supply.
  - **Medicines** as a result of provision of plants as medicinal drugs or raw material for their production.

[1] http://bioword.narod.ru/E2/E2043.htm
[2] http://pochemy.net/?n=1242
[3] Cited from TEEB 2010

- **"Regulating services"** – functions of management by natural processes or quality of provided/delivered services, for example

  • **Local climatic control and air quality** by way of provision of air cleaning, provision of shade and impact on precipitation by forests.

  • Plants **fix carbon and retain** it their tissues**, thus** affecting climate change processes.

  • Trees and other vegetation are of paramount importance **for prevention of natural disasters,** such as storms, avalanches, landslides and floods.

  • Marshes and wetlands have the function of **waste water treatment.** Soils have function of decomposition which neutralizes harmful substances.

  • Well-functioning ecosystems have a mechanism of **soil fertility control.**

  • **Pollination by wildlife** is an important ecosystem service; two thirds of global agricultural crops depend on it.

  • Provision of natural regulators for managing pests and parasites **(biological control),** such as predators, insects, birds and plants.

- Provision of **"habitat or additional services"** is a base for all other services. They include provision of habitat for flora and fauna, control of genetic diversity.

- **"Cultural services"** include non-material benefits and goods that ecosystems provide to people. They contain recreation, psychic and physical health and tourism; aesthetic value for culture and art as well as spiritual value, including religious aspect.

The example of ecosystem services of water resources is shown in the Box 1.

The Programme on "Millennium ***Ecosystem Assessment", MA or MEA*** identified the significant dependence of human well-being on ecosystem services. The value of benefits provided by global ecosystem services to all people is estimated as several gross national products of the whole mankind.

Ecosystem services of water basins.

Services for food supply:

- food;
- fresh water;
- genetic resources;
- medicinal plants;
- fuel (hydropower).

Regulating services:

- climatic control;
- soil erosion control;
- management of water;
  resource quality;
- health management;
- prevention of soil erosion;
- biodiversity control.

Cultural services:

- recreation and tourism;
- educational services;
- aesthetic value;
- scientific value;
- additional (supportive) services;
- water circulation;
- nutrient cycle and their decomposition.

Additional (supportive) services:

- water circulation;
- nutrient cycle and their decomposition.

Source: Guchgeldiyev O. Economic tools for the assessment ESCB: benefits, instruments, prospects, 2012.

[4] http://www.unep.org/maweb/ru/About.aspx

Box 1. Ecosystem services in the context of water basins.

Picture 1. Examples of natural ecosystems of Turkmenistan: mountainous, marine, desert and river ecosystems (pictured by authors).

Nature of Turkmenistan comprises a number of ecosystems: desert, marine, river and mountainous (see Picture 1). The key ecosystem services in Turkmenistan which were identified by an intersectoral technical team during the national valuation include the following[5]:

- irrigation water and drinking water;
- tourism and recreation, health resorts, historical and cultural monuments;
- provision of habitat and landscapes by nature reserves;
- pastures;
- hunting and fishery goods;
- harvesting of fruit including pistachio nuts;
- medicinal herbs, fat;
- pollination;
- climate management by forests.

[5] ESVAL 2014. "Nature and the Economy. The results of economic valuation of ecosystem services in Turkmenistan. Technical report. Ashgabat. 2014.

ECONOMIC VALUATION OF ECOSYSTEM SERVICES

Economic valuation of ecosystem services is carried out primarily in order to estimate the ecosystem value, its goods and services in monetary terms. Economic analysis will enable:

- identify the most essential services from the point of view of economic value, which in turn may affect a decision on investments;
- provide the monetary value and compare services/resources which would be impossible to compare due to the lack of market value;
- identify main users of ecosystem services; identify those whom provision or conservation of such services depends on, and also obtain a scheme of flows of ecosystem services.

Economic valuation of ecosystem services is based on the assessment of values which are owned by the function of ecosystem or ecosystem goods. The main values of ecosystem goods or services are presented in the Figure 1. The concept of the **total value** of ecosystem services or a service currently has become extremely popular. Total economic value of ecosystem or ecosystem services can comprise several parts:

- Direct use values include the value of consumption and value of trade in any given goods (e.g. wood).
- Indirect use values comprise maintenance of functions (e.g. prevention of landslides by forests along river banks) and global value of the given territory (for instance, habitats of birds included in the list of wetlands by the Ramsar Convention).
- Potential use value shows potential value which ecosystem services can have in case of their alternative use (e.g. fresh water lakes for future use, or forests).
- Non-use value includes value of existence of goods (for example, water basin with clean drinking water) or services for present and future generations. Cultural and aestetic value of ecosystem services can also be included in this.

Each ecosystem service or goods can have several values. For example, vegetation in the Karakum desert has value as an essential forage for cattle grazing and tourism (direct use), potential provision of Saxaul/ Haloxylon with heating purposes (potential use), protection from moving sands (supporting function), national and global heritage as one of the biggest deserts in Eurasian continent (non-use value).

The most important ecosystem services, which can be assessed, are selected for economic valuation. When there is no data for assessment of some values, but these values are important (for instance, for health or vital activities of local population) and should be taken into account during decision-making process (e.g. whether a hydraulic construction for generation of electric power should be built on a river or not), then they should be included in the reports on economic valuation without monetary valuation. As a result of the above-said it can be concluded that,

"the total (full) economic value of goods or services is the sum of all values."

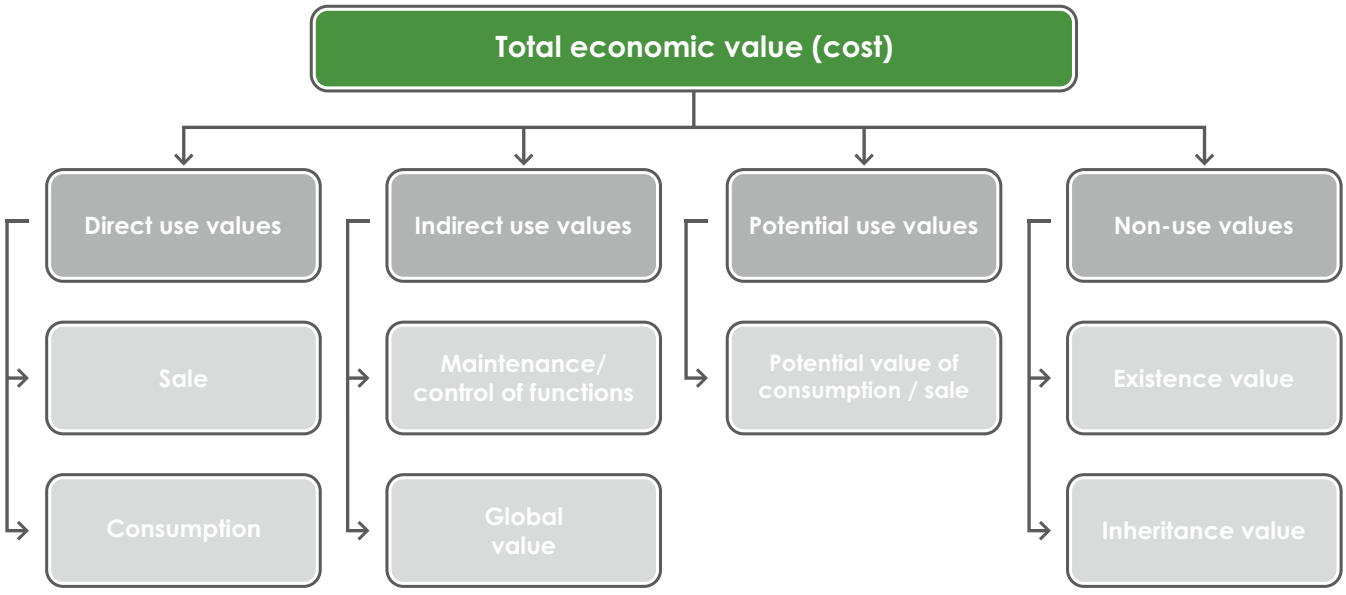

Figure 1. The concept of the total economic value.

METHOD OF CARRYING OUT ECONOMIC VALUATION

The classical method of carrying out economic valuation of any territory is almost the same everywhere.

I First, essential ecosystem services are identified. This includes identification of services delivered by ecosystem, identification of key flows, and primary collection of quantitative data on ecosystem services.

II Then the ranking of services is carried out based on their relevance in terms of both impact on ecosystem and provision of services. Moreover, at this stage "ability for assessment" is devined, i.e. is it possible to value any given service and to what extent, and valuation method for each of these services is selected.

III Then economic valuation is carried out; it could include field trips, interviews with local stakeholders and potential sources of information, carrying out measurements/ calculations in situ, work with documents on the ground.

IV As a follow-up, the obtained data is processed in order to get valuation. Based on the achieved results, the total value of ecosystem services is calculated. On the base of the whole picture it is possible to develop proposals (e.g. taking investment decisions) or develop payment schemes for ecosystem services to implement.

The process is presented schematically in the Figure 2.

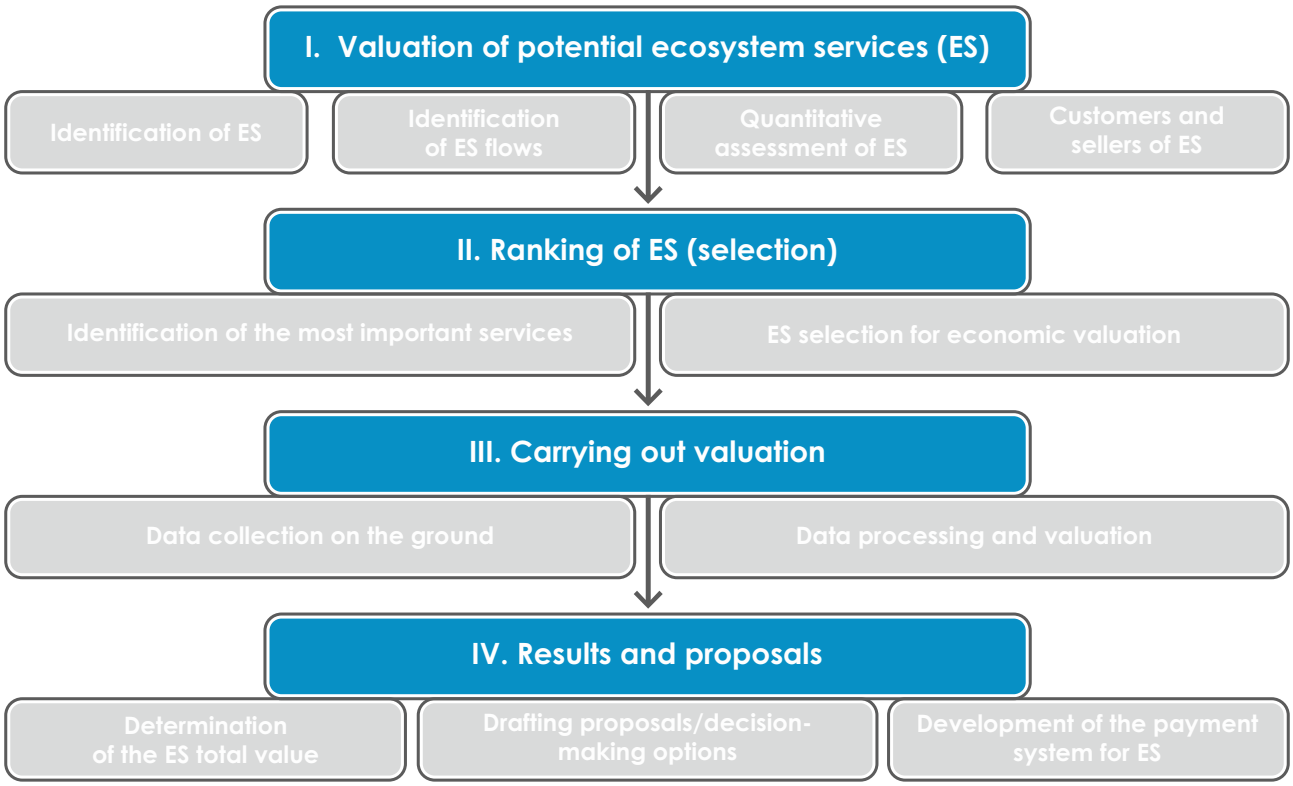

Figure 2. The process of carrying out valuation of economic services.

The work on "Identification and valuation of ecosystem services in Turkmenistan (ESVAL)" was performed in Turkmenistan in 2014. The key objectives of valuation included the following:

- identification of the level of relevance of nature goods and services for economy and vital activities in Turkmenistan;
- raising awareness among decision makers and general public on economic value of nature ecosystem services;
- mainstreaming the results of valuation of ecosystem services into biodiversity conservation plans.

The process of activities within the ESVAL framework included capacity building (improvement of expert skills) of the country in the field of economic valuation of ecosystem services, engagement of the broad circle of stakeholders in the process of identification of ecosystem services (Figure 3)[6].

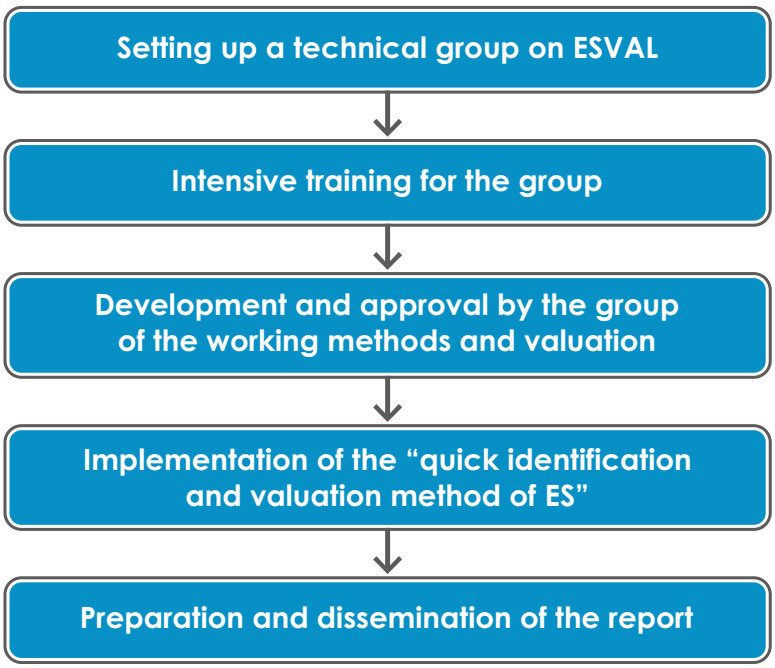

Figure 3. The process of carrying out identification and valuation of ecosystem services in Turkmenistan in 2014.

[6] ESVAL 2014. "Nature and the economy. The results of economic valuation of ecosystem services in Turkmenistan" Technical report. Ashgabat, 2014.

INFORMATION SOURCES

Selection of method for each type of ecosystem services depends on **availability of data for valuation,** possibility to conduct research for valuation of ecosystem services, and obtaining data. The following may serve as key sources of information for valuation:

- Evidence-based research documents, including studies in nature protection territories, research of ecosystem functioning (e.g. forage capacity of habitats), content of plants or animals etc.
- Statistical reports of government institutions, including those from local governments, can provide data of socio-economic nature (population, livestock breeding, land use, yield etc), as well as data on market mechanisms in place (sales volume, cost of services and goods and so on).
- Interviews with local people, staff of nature protection agencies, government institutions and private sector in situ can provide important information for valuation, including:

  • the boundaries of nature protection areas, key ecosystem services, flows and the use of ecosystem services within nature protection areas and surrounding areas (experts from nature reserves, protected areas etc);
  • data on the flows of ecosystem services, data on the use of ecosystem services and goods by local people, importance of conservation of ecosystem services for population (local authorities);
  • relevance of ecosystem services for family budgets, the level of the use of ES in family budgets, data on the load on nature resources, market value and purchasing price and other market information (local people);
  • possibilities to implement payment schemes for ecosystem services, implementation of activities for ES conservation, data on the state of ecosystems and nature including meteorological data (ministries and agencies at national level).

The latter source of information is important for Turkmenistan, as there is no statistical system concerning the use of many ecosystem services here. A number of advises and a case study on how to carry out field work are presented in the Annex1.

The ESVAL valuation conducted in Turkmenistan used the following method of gathering data (Figure 4).

Figure 4. The process of gathering and processing data during the conduct of ESVAL[7] valuation.

[7] Source: Presentation of Aygul Melyayeva during the Forum on Biodiversity in May 2014.

METHODS OF ASSESSMENT OF ECONOMIC VALUE

Valuation of each of ecosystem goods and services is carried out by methods of valuation based on the available information and data. For each service or a good the values which they can deliver to society, ecosystems etc are identified, followed by selection of values for economic valuation. Methods of valuation include ***direct valuation method and indirect valuation method***, as well as ***method of contingent valuation i.e. willingness to pay***. for ecosystem services. In the first method direct benefits and expenditures from the use of services or goods are estimated. In the second method potential and ***"surrogate"*** markets for the given services or goods are estimated. In the last case, a group of survey respondents is asked whether they are willing to pay for existence or use of a certain service in future or for willingness to accept compensation because such service will not be accessible in the future.

Direct valuation methods based on ***market pricing approach,*** use production function of ecosystems and market prices. For the simplest case, the quantity of delivered goods during one year based on non-depleting (sustainable) use and their market value are used. Then, for instance, the value of fishing ***V*** in a certain ecosystem can be calculated according to the following formula:

$$V = Q_{coll} \times P_m - Q_{coll} \times C_{extr},$$

where

Q_{coll} – quantity of goods delivered, collected, extracted or harvested from nature,
P_m – purchasing or market price of goods,
C_{extr} – costs of fishing or harvest of a unit of goods.

When the data about costs of fishing, deriving, extraction, collection or harvest of resources C_{extr} is lacking, then costs estimate as profit percentage can be applied. In case of total absence of information, economists apply informally the rate of 50% of production value.

The method can be applied for fishing, hunting, wood cutting, harvest of medicinal herbs or berries and other similar services.

When there is a lack of information about market prices, e.g. a good is harvested solely for consumption, the calculation of the value of a good can be made as cost value of its production. For example, the value of irrigation water can be calculated as ***cost value*** of irrigation water supply to the field, i.e. operational costs for maintenance of the irrigation system. This method is often called a "shadow pricing method".

Method of ***"travel costs"*** calculates costs of visiting ecosystems as value, which visitors prescribe to this system. In general it is used for tourist, scientific, aesthetical goods and services provided by ecosystems. They include such amenities as monuments of nature, sites of pilgrimage and rites, beautiful landscapes, sites for animal and bird watching, and research studies, and other places people visit in order to obtain goods.

Box 2. Valuation of tourist capacity - case study.

Valuation of tourist capacity of the Hazar part (Turkmenbashy Bay) of the Hazar state nature reserve (2009).

In 2009 the research of ecosystem services delivered by the Hazar nature reserve was conducted. Tourist value of visiting landscapes and bird-watching was identified as one of the potential values of the Hazar part of the nature reserve (the southern part of the Bay of Turkmenbashy). Directors and marketing personnel from seven hotels situated in Awaza tourist zone and Charlak hotel in Turkmenbashy were interviewed. During the interviews it was discovered that an average 40% of guests during the tourist season and 30% off-season guests wanted to visit the nature reserve, that was in total about 15,000 visitors annually. Estimated price of one-day visit was about 25 manats per year. Therefore, economic valuation of tourist services in this area in 2009 was approximately 132 thousand US dollars per year.

Source: Working documents of the Report by Morling P., Guchgeldiyev O. "Economic potential associated with the environmental goods and services provided by the Khazar State Nature Reserve and the Kopetdag State Nature Reserve", 2011.

For instance, the tourist value of the of the Garmyab river valley in the Central Kopedag can be calculated by multiplying a number of tourists visiting the valley (per year) by the (average) costs incurred by one tourist when he/she visits the place. Costs include expenditures for travel, accommodation, meal, tickets and other. If a visit relates to research purposes then it is possible to include the salary payment for working days of the trip. Identification of costs directly associated with the visit of a specific site, when a tourist visits several sites in a row, becomes a key challenge of this method.

The example of the method based on valuation of tourist capacity is given in the Box 2.

As one of the type of such methods, ***change of production*** functions, e.g. reproduction of certain species within the given territory could serve as an indicator of the cost of degradation of this ecosystem. In this case productivity of provision of services in the long-run is compared, and analysis of the lost benefit due to decrease of production (catch) is made. An example of decrease of productivity (degradation) of ecosystems is shown in the Figure 5.

This method can be applied solely, when there are available quantitative parameters about provision of services/goods and when there is a market price. In case when there is no market price in the local market, the price in other countries can be used and calculated according to local conditions (see "the transfer method for services").

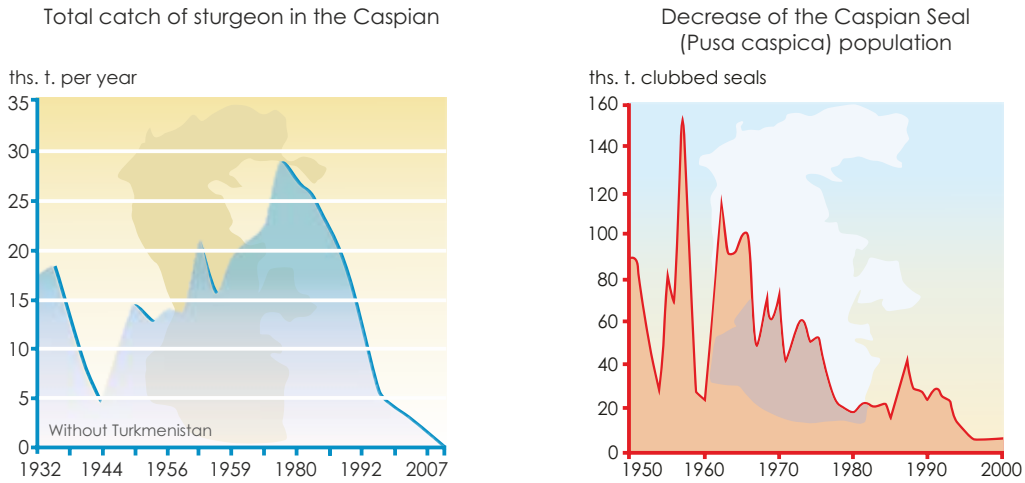

Figure 5. Decrease in the catch of sturgeon and population of the Caspian seal
Source: Report on "The Caspian Sea. The state of environment".

Methods of ***indirect valuation*** include consideration of alternative options of provision of resources (alternative markets) or establishment of "surrogate" (artificial), or anticipated markets where service or a good affect pricing. The method is based on calculation of a given component of the price, which represents the value of service or a good.

The method of ***"use of the cost of alternative provision of services"*** assumes that service will be provided by alternative sources. For instance, provision of drinking water from a river can be replaced by water truck supplies or water abstraction from underground aquifers. In this case, the value of water provision can be equated to costs of water supply or abstraction. Examples of how to use this method are shown in the Box 3.

Box 3. Valuation of ecosystem services by method of alternative valuation - case study.

Case study 1.
According to the estimates of local experts, about 30% of the population of 9 villages situated along the river course or about 14,000 people depended on water delivered by the Sekizyab river in 2009. Total minimum demand in drinking water is estimated as 87 m3 per day. Provision of water treatment for the water supplied by an alternative source, in this case abstraction of water from groundwater sources with subsequent treatment, including service costs (salaries, spare parts etc), is about 102,000 US dollars per year. Therefore, the value of drinking water provided by the Sekizyab river is 102,000 US dollars.

Case study 2.
Another example can be taken from valuation of the ecosystem service 'provision of habitats for animals'. For instance, for calculation of feed provision for kulans, the evidence-based animal diet for enclosures comprised of vegetables, grass and vitamins was taken. The cost of such diet for one kulan is 2,770 manats per year in market prices. In order to get a total value of provision of feed for kulans, the total number of kulans in the country should be multiplied by the cost of the diet.

Source: Working document of the report by Morling P., Guchgeldiyev O. "Economic potential associated with the environmental goods and services provided by the Khazar State Nature Reserve and the Kopetdag State Nature Reserve", 2011; also presented in Guchgeldiyevev O., "Manual on ecosystem services, related to water resources, and their valuation", CAREC, Almaty 2014.

Such method can be applied when service or a good is provided gratis, for instance, provision of animals by forage or drinking water. The main drawback of this method is that in some cases there is no an alternative, or the alternative is highly overpriced.

Method of ***hedonic pricing*** is aimed at the use of price difference between the sites of provision of ecosystem services and beyond. For example, price difference for the fixed property of the same quality, some of which are placed close to ecosystem landscapes and others in other places, can serve as an indicator of the value of

beautiful landscapes. Or difference in payments for the same type of labour can show environmental effect at the working place.

The method is applied for valuation of services which have non-use values, but affect market values. These are environmental amenities and they include landscapes, beaches, parks, environmentally friendly resident area etc. The main drawback of this method is a need for complex study, especially derivation from the price of a part representing the value of ecosystem service. Such factors as available infrastructure (schools, pre-schools, and shops), criminal environment and other factors can affect the price; therefore, in order to derive an "environmental" component from the price, the solid statistical research may be required.

Method of contingent valuation comprises a range of methods based on preferences of people and their willingness to pay for any given service:

- for its availability (existence) for themselves in future (delayed value, or value of future use) or for generations to come (inheritance value);
- in case of its disappearance, for its re-appearance (e.g. rehabilitation of extinct species or disappeared landscape);
- or for the improvement of environmental medium (e.g. reforestation and restoration of the landscape value of forests).

While applying such method, a survey among population for valuation of the willingness to pay should be conducted as follows:

- for conservation (existence) of a certain good or service, e.g. "How much are you willing to pay for existence of certain species?" or "How much are you willing to pay for conservation of wildlife in this area?"
- for conservation of a certain type of goods or their restoration: "How much compensation would you ask to reimburse the cost of a certain good or service if they will go for sale tomorrow?" or "If access to a park was denied would you be able to pay $10 as an entrance fee?", "How much would you pay for reforestation or restoration of other ecosystem?"

Then extrapolation of results to the whole group of population should be made and the amount, which the population is willing to pay as a cost of this ecosystem service or for conservation etc. should be calculated. It should be noted that results should be extrapolated to the group of population that knows about this ecosystem service or a good or depends on it and will be indeed willing to pay for it.

For effective application of the method, the following steps should be undertaken[8]:

- Identification of the service to be valued.
- Selection of valuation method. Valuation can be done by way of:
  - interviewing on the ground– especially effective for complex issues when it is imperative to obtain additional information; at the same time this type of valuation is the most costly;
  - interviewing over the telephone or mail, including e-mail – it is taken when the target group (sample population) is well known, the scope of questions is not broad and they [questions] are clearly defined.
- Development of questionnaires for interviewing, which may be:
  - fully structured, i.e. contain clear definite questions which are within the framework for the interviewees;
  - half-structured, i.e. contain specific questions and general questions for discussion (such as, Let us discuss what are the underlying reasons for tourist value reduction of the site?)

[8] Adapted from http://www.ecosystemvaluation.org/contingent_valuation.htm

- interviews in the form of discussion, they do not contain questions prepared in advance, but require high skills and expertise from interviewers. Besides, apart from the questions associated with valuation, questionnaires should include general questions of social and economic nature, such as education, family status, level of earnings etc, which will enable to use obtained valuations in a proper way.

- Conduct of surveys includes identification of a target group (or sample population) on a random basis; field studies need meticulous planning, staff training, monitoring of activities on the ground. Some recommendations for successful surveys are included in the Box 4.

- Processing of results should be based on statistical instruments (e.g. software).

Box 4. Application of the method of contingent valuation - case study.

Case study. The use of contingent valuation for valuation of landscapes in the Hazar nature reserve.

During assessment of the value of existence of landscapes in the Hazar state nature reserve, a survey among the local population was conducted. In response to the question on "how much one family would pay for the existence of the Hazar reserve?" it was revealed that an average price for the maintenance of existence of the reserve, which an average family was willing to pay, was 20 manats per year. A target group comprised citizens of Turkmenbashy city. In 2009 the value of existence of the nature reserve for local people was about 325,000 per year .

The method can be applied during valuation of essential and well-known among people types of landscapes, flora and fauna, e.g. leopards in the Kopetdag mountains or Plateau of dinosaurs in the Koytendag mountains. In the first case, it is almost impossible to value with other methods, as there is a clear absence of human use and, therefore, the non-direct benefits (e.g. maintenance of food chains) are difficult to estimate. In the second case, landscapes or historical monuments have not only tourist value but the value of existence as well, both national and global. Big parks or areas of nature reserves, neigbouring settlements also can be valued using this method.

Method of valuation based on willingness to pay has a number of drawbacks. First of all, valuation of willingness to pay has subjective character, i.e. declared preferences do not necessarily mean that the payment will be made. Another drawback is a complexity of its implementation. Moreover, because of the subjective nature of declared willingness to pay, very often this method is not accepted by decision-makers. U.S .National Oceanic and Atmospheric Administration (NOAA) made a review of methodology and proposed a number of recommendations on how to conduct surveys related to subjective valuation. They are shown in the Box 5.

One of the options of contingent valuation method is a method of ***choice modeling.*** This method offers a range of various solutions or services with various prices. A respondent can either choose a price band within the limits of which he/she is willing to pay for ecosystem service or to make ranking of preferences for the further analysis. The choice modeling becomes also possible when a choice out of two options is offered to the respondent.

Method of ***cost or value transfer*** is applied when information for valuation of services/goods is completely unavailable or there is no time to conduct the research. This method uses valuation of similar goods/services in other countries, which is corrected against the conditions of the country in question.

Box 5. Selection of recommendations of the U.S .National Oceanic and Atmospheric Administration (NOAA) on contingent valuation.

Selection of recommendations of the U.S .National Oceanic and Atmospheric Administration (NOAA) on contingent valuation.

1. The type and size of the group of respondents (sampling) should be evidence-based and selected by, preferably, professional experts in the field of statistics. It is important to use the random choice, especially during valuation of damage and compensation.
2. It is necessary to avoid a high ratio of respondents who refused to answer, as the high ratio of them makes the survey unreliable.
3. Personal interviews should be used to conduct the survey. Telephone interviews or sending questionnaires by mail also carry certain benefits e.g. low cost.
4. Test surveys' should be conducted to ensure that the respondents clearly understood the topic and questions posed.
5. The design should be conservative: the simpler the survey's format is the better and more comprehensive the result is. It would be preferable, if the answers are "YES/NO" (a referendum format). Moreover, an option 'I do not wish to answer' should be added followed by further questions on why the respondent selected this option.
6. For better understanding of results, a final report should arrange answers according to categories, including Income, Attitude towards nature, Distance from the object, Understanding of the task, Possibility/Wish to implement the task and others. Therefore, the questionnaires should include relevant questions.
7. Besides, the final report should clearly identify sample population, frameworks of the sampling, size, number and reasons for refusals to answer the questions posed. Questionnaires and other materials as well as a complete plan of its conduct, which were used during the interview, should be enclosed.

The value transfer method can be used almost everywhere where there is no possibility to conduct their own research. The method is also applied to valuation of carbon absorption, globally important environmental services and goods. For instance, the Framework Convention on Climate Change (UNFCCC) issued special tables for countries in order to calculate carbon absorption, which countries can use while undergoing the process of valuation. FAO made an analysis and presented assessments of water value for irrigation, which are shown below in the Table 1.

Table 1. Aggregate value of water for irrigation needs and general water consumption (water supply) in Asia (in US dollars per 1 m^3).

Applied method	Method of production function	Remediation cost and contingency method	Contingency method	Method of market pricing	Total
Use	For irrigation	For general water use			
ASIA					
Number of studies	11	1	13	2	16
Minimal valuation	$0.048	$1220	$0.036	$0.255	$0.036
Maximum valuation	$0.536	$1220	$0.404	$0.309	$1220
Average valuation	$0.219	$1220	$0.235	$0.282	$0.303

Source: Aylward B. Et al. 2010.

There are two policies to apply this method: the method of cost transfer based on ratio (simple method) and the method of derivation of cost function (complex method). Simple policy uses ratios for cost transfer, for instance, gross national product per capita or income per capita etc. The ratio is used in the following formula:

$$V_{tr} = V_1 \times \frac{GDP_{tr}}{GDP_1}$$

where

V_{tr} – value of service or a good in a target research country;
V_1 – value in the country where research was made;
GDP_{tr} – gross national product per capita in a target research country;
GDP_1 - gross national product per capita in the country where the data are taken from.

In this formula it is necessary to arrange results in single currency and by certain time. For example, use the gross national income per capita based on purchasing power parity in USD in 2012[9].

According to the department of Treasury and Finance of Australia (DTF, 2013) in order to achieve success while applying this method, the following conditions should be met:

- according to the department of Treasury and Finance of Australia (DTF, 2013) in order to achieve success while applying this method, the following conditions should be met;
- according to the department of Treasury and Finance of Australia (DTF, 2013) in order to achieve success while applying this method, the following conditions should be met;
- to have consistent and comparable measurements of the willingness to pay;
- proper correction, e.g. use of change in income per capita, age structures, density of population and level of education.

According to the second policy, the statistical function of dependence on the value of the willingness to pay and such variables as income, age, and distance to the object of value, respondents' age and other is derived from the first study (source). Then, in order to get valuation, ratios from that country or territory are applied to the derived function.

Universality is the key merit of the value transfer method. The method can be applied to any method of valuation and any service, but it is advisable to use it where there is a lack of capacity for valuation. This method can assess rare species of plants and animals when there is no any information about their value. Moreover, this method can be successfully applied where there is a need to avoid big expenses for field studies and research. But this method also has a number of drawbacks. In the first place, it is complexity of derivation of function of value from the source. Another disadvantage is based on the fact that the source data is based on the contingent valuation methodology, mostly on “willingness to pay”. Therefore, even at the same parameters of age, income, gender, education and other, the perception of nature (or willingness to pay) for different countries might be different. It is important to have the data on contingent valuation from own country or countries with similar cultural values (perceptions, attitudes etc.).

[9] This data is available on the World Bank site: data.worldbank.org

APPLICATION OF METHODS FOR SPECIFIC ECOSYSTEMS

Agricultural lands

Table 2. Valuation methods for agricultural lands.

Type of service	Valuation method	Methods applied in Turkmenistan
Grain crops.	Market value of grain crops minus production costs, i.e. labour force, service of machinery and equipment etc.	The amount of income is gross value added in the sector as well as any loss of capacity due to soil degradation (salinization and soil erosion) or desertification. Changes of production quantity during the last 10-20 years can be studied, and losses as a result of soil degradation and desertification can be valued. The key problem is the recording of changes in other production factors, such as fertilizers, machinery etc. During the primary comparison the following is proposed: a)conduct valuation of gross value added generated in agriculture, b)study of the quantitative changes in production output (yield) in various areas of the country, and for various grain crops. Gross value added is calculated in the context of national accounts.
Cattle.	Market value of production (milk, meat, woolfell) minus production costs.	
Cultural resources.	Social value associated with agricultural festivities etc is valued on the base of costs incurred during such events.	If there are any important agricultural festivities (the Harvest Day, for instance), then costs estimates for such festivities should be included in expenditures incurred. Changes in this area can eventually cause special interest.
Climatic control.	Carbon stock in soil is valued on the base of international carbon price in accordance with climate reference materials.	In order to value the carbon stocks in agricultural lands of Turkmenistan, fundamental research should be conducted.

Source: Bolt et al., 2005; Markadya et al., 2002.

Proposed steps for economic valuation

I Make valuation of gross value added in agriculture for various grain crops and livestock production in accordance with sustainable agricultural practices. Access to statistical sources on national accounts of the country is required in order to obtain such data. Wherever possible, make valuation separately in various regions of the country, and this data should cover several years.

II Make valuation of the yield dynamics for key agricultural crops and livestock production (per 1 hectare) during the last 10-20 years. Wherever possible, assess to what extent such changes are caused by production costs, such as fertilizers, and to what extent they can be associated with degradation and desertification. More detailed information about available methods can be found in the works of Bolt et al., 2005 and Markandya et al., 2002.

III Collect data about any genetic materials, extracted from agricultural lands and obtain the market value of these materials.

IV Collect information about costs of important cultural events associated with agriculture and present them as cultural values of such ecosystem.

Protected areas (nature reserves and wildlife sanctuaries)

Table 3. Valuation methods for protected areas (nature reserves).

Type of service	Valuation method	Methods applied in Turkmenistan
Water resource management and prevention of/combating soil erosion.	Prevention of degradation of natural resources as a result of soil erosion, silting and non-agricultural flows is valued based on costs for restoration activities and payment for water resources.	For lack of special study on valuation of services, the average indicators in water resource management from other countries can be used. The annual average cost of activities aimed at combating soil erosion is 44 US dollars per hectare according to De Groot R. (2012).
Climatic control.	Carbon stocks in nature reserves areas are valued based on international carbon price in accordance with climate reference materials.	In order to give a preliminary valuation of carbon stocks in the territory of Turkmenistan, a special research should be conducted; therefore, it is recommended to use an average used in other countries. The use of these figures is justified, as the carbon price is a global price. Climate Change and Terrestrial Carbon Sequestration in Central Asia. (2007) gives an approximate quantity of carbon stocks as 0,5-4,5 ton of carbon per 1 hectare. This is a very low figure in comparison with that of grasslands. Cost estimates for such quantity can be about 139 US dollars per ton of carbon (see section about forests). However, this is a cost of the stock and relevant discharge depends on discount rate. The rate of 3% is recommended and it will result in variations from 2.0 to 18,8 US dollars per hectare per year.
Services of birds and animals habitats.	Provision of habitats assumes assessment of value of migrating birds based on the cost of birdseed/appropriate feed for birds.	Services for provision of habitats can comprise the following: provision of feed, allotment of the area and its protection. Costs for provision of habitats can be estimated by multiplying a number of migrating birds by the cost of feed during their stay in the area, by method of market price valuation of alternative feed. The norm of alternative feed is calculated based on scientific standards for animal feed. International estimates from reference materials can be used here. Allotment of the area is estimated through the cost of provision of land for other uses (e.g. cost of land lease per 1 hectare per year for pasture use or planting crops or orchards). Protection of the territory is estimated through operational expenses for conservation (maintenance) of nature reserves.
Rest and recreation.	Valuation of the visits by local and international visitors is measured on the base of their willingness to pay for the visit (or how much money can be effectively spent during one visit).	This requires special preliminary research in some areas of the country, and some of such studies have already been undertaken (e.g. in Kopetdag, Hazar and Amudarya reserves). When there are no tourists, it is possible to use the valuation of visits by potential tourists. In any case, surveys are needed.
Cultural services.	Areas/sites, which have special religious meaning due to extremely valuable monuments, provide additional services, which are valued by method of willingness to pay by local and foreign tourists for a visit.	It would be desirable to identify those key areas/sites in Turkmenistan where the important monuments are, and estimate them through the means which visitors are ready to spend in order to visit such places. Moreover, the people in the country who do not visit such places are also willing to pay for existence of such monuments (non-use value), and they should be included as well.

Type of service	Valuation method	Methods applied in Turkmenistan
Pollination.	Parts of nature reserves, especially wildlife sanctuaries which are situated near gardens, crop fields, depending on pollination (at the distance up to 5 km) can provide pollination services, which are calculated by value transfer method or alternative provision method.	Both methods of calculation are applicable to Turkmenistan. In case of value transfer, the valuation data on pollination for various crops per one hectare of gardens should be used. For the second method it is necessary to calculate how much the alternative provision of pollination services (lease price of bee communities, usually two bee communities per one hectare) will cost.
Provision of pastures, medicinal herbs and berries and other plants for food and medicinal purposes.	Calculation of the market value of harvested goods or consumed forage minus costs of harvesting, delivery and consumption.	The method applied in Turkmenistan in wildlife sanctuaries which provide such services. If costs are not known, then 50% of market values can be assumed as the amount of costs.

Sources: De Groot et al., 2012, Bolt et al., 2005, Markandya et al., 2002.

Proposed steps for economic valuation

I Data collection about nature protection areas/parts of the country (area, main characteristics of each area, annual average number of visitors).

II Estimate cost of genetic resources using the value transfer method in the amount of 1,214 US dollars per 1 hectare per year. Lower and upper margins are 0,00 US dollars and 2,428 US dollars per 1 hectare per year (see De Groot et al., 2012).

III Estimate cost of services for climatic control in regions; lower and upper margins are 2,0 and 18,8 US dollars per 1 hectare per year.

IV Estimate cost of services for management of soil erosion in regions as 44 US dollars per 1 hectare per year (see De Groot et al., 2012). This figure should be calculated based on GDP (gross domestic product/ income per capita).

V For recreational valuation of areas, make an assessment on the base of preliminary research and willingness to pay for access to services. Please note that it concerns only some areas, not all nature protection areas.

VI As far as cultural services are concerned, here the national survey is recommended so to identify to what extent people value such places and how they could make payments aimed at the conservation of such sites.

Forests

Table 4. Valuation methods for forests.

Type of service	Valuation method	Methods applied in Turkmenistan
Timber.	Net value of produced timber.	Decision makers will be interested in trends of timber value, therefore, calculation should be made for some period of time (10-20 years).
By-products of forests.	Net value of goods delivered: animals, foodstuff, genetic materials.	The same method is applied. It is necessary to know trends for timber and make calculations for a number of years (10-20 years). For valuation of ecosystem services it is desirable to use the figures of sustainable deforestation.

Type of service	Valuation method	Methods applied in Turkmenistan
Climatic control.	Carbon absorption by forests depends on the composition of biological species, forest age etc.	Use the capacity (stocks) of carbon for various types of forests as mentioned below, and apply them to national forests. Detailed calculation is described below.
Prevention of soil erosion.	Relevance of prevention of soil erosion has an extremely local character. It depends on where a forest grows, land precipices etc. In this case, approximate valuation is made on the base of reduction of silting process in dams and reduction of losses of top soil.	It will be difficult to make valuation without detailed information on areas where the forests grow, and so on. In the absence of fundamental studies on valuation of services on water resource management, an average from other countries can be used. An average cost of combating soil erosion, according to De Groot (2012), is 44 US dollars per 1 hectare per year.
Biodiversity.	Genetic materials from forests are described in the section on by-products of forests.	See commentary on by-products of forests.

Source: Chiabay et al., 2011, De Groot et al., 2012, Bolt et al., 2005, Markandya et al., 2002.

Proposed steps for economic valuation

I Data collection related to firewood harvested in forests and its market value. If timber information is needed, it can be found in existing records/ reports on business deals. Information on some market prices for firewood can also be available if necessary, but some studies may be required and prices may vary from region to region.

II Data collection on other goods provided by forests, hunting, forage harvesting etc. Besides, it is necessary to gather any data related to derivation of genetic materials from forests. In each particular case the value (amount) is defined by way of setting price of goods minus costs for their harvesting.

III In order to estimate benefits from climatic control, the hectares occupied by forests should be transformed into tons of carbon stocks. The Table 6 shows relevant information, depending on the forest type. The line for Europe and Central Asia contains figures to be taken into account. Estimates of the carbon sequestration quantity should be followed by valuation of carbon stocks using the price per 1 ton of carbon. In order to make this exercise, it is suggested to take the amount of 38 US dollars per 1 ton of CO_2, that was used for social cost of carbon in the analysis on Economics of ecosystems and biodiversity for 2015 (Hussain et al., 2011). As it is a price of 1 ton of CO_2, then the corresponding amount of carbon is 3,6 times higher (i.e. 139.46 US dollars). Thus the cost per 1 ton of carbon stocks in 2015 will be calculated. As it is necessary to estimate the cost of services received from stocks, an annual income is taken which is equal to the price of share multiplied by discount rate. It is proposed to use 3% of discount rate. So, if there are 100 hectares of temperate deciduous forests in the country, then the cost of carbon services will be 100x59.4x139.46x0.03 = $24, 852.00 (US dollars).

Table 5. Carbon sequestration in a biomass of global forests (t of carbon /ha).

World region	Boreal (Arctic)	Tropical	Temperate warm	Temperate mixed	Frigid zone Coniferous forests	Temperate Deciduous forests
North America	37.37*	92**	92**	51*	37.37**	51*
Europe	37.37*	-	92**	59.4*	37.37**	59.4*
Japan and Korea	37.37**	149**	100**	47.35*	37.37**	47.35*
Australia and New Zealand	37.37**	149**	134**	51**	-	51**
Brazil	-	186*	168*	-	-	-
Russia and Caucasus	37.37*	-	92**	37.98*	37.37**	37.98*
South Asia (and India)	59.4**	225*	180*	168*	59.4**	168**
Chinese region	25.77*	96**	78**	25.77*	25.77**	25.77*
Other countries of Asia	59.4**	92*	78**	-	-	59.4*
Eastern Europe and Central Asia	37.98*	-	-	59.4*	37.98**	59.4*
Other countries of Latin America and Caribbean	34**	149*	134*	59.4**	-	34.88*
Africa	-	200*	168*	-	-	59.4**

Note: (*) Data taken from original studies on forest types and geographic.
(**) Date taken from original studies on similar world regions.
Source: Myneni, R.B. et al (2001); Gibbs H.K. (2007).

The Caspian coastal area

Mainland coastal ecosystem on the Caspian Sea provides a range of essential services, but at the same time it is the most pollutant. Valuation of ecosystem services can be followed by the analysis of degradation of onshore ecosystem, mainly, due to oil production and processing, and overfishing (SoECS, 2011).

Table 6. Valuation methods for the Caspian coastal area.

Type of service	Valuation method	Methods applied in Turkmenistan
Fishing.	Net value of fishing.	In order to estimate food function of the Caspian Sea market prices and costs of fishing operation are used. It is important to value the catch per a unit of operational expenses during the last 10-20 years. Cost of depletion of fish stocks can be estimated with the help of net value lost during the period of time required for restoration of fish stocks.
Climatic control.	Cost of carbon stocks in seaweeds and wetlands.	A study on carbon stocks in wetlands should be conducted. The upper price margin is 480 US dollars per 1 hectare per year (data from De Groot R. et al., 2012)
Services in animal habitats.	Functioning/operation of habitats: assume that valuation of marine fauna based on the costs of remediation.	It can be valued based on the cost of feeding grounds. For the lack of fundamental studies, the estimate of De Groot R. et al.., 2012 can be refereed to, which is 194 US dollars per 1 hectare per year, but it should be adjusted using GDP/per capita in Turkmenistan.
Prevention of soil erosion.	Cost of restorative function in combating soil erosion.	Estimate the cost of activities aimed at soil erosion prevention if a coastal zone deteriorates (e.g. construction of dams etc). The upper margin given by De Groot et al., 2012 (25,847 US dollars per 1 hectare per year) should be adjusted, using GDP/per capita in Turkmenistan.
Rest and recreation.	Net value of visits by both local and foreign visitors of key tourist areas of the Caspian, such as Awaza, estimated by willingness to pay for a visit.	A review of main hotels or relevant ministries should be conducted. Such information as annual number of visitors, average stay (in days) and their expenses should be taken into account based on the procedure described above. It is worth to note the relevance of sustainable indicators (e.g., sustainable tourist load).
Cultural services.[10]		

Proposed steps for economic valuation

I For sustainable fishing methods it is necessary to estimate the net value of an annual catch. The cost of fishing in metric tons per unit of volume of work/efforts (total capacity of the fishing fleet multiplied by the time spend in the sea) should be calculated, provided that both legal and illegal fishing are taken into account. If fish stocks are depleted, it should be noted. Cost of activities for restoration of fish stocks can be calculated through reduction of the net annual fishing value as a result of measures taken to protect fish stocks.

II Marine wetlands play an important role in carbon sequestration. A solid study should be conducted for valuation of total annual carbon sequestration/ absorption. An upper margin, according to De Groot et al. 2012, is approximately 480 US dollars per 1 hectare per year.

III Services of animal habitats of the coastal zone can be estimated based on annual costs for maintenance of fish stocks during the construction of fish factories. Data provided by De Groot et al. 2012, whose estimate is 194 US dollars per 1 hectare per year can be applied, provided it is adjusted using the GDP/per capita in Turkmenistan.

IV If there is available information on activities related to combating soil erosion on the Caspian shore, then the functions of combating erosion should be valued using approximate data presented by De Groot et al. 2012, which is 25, 847 US dollars per 1 hectare per year, provided it is adjusted using the GDP/per capita in Turkmenistan.

[10] See "Valuation of nature protection zones/nature reserves."

- Cost of rest and recreational services can be valued through annual net income generated from tourism in the recreational zone Awaza on the Caspian Sea. Besides, a survey on the net profit of lodging rent during the summer season may be conducted.

Wetlands

Note: there are two types of wetlands: mainland and coastal. Each type should be considered separately.

Table 7. Valuation methods for wetlands.

Type of service	Valuation method	Methods applied in Turkmenistan
Fishing.	Value of fishing minus costs, but taking into account any unsustainable methods.	This method can be applied for Turkmenistan. In case of unsustainable use, the data on sustainable use for conservation of stocks should be applied, but the current situation with unsustainable use and stock reduction trends must be shown.
Climatic control.	Value of carbon concentrated in ecosystem is estimated on the base of international carbon price.	For reference: according to estimates, internal wetlands have carbon absorption estimated as 488.00 US dollars per 1 hectare per year, and its cost in coastal wetlands is 465.00 US dollars per 1 hectare per year. Upper and lower margins for these amounts are 4.00 and 2,216, and 7.00 and 84.00 US dollars accordingly. It is suggested that these figures should be used for valuation of wetlands in question.
Genetic diversity(*).	Value of any materials extracted from wetlands, or contract sum with the entities entitled to extract genetic materials.	It is unlikely that some materials will be extracted from nature reserves in Turkmenistan, but if they are ectracted then the value of such materials should be included. For reference: other countries estimate services for genetic conservation in internal wetlands in the amount of 1,168 US dollars per 1 hectare per year (prices ranging from 0.00 to 14,023 US dollars per 1 hectare per year), and coastal wetlands in the amount of 6,490 US dollars per 1 hectare per year (prices ranging from 9.00 to 22,045 US dollars per 1 hectare per year). It is suggested that this average should be used for wetlands in Turkmenistan.
Foodstuff.	Valuation of any foodstuff delivered by wetlands.	This method can be applicable for Turkmenistan.
Waste treatment.	If waste treatment is done within wetlands and it doesn't damage an ecosystem, then the value of service is equal to the cost of an alternative method of waste treatment.	Valuation of any utilization/treatment of waste, which is done within wetlands, and the cost of any acceptable alternative of utilization can be made. The value of the latter is equal to the cost of services provided by wetlands.
Rest and recreation.	Valuation of recreational use is based on the willingness to pay for the possibility to use /to visit.	This objective could become one of the key objectives in valuation of these services, using primary data: value transfer as a matter of fact is not appropriate for this category.
Natural disaster management.	Valuation of prevention of damage as a result of extreme weather events is made by technical valuation of the ability of wetlands to keep floods and other phenomena back in human settlements.	It should be decided in the first turn whether this function is applicable for the wetlands in question. Such valuation can become a hard task, and, therefore, the value transfer is possible. Estimates made by other countries show that internal wetlands valuation is 2,986 US dollars per 1 hectare per year (prices ranging from 0.00 to 14,619 US dollars per 1 hectare per year), and coastal wetlands-5,351 US dollars per 1 hectare per year (prices ranging from 2.00 to 32,291 US dollars per year). It is suggested to use this average for nature reserves of Turkmenistan.

(*) Genetic resources included.

Sources: De Groot R. et al.., 2012, Bolt et al., 2005, Markandya, 2002.

Proposed steps for economic valuation

I Identification of internal and coastal wetlands and obtaining information with regards to each type, i.e. area and main characteristics.

II Collection of data on quantity of fishing provided by wetlands, and assessment of market value minus fishing costs.

III Repeat these actions toward any other foodstuff delivered by wetlands.

IV Valuation of services for climatic control in internal wetlands in the amount of 488 US dollars per 1 hectare per year, and coastal wetlands in the amount of 465 US dollars per 1 hectare per year. Upper and lower margins of these amounts vary from 4.00 to 2,216 US dollars and, accordingly, from 7 US dollars.

V Estimate waste quantity in wetlands. If it is lower than the potential capacity of wetlands then valuation should be made based on the cost of acceptable utilization (for instance, sanitary landfills).

VI If a field research is impossible to conduct, then, as shown above, do not make valuation of the use of wetlands for recreational activity; prepare the description of available territories used for this purpose and submit the data on visitors etc, if any.

VII Assess natural disaster management by wetlands on the base of international research, if it is applicable to this area. According to estimates made in other countries, internal wetlands valuation is 2,986. US dollars per 1 hectare per year (prices ranging from 0.00 to 14,619 US dollars per year), and the value of coastal wetlands can be estimated as 5,351 US dollars per 1 hectare per year (prices ranging from 2.00 to 32,291 US dollars per 1 hectare per year). It is suggested to use this average for nature reserves of Turkmenistan.

Grasslands

Grasslands – are the territories covered by vegetation where grass cover is prevailing. Grasslands can be found in nature of all continents but Antarctica. Majority of the world environmental regions have grasslends. For example, there are five terrestrial classifications (sub-divisions) of environmental regions of moderate grasslands, savannah and shrub bioms ("ecosystems"). In Turkmenistan grasslands are characterized by various shrubs, which also can be found in desert areas.

Table 8. Valuation methods for grasslands.

Type of service	Valuation method	Methods applied in Turkmenistan
Foodstaff.	Value of any foodstuff delivered by grasslands, especially forage for cattle. It is estimated according to the cost of alternative sources of feed for animals.	Majority of grasslands is used for grazing domestic cattle; and experts should have opportunity to estimate the cost of forage for animals as a result of discussions with officials from the Ministry of Agriculture and representatives of local farms. Surveys of cattle owners, shepherds, including "Turkmenmallary"/Turkmencattle" Association, are also possible.

Type of service	Valuation method	Methods applied in Turkmenistan
Climatic control.	Carbon stocks in nature protection areas are estimated according to the international value of carbons set forth in the climate reference sources on carbon.	In order to estimate carbon stocks in relevant areas of Turkmenistan, a solid big research is needed; therefore, it is advisable to use an average from other countries. However, currently there are studies on the quantity of carbon biomass in Saxaul/Haloxilon forests of Central Asia, including Turkmenistan, which are estimated from 0.5 to 4.5 tons per 1hectar (Thevs et al. 2013). Standard cost of grasslands for climatic control is about 40 US dollars per hectare per year. Lower and upper margins vary from 0.00 and 113 US dollars per 1 hectare per year.
Rest and recreation.	Possible costs (potential) visits of local and foreign visitors.	Due to multitude of sand landscapes in Turkmenistan, it is necessary to identify what territories and sites can have capacity for tourist visits.
Cultural services.[11]		

Sources: De Groot R. et al.., 2012, Bolt et al., 2005, Markandya, 2002.

Proposed steps for economic valuation

I Make valuation of grasslands as opposed to agricultural lands. There is a significant difference there, as there is open access to grasslands where all users can keep their livestock or use food resources, while agricultural lands assume control of individuals or groups of people over resources.

II Make valuation of food and water services delivered by grasslands using the costs for provision of users with the same food and water from other sources of the same quality.

III For climatic control, use standard global value in the amount of 40 US dollars per 1 hectare per year, with lower and upper price margins of 0.00 and 113 US dollars per 1 hectare per year.

IV For genetic diversity, use standard global value in the amount of 1,214 US dollars per 1 hectare per year, with lower and upper price margins of 0.00 and 2,428 US dollars per 1 hectare per year.

Quality of environment
Air quality

Air quality is not an ecosystem per se: it rather measures the cost of environmental degradation against clean air.

[11] See "Valuation of nature protection areas/reserves".

Table 9. Valuation methods of air quality.

Type of service	Valuation method	Methods applied in Turkmenistan
Local air pollutants.	Air pollutants which affect human health are particulate matter (emitted as a result of a direct burning of fossil fuels and other fuels, emitted as a result of chemical reaction with participation of emission of sulphur oxides and nitric oxides) and ozone.	Cost of health affected by these pollutants can be estimated on the base of standard ratio between the reduction of morbidity and mortality, and measurable concentration of pollutants. Besides, morbidity and mortality are estimated based on a number of international studies, adjusted to the level of economic and social development of Turkmenistan.
Global air pollutantsants.	Anthropogenic activity resulting in greenhouse gas emissions will lead to climate change in the long run that is a long-term shift of weather conditions, including change in extreme conditions.	Adverse impact of greenhouse gas emissions is estimated at the global level and is called a social carbon price. Social carbon price is an comprehensive estimate of damage as a result of climate change. It includes changes in net production output in agriculture, human health, and material damage caused by high risks of floods. Social carbon price is established (including 3% of discount rate) in the amount of 39 US dollars per 1 ton of CO2 in 2015, and 76 US dollars per 1 ton of CO2 in 2050. (Http://www.epa.gov/).

Proposed steps for economic valuation

Local pollutants

I Data gathering about concentration of particulate matter in the air. Concentration of the total amount of particulate matter is considered adequate if the data about PM10 (particulate matter up to 10 microns) and PM2.5 (particulate matter up to 10 microns) is absent.

II Data gathering about population residing in areas with high concentration of particulate matter, which are not protected from pollutants.

III Data gathering on the level of non-random mortality, mortality as a result of cardiovascular diseases and lung cancer, as well as cases of chronic bronchitis, and mortality cases of children in the age under 15 years old from respiratory diseases among population residing in such areas.

IV Application of the standard ratio of the dose-effect, the doses which uncover the level of additional mortality and morbidity, associated with high concentration of particulate matter in the air (see WHO materials, 2005).

V Valuation of each case of additional mortality using the assessment of average statistical life, which defines the assessment of mortality risk from polluted air, presented in the work of Larsen, Strukova, 2005. Make valuation of morbidity using costs of disease for each case of chronic bronchitis.

Global pollutants

VI Use the figures of green gases emissions according to the cost defined by the State Information Committee of Turkmenistan and multiply them by social carbon cost according to the information at http://www.epa.gov/.

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http://www.epa.gov

Annex 1.

Methods for carrying out a field study. Valuation of fishing: case studies.

Source: Working documents on data collection for preparation of the report by E. Strukova, O. Guchgeldiyev, 2010. "Study of the economics of bio-resources utilization in the Caspian", together with Elena Strukova, Caspian fishery sector' economic analysis, World Bank.

An interview and individual survey of the situation are among the most popular and appropriate methods of research.

An interview

In order to take an interview a list of questions/information which needs clarification should be compiled. In order to obtain the same data a list of questions (the structure of an interview) can be drawn up. In many cases while working with hunters and fishermen and disclosing "sensitive" information, an interviewer with a notepad, who writes down the answers, may appear to be a threat for fishermen and hunters. Therefore, it would be preferable to take an informal interview, not structured one, and use notes or paper solely when there is a need to draw diagrams or use them.

Very often an "interviewee" finds it difficult to answer questions because he is either reluctant to share information or he does not understand the questions, or for some other reason. In this case an interviewer may want to apply the following tools.

Drawing up the seasonal maps

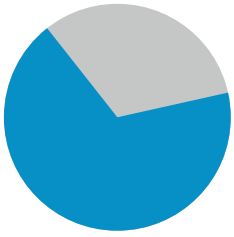
Appropriate for quick assessment of seasonal dynamics for the cases when a table of 12 columns for each month is drawn, which contains necessary information in rows. An interviewer asks an interviewee to provide information on a monthly basis. In order to obtain necessary information the following can be used: monthly average of trips to sea, quantity of catch (by species) or total quantity, number of offences etc. In those cases when the interviewee doesn't remember exact figures, or is reluctant to share them, it is possible to ask about the maximum and the minimum of catch or make a scale of values (from 1 to 5; from 1 to 10 and so on), for example:

Month	1	2	3
Average trips per month	5	10	15
Monthly catch of sturgeon, 1 min - 10 max	5	6	10

While using the tables, it is necessary, however, to set a baseline for calculation e.g. monthly data (current) or total number/quantity per year.

Drawing a circle diagram

It is used in order to get a total picture of the situation and shares. For instance, an answer to the question about quantitative composition of catch or budget can be received based on shares. When the question posed on "What fish species contain an average catch of a fisherman in this area?" a circle can be drawn and a quantity of small fish, sturgeon and other caught fish can be indicated by the fisherman.



Time graphs

Time graphs are one of the versions of seasonal graphs. Time graphs are the graphs of trends (increase or decrease) for any given period of time. They can be applied when an interviewee cannot (or doesn't want) indicate exactly how the situation changed, but can only make an assumption or outline the trend. For this an interviewer asks him to draw a graph (of catch or fish prices) during 5-10 year period. Then, the figures taken from 1-2 years can be extrapolated to the following years resulting in an approximate trend.

It is necessary to visit all or similar parts of fishing sites in order to talk with local fishermen or a fishery inspector.

The following information should be obtained during the interviews:

1) Average monthly or annual catch per one motorboat. A seasonal table of catch can be drawn up in order to take into account seasonal fishing changes, i.e. ask for the average catch per one boat, e.g.:

Month		1	2	3	4	10	11	12	TOTAL
Number of trips per month	A	5	10	15	10	12	…	…	
Average catch per 1 trip (max – min)/2, kg	B	10							
Total monthly catch	C	A*B							AMOUNT
Share of sturgeon in the catch	D	%							
Catch of sturgeon	E	C*D							AMOUNT
Catch of other fish	F	C - E							

It might be that separate tables for sturgeon and other fish will be needed, as fishing methods and trips can differ.

2) Costs for fishing (depending on methods of fishing).

Calculation of fishing costs by kalada method

(kalada – net for long-line fishing of the bottom-living/ground fish)

For fishing of sturgeon by kalada method (example from Turkmenistan), the costs can be calculated as follows:

Price of the boat:	
OKA 4M	1 500 $
Yamaha motor 40	3 400 $
Total investments in a motorboat	4900 $

Average lifetime:	
Boat	10 years
Motor	8 years

Calculation of depreciation per year	=	Cost of the boat | Lifetime	+	Cost of the motor | Lifetime	=	$ 575

Cost of engine repair:	
Shaft replacement (once per 3 years 750$), per 1 year	$ 188
Other expenditures (estimated) per year	$ 42
Total repair costs	$ 230

Costs of kalada (1 kalada per 1 boat per 1 season)	
Rope (100 м)	$ 53
Hooks (150 units)	$ 42
Anchors (2 units)	$ 10
Total	$ 105

Costs for fuel and lubrication materials:	
Number of trips per month	12
Fuel (15 litres per 1 trip)	$44
Motor oil	$13
Total costs for fuel and lubricants	$57
Total costs per year	$682

License for sea trips (yearly) $421

Total expenses: $575+$230+$105+$682+$421= $2,013

Depending on fishing methods, expenses will approximately be the same for the same methods, therefore, they can be calculated once for each fishing method. Data obtained in regard to costs per one boat shall be multiplied by a number of boats engaged in sturgeon fishing (by kalada method).

Another way of valuation is that based on peer reviews, provided either by researchers or veterans of fishing inspections, who base on their life experience and can provide valuation of catch in tons in certain locations. Local population, market sellers (valuation of supply and sales) and estimates of transboundary transportation of the goods from customs services can also become sources of information.

The following is very important to keep in mind while taking interviews:

I It is necessary to take notes about sources of valuation, such as "a place of obtaining information, date, time, and source". If a source wants to be anonymous, his name/pseudonym can be used, in this case time and date, possibly an agency, where the source is from, should be indicated. For example, "Interview of the fisherman KURBAN, 30 years old, motorboats mooring, town of Garabogaz, 13/06/2009 15:00".

II Only those information sources which can provide reliable information related to the specific issue should be used. For instance, a fisherman from a village cannot provide reliable valuation about non-official fishing on a national scope, whereas an expert from the ministry will hardly be able to value costs per one boat in the rural area. Sources should be trustworthy!

III In order to make sure that information is reliable, it is advisable to obtain data from two or more independent sources. For instance, information about the catch can be obtained at the same time from both a fishery inspector and a buyer of fish from a village.

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