Warsaw University
Warsaw Ecological Economics Center

Guide on Economic Instruments & Non-market Valuation Methods

POLFOREX

Table of Contents

List of Boxes and Figures

Introduction

The aim of this guidance document is to provide forest practitioners, decision makers and forest owners insights into the various economic instruments available to enhance the *non-market ecosystem provision* of forests such as a high quality biodiversity; enhanced carbon sequestration; improved recreation experiences for the public; and a wide range of other important ecosystem services that forests in Poland provide.

Non-market ecosystem services from forests are defined as goods and services from forests that benefit society at large and which are not traded in the market. Non-market benefits are different from market-based benefits of forests such as fuelwood and industrial woods, which are not included in this overview.

In order to enable the development of a policy framework and subsequent instruments that enhance the provision of non-market based ecosystem services, it is central to take into account the true value of the services that forests provide. Monetary valuation of ecosystem services can contribute towards better decision-making, i) by ensuring that policy appraisals take full account of benefits and costs of the environmental impacts; ii) by taking better account of costs associated with ecosystem degradation and iii) by recognising the substantial economic and welfare benefits of better management of ecosystems in forests.

Ecosystem services contribute to economic welfare in two ways:

- by contributing to the generation of income and wellbeing; and
- by preventing damages that inflict costs on society.

A brief summary of the main *non-market* benefits – biodiversity, soil and water protection, protection of fragile ecosystems, non-wood forest products and socio-cultural values and services - that forests supply to society and their importance is given in Box 1 overleaf.

When forest owners manage their forest ecosystem to improve a service, this generally results in changes to other forest based ecosystem services. In some cases there will be trade offs between ecosystem services – for instance between ensuring a high timber production and enhancing biodiversity – whereas in other cases there is scope for synergies – for instance between managing for biodiversity and carbon sequestration. For this reason, different goods and services provided by forests interact in different ways with forest management activities. When promoting non-market benefits of forests in policy initiatives it is therefore essential to consider trade offs and synergies between the complex interplay between ecosystem goods and services within an ecosystem,

For the ecosystem services considered in this document there are potentially various interacting effects of promoting changes to current forest management practices. Figure 1 provides some generic examples of trade-offs and synergies between some of the forest based ecosystem goods and services.

Part I of this guidance is dedicated economic instruments and provides a brief overview and some examples of how economic incentives may be applied in order to enhance non-market ecosystem services in forests. Part II provides guidance and overview of ways in which it's possible to attribute a monetary value on non-market ecosystem services from forests. This section furthermore lists advantages and limitations of each approach. The two parts of this document are deliberately kept very short. Annexes provide further information on valuation techniques and studies for those interested in pursuing this topic more in-depth.

Box 1 - Types of non-market ecosystem services provided by forests

Biodiversity in forests is important as a major component of global biodiversity and as a provider of innumerable biological resources used by people. Biodiversity is also an essential factor in sustaining ecosystem functioning and hence the ecosystem services that forests provide such as timber, carbon sequestration, non-wood products and soil and water protection.

Soil and water protection - in many regions of the world, forest is a major stabilizing component of natural landscapes, providing protection of soil and water, households, and fields and reducing or preventing floods and landslides. From a hydrological point of view, forests increase precipitation and decrease evaporation; regulates total runoff; redistributes surface and belowground runoff; forests smooth out seasonal course of river discharges; increase total annual river runoff; protest landscapes against soil erosion and landslides, particularly in mountains; maintains water quality; prevents and mitigates the consequences of floods ad protects river banks against destruction and prevents siltation of reservoirs.

Protection of fragile ecosystems in mountains and drylands – forests in mountains regulate water supplies and forests in mountains have a high ability to capture atmospheric water, providing important supplies of freshwater to the downstream catchment area; forests in mountains are centres of biological diversity and stabilise land against erosion. In drylands forests provide critical functions through soil conservation, shade and shelter against wind.

Non-wood forest products (NWFPs) –forests supply a wide range of wild foods (berries, mushrooms, fungi, moss, and bee products), medicinal plant species, and fodder. Globally, 2-300 million people earn much of their subsistence to NFWPs.

Carbon sequestration – forest play an important role in the global carbon cycle and helps regulate the global climate system. Forests accumulate a major part of the planet's terrestrial ecosystem carbon and forests, along with wetlands, are able to provide long-term carbon sequestration above what other land cover classes are able to sequester.

Socio-cultural values and services – Forests have through time been a central host of social, cultural and spiritual activities and beliefs. Forest and people have co-developed and few forests in Europe have been left untouched by people and in turn forests exert a powerful influence over human cultures. Forests provide recreational services for tourisms and local populations such as ecotourism, recreation and sports (e.g. fishing and hunting). Globally, nature-based tourism has increased more rapidly than the general tourism market, evolving from a niche market to a mainstream element of global tourism with annual growth rates of 10-30%.

Source: Excerpts from "Ecosystems and Human Well-being: Current State and Trends", Millennium Ecosystem Assessment, Island Press (2005)

Figure 1 - Trade offs and synergies in the delivery of different forest based ecosystem services – some generic examples

Combining aims in multi-functional forestry	Ensure a stable or growing timber production	Enhance recreation services	Enhance carbon sequestration services
Enhance biodiversity services in forests			
	Biodiversity services will be enhanced through reduced harvesting which goes counter to the aims of ensuring a stable or growing timber production Enhancing biodiversity necessitates restricting the choice of species and forest management activities, reducing the output of timber production Taking forest areas out of timber production would enhance biodiversity on those sites, but reduces timber output	Biodiversity measures in forests can imply reducing or completely restricting access to avoid disturbance from recreation. Depending on substitution areas for visitors, this may be negative or have no effect on recreation services. Enhancing biodiversity services means prioritising conservation on environmental rather than social criteria	There is a high degree of synergistic effects between enhancing carbon sequestration and biodiversity through the building up of carbon in the forest (dead wood, below ground carbon storage, older stands). However, glades in forests sometimes require management intervention in order to maintain and support biodiversity that depends on open areas in forests; this management goes counter to maximising carbon sequestration.

Combining aims in multi-functional forestry	Ensure a stable or growing timber production	Enhance carbon sequestration services
Enhance recreation services		
	Recreation services would be enhanced if areas of harvesting are reduced and rotations are extended (preference for old growth by visitors). This may play counter to timber production aims.	Visitors may prefer forests that show a high diversity in age, dead wood and older stands compared to mono-clutures of high productive forests

Combining aims in multi-functional forestry	Enhance carbon sequestration services
Ensure a stable or growing timber production	
	Extending rotations increase carbon content but harvesting and wood processing releases some of the stored carbon. Carbon content in harvested wood products is not yet accounted for in international climate policy.

Part I – Economic Instruments for Sustainable Forest Management

A1.1 Motivation for using economic instruments in forest administration

Sustainable Forest Management (SFM) is central to the New Forest Act (1991 and updated 1997) and aims at maintaining biodiversity, productivity, regeneration capacity, vitality and the potential of forests to fulfil relevant ecological, economic and social functions now and in the future at different spatial scales without causing damage to other ecosystems (MCPFE, Helsinki Resolution 1, 1993). SFM is consistent with an ecosystems approach to forests (2005/2006).

SFM is traditionally implemented through regulations, orders, and forest management plans, with other words through command and control measures.

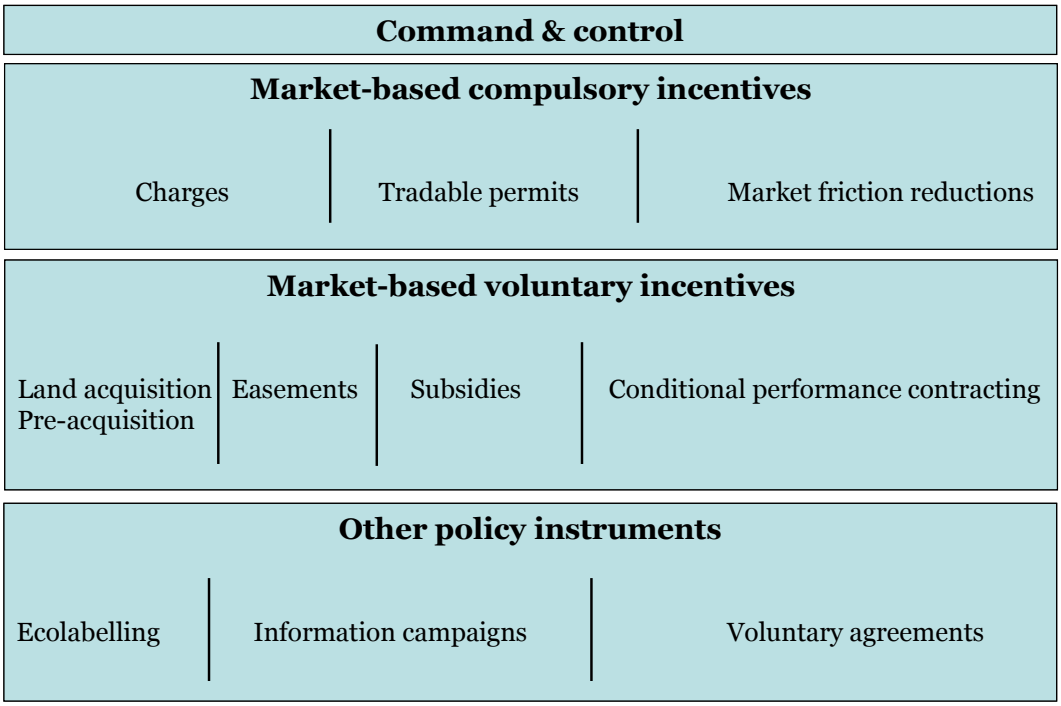
Command and control is the traditional instrument applied to regulate behaviour in a certain direction, for instance through the regulations in the New Forest Act or the restrictions on activities in the forest management plans, restrictions on access and land use in order to reach conservation objectives in National Parks and Nature Reserves or on non-conserved land to preserve a certain level of biodiversity. The challenge for command and control regulation is the high level of information needed about private land owners along with costs of administration to ensure that policy instruments are efficient.

Compared with command and control measures, economic incentives have the potential to deliver more cost-efficient implementation of enhancement or protection of ecosystem services. The reason for this is a higher flexibility under economic incentives for the land owners to determine the intensity and type of activity that is optimal given the taxes, charges or conditional contracts.

A1.2 Overview of economic instruments

Some economic instruments are mandatory such as charges and tradable permits, which seek to reduce negative impacts on the environment. Other economic instruments, such as subsidies, land acquisitions, easements and conditional performance contracting are voluntary and seek to compensate land owners for positive action that they undertake on their land, for instance increasing the wildlife enhancing vegetation; leaving more dead litter for the benefit of biodiversity etc. Other policy instruments are most often also voluntary and include eco-labelling of produce from forests, information campaigns and other agreements made between the State and forest associations. Figure 2 gives an overview of the different types of environmental policy instruments found in use in forestry.

Figure 2 Overview of Environmental Policy Instruments



Taxes & Charges

Taxes and charges in environmental policies are mandatory market based instruments that aim at changing behaviour where activities have negative impacts on society (called negative externalities) such that the impacts on society reflects the level of preferences of the population in terms of their willingness to pay for such goods.

Taxes and charges of course have a role in financing the administration and services at State, provincial and local level. In many instances tax incentives are in place to enhance a specific behaviour. This can also be applied for the improvement of pro-ecological forestry. **Błąd! Nieprawidłowy odsyłacz do zakładki: wskazuje na nią samą.** below shows an example from Canada of how to link property tax incentives and good stewardship of forests.

Box 2 – Linking Property Tax Incentives and Good Stewardship of Forests

The State of Ontario in Canada has a number of programmes for private forest owners in order to enhance a pro-ecological forest management also outside the crown estate. Several tax incentives are offered:

The Managed Forest Tax Incentive Program (MFTIP) offers a reduction in property taxes to landowners of forested land who prepare a plan and agree to be good stewards of their property. Areas should be above a certain size (4ha), the owner should have a managed forest plan that is approved by a Managed Forest Plan Approver and the owner should have the commitment to good stewardship. The delivery of the programme is supported by the Ontario forestry association and the Ontario Woodlot Association

Conservation Land Tax Incentive Program (CLTIP) offers a reduction in property taxes to those who agree to protect identified and regionally important natural heritage features such as significant wetlands, significant areas of natural and scientific interest, habitat of endangered species etc. Activities that degrade, destroy, or result in the loss of the natural values of the site are not allowed.

Source: Ministry of Natural Resources, Ontario, Canada.

Tradable permits

Tradable permits are typically compulsory and allow for the market to work out the most cost-efficient level of protection or conservation. The regulator specifies a cap or other requirements, which the participants in the market are required to follow. The market then determines the optimal price. The advantage is that the regulator does not need to know the individual cost structures of the land owners to ensure a specific minimum conservation level. On the other side, the regulator needs to find a cap that is neither too lenient (leading to low prices that collapses the market) nor too restrictive (participants are forced out of their economic activity due to too high prices).

Box 3 - Example of a land-based tradable permit system

The EcoTRADE project studies the applicability of tradable development rights (TDRs) as a cost-efficient way to biodiversity conservation. The idea of a TDR market is based on the requirement that whenever land is developed for infrastructure or industrial areas, a development right to compensate for ecological impacts is required. Such development rights can be supplied by landowners who restore or upgrade the ecological value of their land. A regulatory authority determines the exchange rules taking into account ecological targets and spatio-temporal contexts such as mutual dependency of habitats and temporal aspects like turnover rate. A case study is being carried out in the Randstad area in the Netherlands. The EcoTRADE project is carried out by Heimholz Centre for Environmental Research (UFZ), Wageningen University and Research Centre, The University of Queensland, Australia, Centre for Environmental Management, and European Science Foundation.

Source: www.ecotrade.ufz.de

Easements

Conservation easements is one way in which the State may prevent that certain types of land uses or developments take place on private land. The landowner voluntarily agrees to have certain legal rights forfeited or removed in perpetuity provided he is paid a certain payment or tax relief, while keeping the property rights. The changes in land use rights to the land are inscribed in the land title. Easement selectively targets only those rights that are necessary to protect specific conservation values. Easements are frequently used in the US.

Land Acquisition & Pre-acquisition

Acquisition of land and pre-acquisition is one step further compared to easements that the State can undertake to ensure a specific land use does no longer take place in a specific area. Land acquisition on forest land is for instance the prevailing way of protecting biodiversity in private forest land in Finland and Norway. The State buys the land on a voluntary basis from the land owner and a protection regime is imposed on the land. Pre-acquisition is frequently used in the US, where the State acquires a peace of land, implements an easement and sells off the land again with the specific restrictions on the land.

Subsidies

Subsidies from the EU, national level or local authority level to a private land owner should preferably be done in order to compensate a land owner for undertaking protective measures on his land that goes *beyond* what society demands as a minimum or *beyond* the minimum legal requirements. With other words, subsidies should be used to pay for activities leading to a positive impact on the ecosystem services that are valued by society.

An example of a European wide subsidy for a positive measure in forestry is afforestation on agricultural and non-agricultural land (e.g. degraded or marginal land) in order to contribute to the protection of the environment, the prevention of natural hazards and fires, and mitigation of

climate change. Explicitly, afforestation co-financed from the EU through the EU Rural Development Regulation 2007-2013[1] should be compatible with the environment and enhance biodiversity. The same regulation opens for the possibility to receive support for 'non-remunerative' investments such as enhancing the public amenity value or other environmental objectives.

Another example of how a subsidy is applied to enhance the economic situation of private forest enterprises is the creation of forestry saving funds in France and Norway (See Box 4). Such funds can be targeted more or less directly towards a pro-ecological and multifunctional forestry. Funds are recycled into the forestry sector as an incentive to increase private investment in forestry.

Box 4 - The Norwegian Forest Trust Fund (FTF)

The Norwegian Forest Trust Fund (FTF) is the main financial instrument in Norwegian forestry. The objective of FTF is to ensure the funding of a sustainable management of forest resources, for instance through building a better foundation for long-term investments. The fund is built through compulsory deposits made by all forest owners when selling timber and biofuels.

Each forest property has its own fund account, and the funds are tied to the specific property. From 2007, 85% of the capital used from the fund is exempted tax. Consequently, for each 1000 NOK invested from the fund, only 150 NOK are taxed. The size of the transfers to the fund is decided when the timber contract is agreed, and is in the range between 4 to 40 % of the gross value of the timber, depending on the need for new investments at the specific property.

The Forest Trust Fund can fund for instance planting of forest, building and maintenance of forest roads, environmental actions and insurance of forest.

Source: Bergseng and Solberg (2007) and SLF (2009)

Subsidies are often also applied to support a more efficient forest management of private forest areas, for instance through the support to develop forest management plans, borrowing of machinery at reduced cost or free of charge, support to the establishment of forest roads; access to seedlings and advice etc. The EU supports the establishment of agri-forestry systems for their high ecological and social value as well as the restoration of forest potential that was damaged after natural disasters and fire.

In order to strengthen the productive capacity of the wider forestry sector, subsidies are in some instances applied to support small and medium size enterprises in the forest wood-processing industry, for example in the UK, France, Finland and Greece. Such production based subsidies may only indirectly enhance the non-market based ecosystem services of forests to the extent that the support is linked to an increased pro-ecological forest management practice.

Conditional performance contracting

Conditional performance contracting is like a specifically targeted subsidy, where the public administration, a NGO, company or group of users make a contract on a voluntary basis with a land owner to supply a specific conservation activity or enhanced production of ecosystem service in exchange of compensation for the change in land use. The compensation should as a minimum be the level that equals the benefits that the land owner gives up. If the land owner does not provide his part of the agreement, he is not paid by the buyers of the ecosystem service.

Conditional performance contracting can be set up in different ways and for different types of outcomes or management activities. Typically such contracts are remunerated on the basis of a specific set of activities that are expected to lead to a certain improvement in one or more of the non-market ecosystem services that forest ecosystems provide.

Activities that could be considered a proxy for delivery of ecosystem services comprise (the list is non-exhaustive):

[1] Council regulation (EC) No 1698/2005

- Afforestation on water catchment areas to protect drinking water
- Set-aside of forest areas in biodiversity hotspots
- Set-aside of existing forest area to allow for natural forest dynamics
- Leaving a higher amount of dead-wood in the forest than what the minimum regulation requires
- Leaving old growth trees standing
- Protection of rare, threatened and endangered forest based species
- Enhancing or establishing recreation infrastructure such as paths, picnic areas, huts, climbing walls, fireplaces and wood delivery

An example of such a contractual agreement is presented from Finland (See Box 5).

Box 5- Nature Conservation Contracting in Finnish private Forestry

The Finnish Forest Biodiversity Programme for Southern Finland (METSO) was established in 2001 as a response to the low level of biodiversity protection in forests in the southern part of Finland. 2% of forests in the southern part of Finland are protected compared to 28% in the northern part of Finland. Three ***voluntary*** incentive-based measures were carried out and tested in METSO:

1. **Nature values trading scheme** – forest owners were given the opportunity to set aside forest areas for conservation and to receive compensation for foregone revenue. Price and terms were negotiated on a case-by-case basis and if the forest owner and the Government agreed, the forest owner could enter into a fixed-term contract lasting 10-13 years. After the contract period, the owner may choose to revert the conservation practice.
2. **Cooperation network** – between land owners, local authorities and NGOs was created to promote innovation, cooperation and interaction with the aim to protect biodiversity on a local level based on voluntary participation and land owner's own initiative.
3. **Competitive tendering** – owners of forest areas that cover at least one of seven habitat types (heathland forests with plenty of decaying wood, herb-rich woodlands, spruce mires, swampy woodlands, sunlit esker slopes, wooded pastures and meadows, and natural forests along emerging coastlines) can participate in a tender. The forest owner presents basic information on the site and reveals personal views on compensation. The Government then chooses the offers that provide most of the ecological services they demand at an acceptable price. Protection means, delimitations and level of compensation are subject to negotiations. The land owner can choose between i) selling the land as a nature conservation area or he/she can ii) establish a privately owned nature conservation area. As under the nature values trading scheme, the competitive tendering of privately owned nature conservation area is for a fixed contract period (10 to 13 years).

Source: Ministry of Forestry and Agriculture, Finland

Another example of application of conditional performance contracting is the EU Rural Development Regulation 2007-2013, which co-finances forest-environment payments for voluntary commitments that enhance biodiversity, preserve high-value forest eco-systems and reinforce the protective value of forests with respect to soil erosion, maintenance of water resources and water quality as well as natural hazards.

Eco-labelling

Eco-labelling is a voluntary measure that seeks to reduce market barriers of more environmentally and socially friendly produce. Eco-labelling or certification means that forest management and each part of the supply chain (chain of custody) is subject to sustainability criteria and independent control. If forest owners and/or the supply chain do not respect the given rules, certification is withdrawn. Forest owners can thereby prove that they manage their forests in a pro-ecological way. Eco-labelling increases the amount of information and trustworthiness of SFM to end-consumers

who have a possibility to indirectly support the enhancement of ecosystem services in forests through their purchase. It is expected that over time, it will become increasingly difficult to sell non-certified wood products.

Two forest eco-labels exist – PEFC and FSC, none of which are applied on private or community forest land in Poland. (See **Błąd! Nieprawidłowy odsyłacz do zakładki: wskazuje na nią samą.Błąd! Nieprawidłowy odsyłacz do zakładki: wskazuje na nią samą.**). One reason for the absence of private forest owners in eco-labelling schemes is the rather small, irregular wood supply that makes them difficult to become partners with the down-stream forest industry.

Box 6 - Eco-labelling in Forestry

Forest Stewardship Council (FSC), developed by environmental organisations, companies and social organisations, covers certification of Forest Management (FM) as well as FM and chain of custody (FM/COC) certificates. By February 2011, a total of almost 5.7 million ha forest land in Poland was certified according to the FSC standard, representing close to 63% of the land area, or close to 11% of forest area in Europe. Poland ranks as the 6th most FSC certified country globally, with Canada, Russia, the US, Sweden and Brazil having a higher absolute forest area under certification.

Programme for the Endorsement of Forest Certification (PEFC) is owned by the forest owner associations. In January 2011, the first PEFC certificate for forest management was granted to 316,000ha in RDLP Radom with the expectation that an additional 180,000ha of forests owned by RDLP Warsaw will obtain PEFC certification in the near future.

Source: FSC (2011), PEFC (2011)

Voluntary agreements

Voluntary agreements between private actors and the public administration is a popular and versatile tool by industry in many sectors in order to enhance a certain agenda without resorting to regulatory measures. These agreements are most often entered between the industry associations and the public administration. Voluntary agreements can also be in the form of joint ventures, partnerships, or arrangements where the public gains additional services and the private forest owner has a reduced administrative burden. Typically, no payments are involved in voluntary agreements.

Box 7 – Examples of Voluntary agreements

Ontario Stewardship, Canada - is a programme where forest owners can find information, expertise and funding to ensure that good management occurs on private land. The stewardship programme is organised around stewardship councils, which are volunteer groups of landowners and land interest agencies. Each council discusses, develops and delivers local programmes and projects while working together with a coordinator from the Ministry of Natural Resources in Ontario. Examples of projects include: workshops on woodlot and wetland management, stream restoration projects, endangered species conservation and community planting.

Rambles through the landscape, Denmark – is a voluntary agreement between land owners and the Nature Agency where land owners agree to make public tracks through their land. Tracks go far across a region and cover many landowners. The Nature Agency has made proposals for the most beautiful routes and come to agreements with land owners, incl. forest owners. Maps and information about the tracks are made available from the Nature Agency.

Watershed Forestry Programme, US – is a voluntary pollution prevention and educational partnership between the city of New York and the forestry community, which supports and maintains well-managed forests as a beneficial land-cover of watershed protection.

Source:Ministry of Natural Resources, Ontario; Nature Agency, Denmark;

Recommendations in the use and application of economic instruments

Ecolabelling can increase income from private forests and ensure sustainable forest management

If private forest owners would join into holdings starting from 5-7000 ha, for instance initiated through the forest associations, they would be able to offer a more stable wood supply than when managing their forest land individually. In such a case, industry would most probably be interested in signing contracts with private forest owners, thereby both increasing the income of forest owners while ensuring a sustainable forest management.

Ensure spatial targeting of economic instruments

Different areas have different potentials for the delivery of ecosystem services. Especially the history of how a forest area has been managed (or not), but also the environmental conditions determine the impacts that a specific change in management or initiative will have.

For instance, a forest that has only been extensively managed will under the same environmental conditions be able to generate higher biodiversity benefits than a forest that has been intensively managed for a longer period of time, when implementing the same set aside regime, for instance. Another example is a forest site far away from population centres will unless indeed unique in feature not produce as high a recreational value as a site closer to population centres.

The result of spatial targeting of economic instruments is both to ensure a high value of the ecosystem service provision and to minimize costs involved.

Ensure high level of content targeting in economic instruments

For programmes and initiatives to make a real difference on the ground, requirements and criteria should be as specific as possible and avoid general terms of for instance 'ensuring a sustainable management practice'. Conditional performance contracting is one way of ensuring a targeted programme. This type of contracting can even be based on making the payment depend on the quality of the outcome of the management action.

Make use of existing frameworks of monitoring and verification

Monitoring of new programmes using economic instruments may be costly to monitor and verify. It therefore makes sense to combine any needed monitoring of additional initiatives with the existing framework for monitoring in place through the forest management plans.

Make use of competitive tendering for the delivery of ecosystem services

Competitive tendering is a cost-efficient way of enabling an enhanced delivery of ecosystem services. For instance in the delivery of biodiversity (See Box 5) or in the afforestation of forests on private lands (an example is the Scottish Challenge Fund). The competitive tendering can also be used for the public administration to find out the appropriate level of compensation needed in future flat rate payment schemes.

Enable synergies between ecosystems when designing economic instruments

The interface between ecosystems often produce the most dynamic environment while optimising ecosystem services to the land owner and society at large. For instance, protecting or restoring riparian buffer zones with native woody vegetation not only creates a dynamic habitat for wildlife; it also helps reduce runoff; stabilise soil; enhance groundwater recharge; and decrease heating and cooling costs if settlement are located close by. Also the combination agro-forestry or the creation of vegetation corridors across a cultivated landscape offer significant co-benefits. Economic incentives can be designed to enable and enhance such synergy effects.

Make water users pay for protection of water catchment areas through woodland planting

One way of ensuring the quality of drinking water is to afforest the water catchment area and allow no use of pesticides. Examples of payment for ecosystem services in order to protect drinking water resources are found in for instance France (Vittel paying farmers to follow certain rule of management not impeding on the quality of the source), the US (the Watershed forestry programme, protecting in Denmark (Water companies buying up farmland and afforesting the area in coordination with the local authority and Nature Agency, with co-enefits such as recreation and carbon sequestration).

Part II – Monetary valuation

A1.1 Motivation for monetary valuation in forest management

As Box 1 in the introduction illustrated, forest ecosystems provide a wide range of services that benefit our society, without these services being bought or sold on the market. Nevertheless, they contribute a distinct value to our lives and some of them even provide the basis of our survival, protection and well-being. Although the markets often cannot directly capture this value of nature's services to people and society, a number of methods have been developed since 1940s to approximate the value of marginal changes in our environment. Changes may have positive or negative consequences for society depending on what activities are carried out.

Valuation of ecosystem services such as carbon sequestration, biodiversity and recreation are useful in a number of policy and management areas.

Generally, attributing a value to a change in service from forests helps raise awareness of the value of services provided by the natural environment 'for free' and it spells out the costs to society of not dealing sustainably with our natural resources and ecosystems.

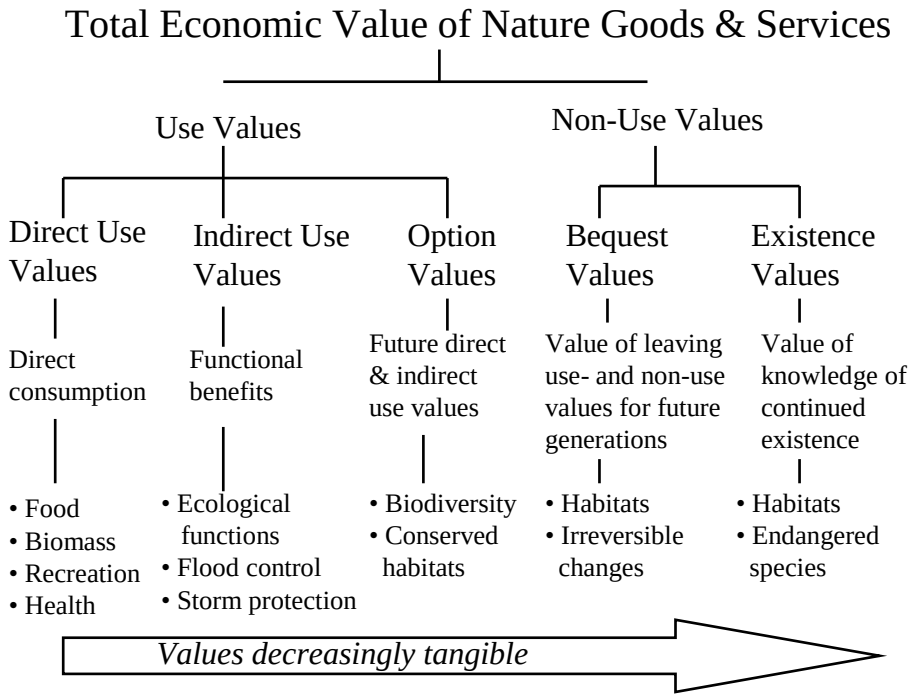
Specifically, valuation helps improve decision making, ensuring that for instance policy appraisals and cost benefit analyses take full account of benefits and costs of new policies or ensuring that a new policy delivers net benefits when the policy aims at altering the condition of an ecosystem.

The aim of this part of the guidance is to give a brief overview of the typology of values, the different types of valuation approaches and when the different approaches can be applied, their individual advantages and limitations. Annex 2 gives a technical overview of how to apply the individual valuation methods and Annex 3 gives an overview of European forest valuation studies, which may be helpful in terms of benefits transfers or inspiration for futher original studies in Poland.

A1.2 Typology of Values (TEV)

A concept used by environmental economists to describe and estimate the values of the benefits that nature has on human society is 'Total Economic Value' (TEV). TEV is a welfare concept which is the sum of both the use and non-use values that individuals and society gain or lose from marginal changes in ecosystem services. Use values involve an interaction with the ecosystem service, either directly or indirectly, whereas non-use values are associated with benefits derived from the knowledge that the ecosystem service is maintained or restored. Figure 3 below illustrates the different typologies of values and gives some examples of which types of ecosystem services we are thinking of.

Figure 3 – Overview of Economic Values of Ecosystem Goods and Services



***Direct use values**:* involve an interaction with the final products of nature such as extraction of timber, berries, mushrooms, hunting, consumption of drinking water or recreational fishing. These activities can be traded on a market (e.g. timber) or can be non-marketable i.e. there is no formal market on which they are traded (e.g. recreation or the inspiration people find in directly experiencing nature).

***Indirect use values**:* are derived from intermediate services of the ecosystem such as groundwater recharge, pest and disease control, prevention of downstream flooding and removal of nutrients. These ES are often not noticed by people until they are damaged or lost, yet they are very important. Measuring indirect use values is often significantly more challenging than measuring direct use values. Changes in the quality or quantity of a service being provided are often difficult to measure or are poorly understood.

***Non-use values**:* can be derived both from nature's end products and intermediate products based on the satisfaction of knowing the ecosystem services continue to exist (existence value), or associated with the knowledge that ecosystem services and ecosystems will be passed on to future generations (bequest value), or derived from knowing that people elsewhere can enjoy ecosystem services (altruistic value).

A1.3 Overview of Valuation Methods

The three most commonly used valuation methods to capture non-market goods and services in relation to forest areas are travel cost method, contingent valuation and choice modelling (also called choice experiment). These methods each have their pros and cons and can value different aspects of ecosystem services provided by forests. Another valuation approach, less often applied, is the hedonic pricing method.

The main difference between these methods is whether they are based on observed behaviour (travel cost and hedonic pricing) or whether the study elicits the value based on a hypothetical scenario of changes in the natural environment (contingent valuation and choice experiment).

Table 1 below gives an overview of the methods, the element of Total Economic Value captured (described in the previous section), the ecosystem service valued and benefits and limitations of each approach.

Table 1 – Choice of Valuation Methods for Different Ecosystem Services

Valuation Method	Element of TEV captured	Ecosystem Service valued	Benefits of approach	Limitations of approach
Travel cost	Direct and indirect use	All ES that contribute to recreational activities	Based on observed behaviour	Generally limited to direct use values and recreational benefits. Difficulties arise when trips are made to multiple destinations.
Contingent valuation	Use and non-use	All ecosystem services	Able to capture use and non-use values	Bias in responses, resource-intensive method, hypothetical nature of the market
Choice experiment	Use and non-use	All ecosystem services	Able to capture use and non-use values	Similar to contingent valuation above
Hedonic pricing	Direct and indirect use	ES that contribute to air quality, visual amenity (e.g. forests), landscape, quiet i.e. attributes that can be appreciated by potential buyers	Based on market data, so relatively robust figures	Very data-intensive and limited mainly to services related to property
Benefit transfer	Direct and indirect use	All ecosystem services, but most accurate for recreational use values	Inexpensive and quick way to economic benefits	Transfer errors are inevitable. High demands on similarity across sites.

Source: based on Defra (2006 & 2007)
Note: ES = Ecosystem Services

A1.4 *When* to use Valuation Methods

1.4.1 Travel Cost Method

The Travel Cost Method (TCM) is applied when the aim is to value ecosystems or specific sites that are used for ***recreation***. TCM can be used to value recreational values of forest sites in cases of:

- changes in **access costs** for a recreational site
- **elimination** of an existing recreational site
- addition of a **new** recreational site
- changes in **environmental quality** at a recreational site

TCM is based on *observed* behaviour regarding recreation in forests. The basic idea of TCM is that the travel cost incurred in travelling e.g. by car (such as petrol, insurance, depreciation etc.) to a forest site and the time spent travelling indicates a 'price' of access that people going to the site are willing to pay. The longer distance that people need to go to a forest, the less frequently they will go there due to the costs involved all else equal.

The value of access to a forest using the TCM is estimated based on the number of trips people take at different travel costs. This is similar to estimating people's willingness to pay for a specific market good based on the quantity demanded at different prices – the more expensive the good, the less it will be demanded.

Main variations of TCM include:

- **Zonal TCM** – is the simplest and most inexpensive approach. It uses mostly secondary data with some simple data collected from visitors (number of visitors and their zip-codes). Zonal TCM produces a total recreational value of a site. It cannot easily estimate the value of changes in quality in a site and may not consider some of the determinants of value that are important (e.g. such as presence of substitute sites in the area);
- **Individual TCM** – necessitates more detailed information from visitors (e.g. travel distance, length of trip, travel expenses, number of visits over a specified period, substitute sites that the respondents might visit instead, and socio-economic information). This approach is therefore more expensive, but provides more precise results. It also allows for estimation of changes in site quality, extension of site area, and impact of substitute sites on the value.
- **Random Utility** approach – is the most complicated and expensive approach among the TCM variations as it requires information not only from one forest site but from all forest sites that respondents could have chosen to visit instead. In addition to the individual TCM, this approach makes it possible to estimate the values of new sites and changes in values in existing sites due to more forest sites available for people to visit.

Some Advantages of TCM

- TCM is a relatively inexpensive method to apply, which makes most sense to apply when project expenditures to protect a site are deemed to be fairly low.
- TCM should be applied when the site is primarily valuable as a recreational site, and there are no endangered species or unique features on the site that makes non-use values significant for this site. If a site is valuable both in terms of recreation and biodiversity TCM could be combined with contingent valuation methods or choice modelling.
- TCM is based on what people actually do and not on what they would do under a hypothetical situation;
- TCM is closely linked to conventional economic valuation based on market prices.
- Results are relatively easy to explain and interpret.

Some of the Issues and Limitations related to TCM

- TCM deals poorly with trips made by people who both want to visit a forest and family, for instance (called multi-purpose trips). The link between quantity and distance of trips to a forest site is in the case of multipurpose trips disturbed.
- TCM cannot estimate the values of people having travelled to the forest by bike, by foot or other 'free' means of travel. If half of people visiting a forest site arrive by car, the value estimate will be conservative in that it will not include values of people not arriving by car, busses or trains.
- TCM assumes that people would respond similarly to changes in admission fees to forest sites as they would to changes in travel costs;
- The treatment of substitution sites is not possible when using the zonal TCM. The consequence may be that the value of access to a forest site is underestimated if the respondent made a choice between a number of sites before choosing the one he/she visits;
- The standard zonal TCM can only value the current situation; it cannot deal with plans to change provision or quality of recreation services.
- Non-use values cannot be estimated using TCM.

1.4.2 Contingent Valuation Method

The CVM method should generally be used when the site generates an important and significant share of **non-use values** to society, and/or when few people actually visit the site.

CVM can be used to estimate both **use** and **non-use values** of ecosystem services and it's the most widely used method to estimate non-use values such as the value of knowing that biodiversity is preserved in a specific forest, the value of leaving clean groundwater reservoirs to future generations or the option to have high quality fishing or hunting experiences in future.

Valuation is based on the description of a **hypothetical scenario** (e.g. a protection of a forest that is commercially used today) and people are asked in a survey what they would be willing to pay out of their personal or household budget for an enhancement of an ecosystem service (e.g. increased biodiversity as a consequence of conserving a previously commercially exploited forest).

Because people directly state their willingness to pay, CVM is called a '**stated preference**' method. As non-use values are not detectable on the market, the only way of estimating a monetary value is by directly asking people a 'what .. if.. ' question. It is assumed that people are able to make choices and attribute values to environmental goods and services just like in the market place, where people daily make choices between day-to-day consumption goods or periodically of more

long-term goods such as cars, houses or education. Due to the hypothetical nature of CVM, it may also be **controversial**.

Some Advantages of CVM

- CVM is an extremely **flexible** valuation method in that it can be used to value both use and non-use values for practically all types of ecosystems and ecosystem services.
- CVM is the most **widely accepted** method for estimating Total Economic Value.
- The results of the CVM survey are **not difficult to analyse or describe**. Values can be expressed as a mean or average PLN per person or household or as an aggregate for the total population to whom the values are deemed relevant.
- There is a lot of past and **ongoing research** to improve the performance of CVM and to understand its strengths and weaknesses.

Some of the Issues and Limitations related to CVM

- Caution should be applied both when undertaking a CVM survey and when using the CVM results because there is a **fair amount of criticism** concerning the conceptual, empirical and practical challenges in answering a hypothetical question about hypothetical markets. Research is still ongoing to address these problems.
- **CVM is a time-consuming and expensive survey approach** because of the extensive pre-testing and survey work involved, including several focus groups and pilot surveys.
- The set up and design of the CDM survey requires **competent survey analysts** in order to ensure as precise and defensible values as possible.
- Some critics of the valuation methods **question the fundamental ability of eliciting values** of ecosystem goods and services.
- People may **not be able to attribute their true values to ecosystem services** in the same way as they make choices in the market place and thereby indicate their true willingness to pay.
- People may **interpret and associate different things** with the questions than intended by the researcher. For instance, people may feel good about spending money on environmental goods in general because it makes them feel good, but this does not indicate their true willingness to pay for the service in question. Another example is that people may find the specific service important and be willing to pay for it but they object to the way in which the payment should be collected, e.g. through increased taxes, and they therefore state a zero willingness to pay.
- **People may not be able to distinguish their true value between a part of an ecosystem and the whole ecosystem**. For instance, people may state the same value for preserving biodiversity in one forest in a region (e.g. 1% of forest area) as for preserving biodiversity in 50% of all forest area in a region.
- **The order in which services to be valued are presented may have an influence on the level of stated WTP**. For instance if biodiversity figures as the last item on a list of services to be valued in a forest, it may have a lower stated value than if it had been the first on the list.
- Other types of biases include non-response bias, information bias, strategic bias.

1.4.3 Choice Experiment

Choice Experiment is especially well-suited to policy decisions where the choice between possible actions may result in different impacts on ecosystem services, where we want to value the outcomes of different policy options in order to inform decision making and where non-use values are important.

Like CVM, Choice Experiment is a **stated preference approach** based on a hypothetical scenario and questions. Choice modelling is also like CVM highly flexible and can be used for most use- and non-use values of ecosystem services.

The difference between CVM and Choice Experiment is that where CVM directly asks people for their willingness to pay, **choice modelling asks people to make choices between different sets of hypothetical alternative scenarios with different attributes and costs**. In each alternative, a different hypothetical policy action is introduced with associated different sets of environmental impacts and costs. People are asked to make a trade off between the alternatives. Values are then inferred from the hypothetical choices or tradeoffs that people make. The theoretical basis for choice modelling is the same as for random utility modeling (see 1.4.1), namely 'discrete choice modeling'. The random utility framework may also be used for ranking the alternatives.

Main variations of Choice Experiments include:

- **Discrete choice** – people are simultaneously shown two or more programme alternatives and their individual characteristics and they are asked to select the alternative that they prefer the most.
- **Contingent ranking** – asks people to compare and rank different programme outcomes with various characteristics and costs. Each of the programmes have different outcomes and costs and are mutually exclusive. Ranking is done in order of preference.
- **Contingent rating** – people are asked as in the discrete choice variation to select the alternative they prefer the most. They are then also asked to state whether they prefer this alternative strongly, moderately og sligthly to the other programme(s).

Some Advantages of Choice Experiment

- People may find it easier to respond to a trade off rather than stating a specific PLN amount as in CVM. Also, it is easier to check for consistencies in answers and the method encourages people to think about the environmental issue as a whole.
- Price of delivering a certain set of ecosystem services is de-emphasised in choice modelling, as price is one of the characteristics in each of the hypothetical scenarios.
- Choice Experiments also provide relative values as opposed to only absolute values in CVM. This increases the reliability of the method because even if the absolute values are not very precise, the relative ranking between policy options is useful for decision making.
- Choice Experiments has the potential to reduce many of the biases found in CVM surveys that present people with a sometimes unfamiliar task of putting prices on non-market ecosystem services.

Some of the Issues and Limitations related to Choice Experiments

- The validity and reliability of Choice Experiment in valuing non-market commodities is still being extensively tested and improved.
- People may find the trade offs unfamiliar and therefore difficult to evaluate. Often there is a learning effect in a questionnaire, making the first questions less reliable compared to the later questions.
- Other biases than found in CVM may arise. For instance, if the choices are made too complicated, people may begin to answer using simplified decision rules. This risks imposing bias on the subsequent statistical analysis.
- By limiting the number of programme options, people may be forced to make choices that they would not otherwise make, had they had the opportunity.
- Choice Experiment demands more advanced statistical analysis.

1.4.4 Benefit Transfer

If there is limited time available to produce a valuation of an ecosystem service and/or there are tight budget restrictions, benefit transfers represent a second best alternative to primary studies, described above.

Benefit transfers are applied by transferring economic values for ecosystem services from studies that have already been completed in another location or context to the site or ecosystem service that needs to be valued. The site characteristics, regional substitution patterns, population density and socio-economic characteristics should be as similar as possible in order to avoid too large biases in the transfer between site A and site B.

It should always be kept in mind that benefit transfers can never perform any better than the quality of the original study that is used for the transfer. If there are biases or other weaknesses in the original study, the transfer will necessarily transfer these weaknesses as well. In addition, it should also be kept in mind that benefit transfers will ***always*** entail transfer errors. By transfer error we understand the difference between the transferred value to site A compared to the *true* value of site A (i.e. if an original survey would be carried out, See Box 8).

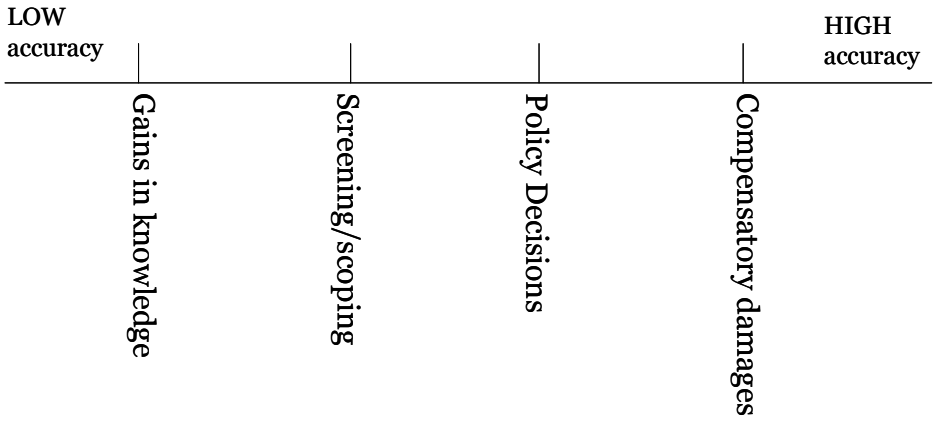
Main variations in Benefit Transfers include:

Value transfers – are the most simple way of transferring values from one site to another, but it is also deemed as the approach with potential for high transfer errors. An example is a single point value of recreation from site A, for instance 30PLN per visit per person, is transferred to site B without adjusting the value to the characteristics of the other site. Value transfers can also be conducted as the average estimate of a number of surveys or as an 'approved estimate' by experts.

Function transfers – are the more complex approach to transferring values between sites, but is deemed to lead to more accurate benefit transfers. Function transfers allows for adjustment of determinants of willingness to pay, for instance characteristics of a site or population average income level, such that for instance the regression function from site A is transferred, but the underlying data is coming from site B that is going to be valued. Function transfers can be carried out as a demand function transfer from one or several sites, or as a meta-analysis function that assembles a high number of studies and seeks to find the central value given characteristics of the methods, sites and populations surveyed in original studies.

Box 8 – What are acceptable levels of transfer errors?

Acceptable errors in benefit transfer depend on the circumstances of the transfer. If the transfer is used for gaining more knowledge about the scale of values in a specific ecosystem or ecosystem services, or for screening sites to find out whether a more detailed original survey is needed, higher transfer errors would be acceptable. For policy decisions or for paying out compensatory damages due to a pollution of an area for instance, transfer errors should not be allowed to vary much from the values of an original survey. The figure below illustrates the demands of accuracy needed in transfers depending on the use of the transfer.



Source: Brookshire (1992), Benefit Transfers: Conceptual and Empirical Issues, Water Resources Research, Vol. 28, No 3.

Some Advantages of Benefit Transfers

- Benefit transfers are less costly than conducting original surveys because benefit estimates can be estimated more quickly and there are no costs for carrying out surveys (unless performing a function transfer, where some survey would be needed).
- Benefit transfer is a useful tool for conducting screening of sites, for instance in order to find out whether the site warrants an original survey.
- Especially for recreational values, benefit transfers are useful as a tool to easily and quickly making gross estimates.

Some of the Issues and Limitations related to Benefit Transfers

- Benefits transfers to site B can only be as good as the original study at site A. If biases are significant in the study of site A, these biases will remain in the transfer.
- The data available from the original study may be very limited, making, for instance, a function transfer or adjustment of a value transfer impossible.
- Transfers of values from other countries to Poland may lead to high transfer errors because of differences in population characteristics, culture and behaviour.
- It may be difficult to find appropriate studies on which to base the transfers. In order to ensure as small a transfer error as possible, location to population centres, substitution possibilities (i.e. type and number of alternative forests), site and population characteristics need to be if not identical, then at least very similar.
- In reality, there will always be differences between sites and their use or non-use values, therefore, benefit transfers will always automatically lead to transfer errors.
- Whether or not to conduct a benefit transfer should also very much depend on the use of the benefit transfer (See Box 8).
- Care should be made about transfers over time. Often original studies are a couple of years old or older when they are applied to benefit transfers. Transfers over space induces

transfer errors and transfers over time also induce transfer errors, the longer the period the larger the errors can be expected to be. This is because the underlying determinants of willingness to pay changes. For instance, the travel and visit behaviour to forests may on average for a population change significantly over a 10 year period, or the cultural understanding of the existence value of specific ecosystem services may increase over time and thereby lead to higher values today compared to 5 or 10 years ago.

ANNEX 1 – Monetary Valuation Methods[2]

A1.1 The travel cost method

What is TCM?

The travel cost method (TCM) is claimed to be the oldest from all non-market valuation techniques. The basis of TCM was created by Harold Hotelling in 1947, when the National Park Service in the USA wanted to know the economic value of recreation in national parks. Hotelling suggested to measure different travel costs according to travel distances of visitors to a park. Investigating the negative empirical relationship between increased travel distances (and costs) and number of visits makes it possible to estimate the demand for recreation at a site. The estimated demand function permits calculation of the consumer surplus (CS), a measure of the benefits generated to park visitors (i.e. the difference between the amount a consumer is willing to pay and the amount he/she actually pays).

TCM belongs to a group of valuation methods based on individuals' revealed preferences and it is an example of the indirect valuation approach means - it seeks to place a value on non-market goods by using consumption behaviour in related markets. This method is based on solid economics principles – the theory of consumer choice. Hotelling's original suggestion was developed principally later on by Clawson (1959) and Clawson and Knetsch (1966). Over the last 60 years hundreds of TCM studies have been carried out and the original idea has been elaborated theoretically and empirically by many other researchers.

What can be valued by TCM?

TCM can estimate use values that can be obtained by visiting a site. Usually this method is applied to value access to recreational sites, scenic, and cultural destinations. Examples of such sites are: parks, forests, lakes, fishing areas, hiking tracks, and cultural heritage sites. Travel costs models can be used to assess:

- the value of access to a site, which can be interpreted as the welfare effects of elimination of a site (i.e. due to a change in land use) or a closure of the site to the public (i.e. due to a change from public to private ownership).
- the value of a change in the site attributes/quality, e.g. as paid for by an increased entry fee.

In a forest context, TCM can be used to estimate the total recreation value of a site, or the value of some specific recreation activity in the forest, e.g. cycling, bird watching etc., or changes in forest characteristics which could be associated with different types of forest management.

Travel costs calculation

An application of TCM requires that travel costs connected with reaching a site are significant and they differ between individuals. Travel costs are a sum of all expenditures needed to make a round trip to a site. It usually consists of:

[2] Source: Review of instruments and valuation methods for multifunctional forest policy. WEEC, IBL & Econ Pöyry. 2009 (http://www.polforex.wne.uw.edu.pl/docs/R-2008-157_review_final-03-10.pdf)

1) Transportation costs

In this case two approaches are possible. Transportation costs could either be stated by respondents or calculated by researchers based on information of transport mode used by respondents, travelled distance, cost of fuel, number of people covering these costs (last two factors for the private transport case), cost of tickets (for a public transport). The latter approach is more commonly used for two main reasons: first, it ensures that more homogenous data are acquired, second it gives more complete data from respondents since it is easier for them to declare details of their trips such as transport mode and distance rather than cost of these trips.

Although in some TCM models transportation costs are assumed to be equal for people travelling from the same place and using the same transport mode, recently there is a tendency to collect more detailed information which shows that people's travel cost may vary for a given trip distance (e.g. size of cars' engines, age of cars, different price of tickets for different groups of passengers).

2) Entrance fees to a site (if it is chargeable)

3) Equipment costs (needed for some recreation activities)

Cost of equipment that can be used also in other occasions and other costs that are not directly associated with the travel in question should not be included (SEPA, 2006).

4) Travel time

One of the most crucial elements of TCM is the cost of travel time. This element is also the most controversial one. It is possible to distinguish three main approaches to assess value of travel time:

a) A conservative one – value of travel time equals zero. This approach could be based on an assumption that travel time does not provide any utility or disutility on its own, e.g. a person does not choose a site because the travel itself to the site provides utility (Thiene and Signorello, 2008). The other explanation is that the value of travel time for individuals can vary depending on many factors such as, e.g. whether is it a work day or a weekend, the length and route of the trip, transport mode or weather conditions, and - in some cases - travel may even increase the wellbeing of visitors (e.g. travelling a scenic route to the site).

b) Opportunity cost of time in terms of lost income, where travel time is valued at the marginal fixed rate e.g. per hour or day. This approach is derived from the economic theory that individuals can trade off work time and leisure time, in other words that all of them work and have flexible working agreements. So, if they decide to travel, they are at least willing to give up their salary which could be earned during time spent travelling.

c) Some proportion of the wage rate based on an individual's willingness to pay to save time in a non-working situation, typically his journey to work. In this case, separate studies are conducted to estimated value of travel time using e.g. non-market valuation methods such as CV and CE or factor analysis. Many such studies find that the value of travel time equals around one-third of the individual's wage rate.

5) Time on site

The same problem as with estimation the travel time arises when we want to compute value of time spent on a site. On-site time should also be an element in the travel costs calculation in the same way as travel time, since both have an opportunity cost. In practice, it is often assumed that time on site can be estimated in the same way as travel time. But some researchers advocate that cost of travel time should have a higher value giving that travelling can generate some disutility whereas time spent on site does not (since it is the purpose of the visit).

The TCM survey phases

In most cases, the phases of survey being carried out with application of the TCM method could be structured as follows:

1. Identification of what would be valued
2. Definition of target population
3. Sampling strategy
4. Model specification
5. Survey implementation
6. Calculation of travel costs
7. Model estimation

8. Welfare estimates

Since some of the issues starting at point 4 were discussed above, this section covers discussion of issues 1-3.

1. Identification of what would be valued

At this point, the scope of valuation has to be decided; whether it would be the recreational valuation of the site in question, or the specific recreational function, or valuation, with use of the multi-site models, of the change in characteristics which describe a given good. To this end, also delimitation of the physical boundaries of this good has to be performed. Sometimes, it may be an easy task, e.g. in case of the boundaries of a forest, national park, or lake, however, this task involves certain problems, e.g. when the value of a hunting area, or another one being used for recreational purpose is estimated that constitutes a part of a larger environmental site. In case when multi-sites survey is performed, all the sites under analysis have to be defined and one has to make sure that these sites reflect the real choice set for the respondents. In order to be able to survey the changes in the quality of the characteristics, the sites under analysis have to differ in the levels of these characteristics (unless, only hypothetical changes concerning the sites being analysed are presented to the respondents).

2. Definition of target population

Very often a target population in TCM surveys can be restricted only to visitors to sides. However in some studies non-visitors as well are included, which gives a more detailed picture of recreational behaviour for society. If a sample consist only on visitors of the sites, the achieved results can not be extrapolated to the general public. Those studies usually concentrate on the specific recreational activity types, such as biking, walking, horse riding or picking mushrooms.. When performing valuation which relates to a given environmental site it has to be kept in mind that it involves outdoor type recreation, which is heavily dependent upon seasonal features. And the question concerns not only frequency of visits, but also that the visitors who enter the sites in question in various seasons of the year could differ by various socio-economic characteristics, what

should be taken into account in the results interpretation. Defining the target population determines choosing the sampling strategy.

3. Sampling strategy

The two most prevalent sampling schemes are a random sample of population of individuals and an on-site sample of intercept users (Haab and McConnell, 2002). Off-site sampling covers both users (visitors of a site) and potential users (potential visitors). An example could be a random mail or phone survey. In this case we could get data representative for the total population. If researchers are interested in the welfare implication for a particular group of users, than for example a list of people with hunting licenses could be considered.

On-site sampling is a quicker and less costly method, however allows only investigating users of the site. Since the survey takes place during a recreation activity of respondents, it could be difficult for him/her to remain focused on the interview especially when it is long. The key problem is connected with representativeness of the sample. In this case the sampling frame is not representative of the population. Those who visit the site more often are more likely to be surveyed. This can be corrected in the statistical analysis.

The major groups of TCM

Modelling the demand for recreation may be performed with use of travel costs data on the grounds of microeconomic theory. It is assumed that the individuals are able to express in a rational way their preferences and that the choices they make have optimised the utility in the framework of their budgetary limits. In case of the TC models that involves the choice to be made between, on the one hand, the services/goods being provided by a site, to which they used to travel, and any other goods and/or services, on the other hand. Certain other important assumptions are also being made. First, the method assumes weak complementarity between the site asset and consumption expenditure. It implies that when consumption expenditure is zero (no one makes trips to an analyzed site), the marginal utility of the public good (the site or its quality) is also zero. Since TCM uses this assumption, it is clear that applying this method only use value can be estimated. The next key assumption is the "separability assumption". It means that the utility function underlying the TCM must also be separable with respect to different forest activities (Garrod and Willis, 2001). In other words, the demand of recreation on a site in question (e.g. walking) is in no way related to the demand of any other forms of leisure (e.g. demand of cinema tickets).

Selection of statistical models for estimation depends first of all upon the survey objective (i.e., whether the total recreational value, or a specific recreation activity, or the changes in the quality of characteristic feature of a given site are surveyed), and also on specific data features (i.e., whether individual or aggregated data is available). That involves the question of the number of the sites to be analysed. Generally, if a single site only undergoes analysis, the present recreational value of this site will be the non-market good under valuation. Where this the case, either the consumer surplus – which, following the neo-classical economic theory, is accounted for as the area under the demand curve – over the present market value, or the access value to this site, will be the measure of well-being.

In case of the multi-site models, both the access value, and the value of changes in characteristics of the sites under analysis can be estimated. Where forests are concerned, the forest species composition, the age of tree stands, the area or volume and quality of tourism infrastructure, could be these characteristic features. If several sites are analysed, the group to consider must not be restricted only to the individuals visiting the sites under evaluation.

Table 0.1 includes division of the TCM into three major groups following methodological assumptions and data and functions specification. They include zonal travel cost models, individual models relating to valuation of primarily single sites (individual single-site models), and multi-site

models which are not based on a "quantity demanded approach", and describes the demand for recreation as a problem of choice among alternatives.

When considering these models, the further deeper breakdown could be done that indicates a direct determination of the demand functions rather than specifying a utility function and the models in which the analysis begins by assuming a functional form for the utility function and then deriving the demand functions for the site-specific activities of interest. The utility function approach usually deals with discrete-choice models based on random utility maximization (Thiene and Signorello, 2008). The former approach will apply primarily for single-site valuation, whereas the latter for multi-site models.

Table 0.1 Main groups of TCM approaches

Criteria		Models		
		Zonal	Individual Single site	Multi-sites
Aim of study	Access value/ CS connected with a total number of visits	X	X	X
	Changes in quality (e.g. forest characteristics)	-	-	X
Number of sites	Single-site	X	X	-
	Multi-site	-	-	X
Participation	Visitors and non-visitors	-	-	X
	Visitors	X	X	X

Zonal Travel Cost Method (ZTCM)

The ZTCM is the oldest model and is gradually falling out of use. It is used rather for assessment of the CS or valuation of the access value than for changes in the site quality. It is applied primarily for single-site valuation. This model builds on aggregated data on the number of trips and the travel costs to zones surrounding the site under valuation. Delimitation of the zones may be carried out by different methods – typically, by concentric circles being drawn around the site, in such a way that the population which live in a given zone is situated in more or less the same distance to the site under valuation. Sometimes, this approach is replaced with another one which consists in delimitation of the zones upon territorial administrative division.

Relatively low cost of data acquisition for analysis is the strength of the ZTCM. This data may be obtained, for instance, at the entrances into the recreation sites such as e.g. parks where the visitors, when purchasing the entrance cards, could be requested to reveal their respective residence area-codes. Thus, knowing the area-code, the visitors may be assigned to particular zones. Another method involves preparation of a list of the car number plates on parking places in vicinity of the sites under valuation (however, in this case, one has to be sure that the majority of the visitors arrive in the site in question by car, but not by any other transportation mode). Collection of such data should be carried out over a definite time-period, typically a year. Then, the mean distance between given zone and the site under valuation would be determined with application of, e.g. Geographical Information System (GIS).

In order to determine the demand for visits to a site in question, a model is constructed in which the participation rate from a given zone, i.e., the number of visits per capita in the zone, is a dependent variable (see equation below). Explanatory variables include travel costs, socio-

economic variables describing residents in given zone, and variables which describe the substitutes for the site under valuation (e.g. other recreational sites in the surrounding countryside).

$$\frac{V_{hj}}{N_h} = f(P_{hj}, SOC_h, SUB_h)$$

h - zone

j - site

V - number of trips

N - number of individuals

P - travel cost

SOC - vector of socio-economic characteristics

SUB - vector of substitute recreational site characteristics

The major critics according to the ZTCMs is that, that these models operate on aggregated data for particular zones and use an assumption that estimation of the demand is generated by a "representative consumer" whose behaviour reflects the average behaviour in the population (Haab and McConnell, 2002). Secondly, data on both the number of trips and the residence areas of those visiting the site in question are often unavailable.

Individual single-site models

These models, unlike the ZTCMs, build on individual data (being sometimes household data) on travel to the site in question and the socio-economic variables concerning the individuals examined. Data is collected in a direct way, i.e. by means of carrying out, most often, a on-site questionnaire survey with the respondents.

$$V_i = f(P_i, SOC_i, SUB_s) ,$$

Where V_{ij} is the number of visits made by individual *i* to the site, P_i is the cost of travelling to this site incuding the travel time cost, SOC_i is a vector of soci-economic characteristics including income, S_c is a vector of the characteristics of available substitutes sites.

The function above may take various forms depending on the assumed stochastic structure of the demand function. This, in turn, depends on whether the dependent variable, an individual's trips to a site, is assumed to be distributed continuously or as a count variable. For the former case, a linear, square, semi-logarithmic, or the log-log form can be assigned to the demand function, using the Ordinary Least Squares (OLS) method to estimate the function. Making a choice of the most suitable form is a very challenging task, since the various forms of the function might result in different estimates of the consumer surplus. Economic theory is unclear as to the preferred choice here. Functional matching is then based upon statistical grounds. This data is used to derive a demand curve from which the consumer surplus may be estimated.

However, it is noteworthy that the TCM involves a specific variable that is the number of trips which is being truncated and censored. Truncated means that as only visitors to the site are recorded, there is no information on the determinants of the decision to visit the site. Another issue is that data collected in one period can not reflect preferences of people visiting this place in the other season. Censored stands for the fact that less than one visit cannot be observed so it implies that the depended variable is censored at one. This implies that OLS estimates of demand parameters will be biased (Hanley and Spash, 1998). The solution to truncation problem is to use a Maximum Likelihood (ML) estimator instead of OLS.

Since the number of trips is a non-negative integer valued dependent variables truncated count data models are intuitively more appealing for recreational demand then continuous ones. Count models, the most frequently used in TCM, are Poisson and Negative Binomial models. In count data models parameters are used to derive access value.

Multi-site models

When the focus of the research is on multiple-sites, the discrete-choice random utility model (RUM) is the most frequently used (Thiene and Signorello, 2008). This type of model is used for studying changes in the site characteristics, and also the access value, and it builds upon substitution interdependencies between the sites under analysis. In the RUM, an individual makes his/her choice between the sites with regard to a single choice occasion. It is assumed that such selection is based on a comparison between the characteristics of alternative sites, including the travel cost to a given site being one of these characteristics in the TCMs. In these models, the individuals make their choices whether and where to recreate (those are, as a rule, the studies based upon off-site sampling which makes it feasible to collect preference data for both the current visitors to given sites and potential visitors).

Assume that on a given choice occasion, a person i considers visiting one of j sites denoted j=1,2,3,...., J, where j=0 stands for staying at home. Additionally each site is assumed to give the person a site utility U_{nj}. Utilities are assumed to be a function of the trip cost and site characteristics. A rational individual chooses the site to visit that offers him/her the highest utility among all the other sites in the choice set.

Individual *n's* indirect utility from visiting site *j* is the sum of deterministic component V_{nj} (known to both researcher and the individual) and e_{nj} , an error term accounting for unobserved factors.

$$U_{nj} = V_{nj} + e_{nj}$$

The utility for site i assuming a linear form is:

$$V_{nj} = \beta_p P_{nj} + \beta_q q_j + e_{nj}$$

Where p is a trip cost of reaching site *j* and q_j is a vector of characteristics of site *j*, and β are parameters.

Site *k* is chosen if:

$$\beta_p P_k + \beta_q q_k + e_k \geq \beta_p p_j + \beta_q q_j + e_j, \quad \text{for all } j \in J$$

The basic idea is that site utility increases with the number/quality of appreciated attributes of the site. In other words, to capture differences in preferences for different sites, individual characteristics must be interacted with site characteristics.

A rational individual tends to maximize his/her utility:

$U_{nj} = \max(V_{no}, V_{n1,....,} V_{nj})$

Where V_o is the level of utility obtained by not visiting any site.

To capture differences in participation, the no-trip utility function can be depicted:

$V_{no} = \alpha_o + \alpha_{1z} + e_{nj}$

Where *z* is a vector of characteristics believed to influence a person's propensity for recreation.

The Conditional Logit Model is used most frequently for the purpose of the multiple-site analysis. It can be used giving the restriction of Independence of Irrelevant Alternatives (IIA). This restriction implies that the relative odds of choosing between any two alternatives is independent of changes that may occur in other alternatives in the choice set (which in practice may often not be the case). The Nested Logit model and the Mixed Logit model (or Random Coefficient Logit model, or Random Parameter Logit model) by introducing correlation among the site and no-trip utility error terms allow for more general patterns of substitution in the model and therefore relax the IIA restriction.

Problematic issues in TCM

Multi-purpose trips

In TCM, the demand for visits to a given site is determined upon travel costs relating to trip aimed at arrival in the site in question. A problem appears, when several sites are visited during one trip. It is thus interesting to know how to assign total travel costs to particular destinations. One of two possible approaches can be used in response to this problem. First, the respondents may be requested to assign weights to particular travel destinations thus weighting the cost of reaching the site under valuation, whereas the second option involves exemption of the individuals pursuing their multi-purpose trips, and assessing the demand function exclusively for those travelling to only the site in question. The assumption made for the latter case implies that the valuation of the recreation site shows no difference in relation to a statistical individual within both groups.

One day visits and multi-days visits

The issue pertaining to one day and multi-day visits involves the problem of travel cost homogeneity. It is preferable not to mix one-day and multiple-day trips in the same analysis (Haab and McConnell, 2002). The analysis of multi-day visits could be conditional upon both the objective of the study and the characteristic features of the group under analysis.. If however, both the residents (those who make one-day trips) and the holiday-makers (multiple-day trips) will respond to questions on a given site, thus the components of the travel cost will differ between both sub-groups. Three basic approaches to this issue may be distinguished:

1) The first approach treats holiday-makers as one-day visitors and considers only their daily travel costs (travel costs connected with their temporary holiday accommodation to the site). However this approach probably underestimates recreational value. This is because the cost of arrival at the holiday site has been excluded from analysis. However, the proximity of the recreation site could be one of the factors decisive for selection of just this very site.
2) Another approach is the respondents' attempt to assign weights to the factors decisive for selection of the holiday site, including the proximity of such recreational areas as e.g. forests or lakes. One could however imagine how difficult the task is to the respondents.
3) The final approach excludes holiday-makers and assumes during aggregation that their average valuation of the site is no less or no more than that of day-trippers (Hanley and Spash, 1998).

A1.2 Contingent valuation method

What is CVM?

The contingent valuation method (CVM) can value a wide spectrum of goods and services (including their quantitative and/or qualitative changes) which are not valued in a direct way by the market. It can also value both the use value and the passive value of these goods and services. This method involves valuation on hypothetical markets; thus the declared or stated, but not revealed preferences of individuals, are used for determining the value of non-market goods and services. The essence of the CVM consists in questionnaire surveying among a sample selected on

random in order to get to know the individual's opinions on the value of a given good and to infer from the sample to a larger population. Thus, statements of value of non-market goods can be acquired directly just in this way. The name – contingent valuation – refers to a condition that the valuation will be suitable, provided a scenario is implemented under which the good is to be delivered. Practical application of this method has already a more than 40-year history. Originally it was proposed by Davis (1963).

In the beginning, when the method was first used, economists were reluctant towards the CVM because of its hypothetical nature which - as they claimed - can undermine the reliability of the results obtained. In their opinion, on the one hand, a part of the respondent group, using the hypothetical nature of the market presented to them, could be prone to light-hearted overestimation of their preferences, since they will not actually have to pay. However, on the other hand, the nature of a significant portion of non-market goods is characteristic of so called public commodities thus suggesting that a part of the respondents could tend towards "free riding" and will never reveal their preferences while awaiting that someone else will lead to delivery of the good in question, and they could be in no way excluded from consumption thereof.

A breakthrough in the attitudes towards CVM came as late as in 1993, once a report was published by a special US Governmental Commission appointed to prepare an opinion on the assessment method for the losses in Alaskan ecosystem that resulted from the ecological disaster caused by the Exxon Valdez tanker oil spill. In this case, concerns raised by CVM critics over the reliability of this approach led the National Oceanic and Atmospheric Administration (NOAA) to convene a panel of eminent experts co-chaired by Nobel Prize winners Kenneth Arrow and Rober Solow to examine the issue (Carson, 2000). Upon a number of discussions, they produced a report, which concluded that “CV studies can produce estimates reliable enough to be a starting point for judical or administrative determination of natural resource damage – including lost passive-use value[3]..” (Arrow et al., 1993). In order to obtain reliable valuation results by application of the CVM, the panel also recommended some principles which have to be met when carrying out such type of survey, including precise method for construction of the survey scenario and the subsequent course of a questionnaire survey.

Thousands of papers and studies have been produced so far which deal with contingent valuation of non-market goods and services. Studies with application of CVM have been performed in more than 50 countries worldwide and their results are being used by governmental agencies and international organisations. Given more easy way to collect data, and a wider spectrum of potential non-market goods and services possible for valuation, the CVM is more popular nowadays than the methods using the revealed preferences of individuals.

The valuation measures in CVM

The CVM survey includes the valuation scenario and the valuation question. Valuation of non-market goods or services, or their quantity or quality, is being made under this method by a direct manner – i.e. the respondents themselves declare the value during the questionnaire interview. In the CV method, the valuation of a good may be obtained in a dual way: by means of requesting the respondents to reveal either their willingness to pay (WTP), or the willingness to accept compensation (WTA). Valuation in this case is based upon economic theory and the utility maximisation under a budget constrain. Unlike in the case of other methods based upon revealed preferences CVM answers to WTP or WTA questions go directly to the theoretically correct monetary measures of utility changes.

Economic theory indicates the contexts in which valuation questions should be eliciting WTP or WTA compensation. Asking about WTP for an improvement (the higher amount or the higher quality of a non-market good or service) implies that the individual is entitled to the existing level

[3] ”Passive-use value” is another name for ”non-use value”.

as does asking about WTA compensation for a deterioration. Whereas asking about WTA compensation for a possible improvement not actually occurring implies an entitlement to the higher level, while asking about WTP to avoid a deterioration implies only an entitlement to the lower level (Perman et al. 1999).

Table 0.2 An application of WTP or WTA denending on the directions of environmental changes

Direction of changes	WTP	WTA (compensation)
Improvement	for the changes to occur	for the change not occurring
	(an entitlement to the existing level of non-market good)	(an entitlement to the higher level of non-market good)
Deterioration	for the change not to occur	for the change occurring
	(an entitlement to the existing level of non-market good)	(an entitlement to the lower level of non-market good)

Source: Adapted from Perman et. al., 1999, table 14.6, p. 397

However, an application of WTA questions could be empirically problematic, since they tend to cause a substantial number of protest answers (SEPA, 2006). The protest problem will be described further in this Chapter. Besides, it often happens that the replies to the WTA question give very high estimates of the values of non-market goods, which may (partly) reflect that WTA – in contrast to WTP is not limited by any budget restriction. Having in mind these problematic issues, the NOAA Panel on Contingent Valuation recommends application of WTP rather than WTA questions.

Valuation scenario

In general, a CVM survey (scenario and questionnaire) should include the following parts (Carson, 2000):

a) an introductory section that helps set the general context for the decision to be made

b) a detailed description of the good to be offered to the respondent

c) the institutional setting in which the good will be provided

d) the manner in which the good will be paid for

e) a method by which the survey elicits the respondent's preferences with respect to the good

f) debriefing questions about why respondents answered certain questions the way that they did

g) a set of questions regarding respondent socio-economic characteristics

Description of the good

The survey scenario has to be clear, not too lengthy, and realistic, presenting the good to be valued, and justifying any possible cost to be incurred by the respondent in a manner which is eligible and acceptable by him/her. Where a change in the level of a good is valued, then this change has to be described not only with regard to its direction (e.g. deterioration of, or improvement in the situation), but also has to be "measured". In some cases, it is possible to make a quantitative description (e.g. enhancement of a recreational area, as expressed in hectares). However, the presentation of the changes as expressed solely in physical units is not sufficient, as for instance in case of change in noise level shown in decibels (dB), a respondent might be not aware of the effect

which particular noise levels have on his/her health and frame of mind. In those cases the description has to be more qualitative. For example, various physiological responses could be assigned to noise arduousness depending upon its particular intensities, e.g. nervousness, sleeping problems partial loss of hearing, etc. In order to bring closer to the respondents the valuation of the effects described, also photos or other forms of graphical presentation may be used to this end besides verbal descriptions.

When describing a good, a balance has to be retained between huge number of details, the listening to which may be boring to respondent, and too scarce quantity of information they contain, and which could appear insufficient to him/her in order to take optimal decisions. The description has to include information on the occurrence and characteristic features of the substitutes for the good in question (that is, whether the good under evaluation is unique at a regional, national etc. scales, or whether its closer or farther substitutes are available, and what is the cost of these substitutes).

The issue, whether the good provision scenario, and the good as such, and/or the changes therein are presented to the individuals questioned in an eligible and acceptable manner, could be checked by asking the respondents directly during the survey. Comments on the degree of the respondents' involvement in and their understanding of the questionnaire could have been expressed also by the persons who have carried out the interviews with respondents. Additionally, in order to verify whether the good was in a clear manner presented to the respondents the questions could be put in the questionnaire that provide for so called “scope test”. Where the respondents value both the minor and considerably bigger quantities of the good in question (e.g. enlargement of the number of specimens by several, in the first indent, and by several dozen, in the second indent), then it means that the survey has been constructed wrongly and the valuation itself has been insensitive to scope.

Description of the policy, project or program change of interest.

The survey scenario has to present in apparent manner any potential method for delivery of the good on the market. The CVM scenario could then include description of realistic policy, project or programme, including description of its necessary implementation conditions. One of such key conditions is that implementation of the project will be launched when the total benefits it generates exceed the costs incurred to implement it. An element being also essential is a precise description of the qualitative/quantitative level featuring given non-market good at the moment, i.e. the starting level from which potential changes are to be introduced. Another important information is what happens when the project has not been undertaken, i.e. information on the “zero” (status quo) alternative. It is noteworthy to emphasise here that this “zero” alternative does not mean that the level of a non-market good in question will in the future remain unchanged, since in case of certain environmental goods the desisting of a protective programmes could relate to reduction in the quantity thereof.

Payment and a provision of the good

A choice of the method by which the non-market valuation could be performed under real conditions, i.e. definition of a payment vehicle which fits the type of survey scenario assumed, is mostly important when constructing the scenario. Examples of the payment vehicle are the following:

- Increase in existing or introduction of new charges (e.g. water fees);
- Increase in existing or introduction of new taxes (e.g. an ear-marked environmental tax);
- Increase in prices of market goods that results from growing quality/quantity of a non-market good linked to given market good (e.g. being one of characteristics of the market good);
- Increase in prices of all market goods;

Payments for funds.

For a payment vehicle, it is essential that the payment frequency (one-off, monthly, annual payments, etc.) and the duration of the period over which the payments have to be made (e.g. for the subsequent 10 years, or by the end of life) be determined. Also, the date must be fixed on which levying the payment has to be started.

In theory, the payment vehicle should be realistic, reliable, neutral and enforceable. However in practice, it is very difficult to find the payment vehicles meeting the neutrality condition. For example - mechanisms such as income taxes or water rates are clearly- non-neutral and it is relatively common to find respondents refusing to answer the valuation question on the grounds that they object in principle to paying higher taxes or water rates, in spite of the fact that the proposed change is welfare enhancing (Bateman, 2002).

These objections may relate to credibility of the institutions being held responsible for implementation of the programmes, and by lacking faith in effective use of the financial resources collected. As regards the voluntary character of payment – e.g. voluntary contributions to environmental funds, such mechanisms are not recommended, since, where this is the case, the respondents could feel stimulated towards "free riding" types of behaviour and hence they will tend towards lowering their valuations.

Table 0.3 Main elicitation formats in CVM studies

Elicitation format	Some stylized facts
Open-ended	Large number of zero responses, few small positive responses
Bidding game	Final estimate shows dependence on starting point used
Payment card	Weak dependence of estimate on amounts used in the card
Single-bounded dichotomous choice	Population WTP estimates typically higher than other formats
Double-bounded dichotomous choice	The two responses do not correspond to the same underlying WTP distribution

Source: SEPA, 2006, table 11, p.63.

Protests

All respondents should be asked why they gave the valuation responses they did. That refers to both the respondents who revealed positive WTP and those which declared zero WTP. In the former case, one has to make sure whether the respondents "bought" the good which the researchers wished to "sell" to them when constructing the survey scenario. The latter case includes checking the motives which underpin the refusal to pay for the good offered. The respondents could declare their zero WTP not because they do not appreciate the non-market good in question, but because they have the opportunity to express in that way their opposition against the survey scenario on e.g. the aesthetical reasons or they could consider the described program unrealistic. The respondents could also protest against the payment vehicle applied, since they do not trust the institution as proposed within it and the method it allocates the monetary resources. The reasons for opposition could also refer to the social justice criterion. For instance, they might consider that since they do not cause any environmental pollution, they feel no motivation to participate in environmental improvement programmes. The protesting individuals, where socio-economic

characteristics do not differ essentially from those of "non-protesting" group, are typically excluded from the analysis aimed at calculating the welfare estimates.

Data collection methods

Data being used to value non-market goods in the CV survey originate from questionnaires. Various methods for carrying out the questionnaire surveys are applied, depending upon the measures used (e.g. traditional paper-and-pencil interviewing, or web-questionnaires), and the degree of the interviewer's contact with respondent (direct – face-to-face interview, or indirect contact, e.g. when respondent receives the questionnaire by post or answers questions asked via telephone).

Table 0.4 Survey modes and degree of contact with respondents

Degree of contact with respondent	High data collector involvement		Low data collector involvement	
	Paper	Computer	Paper	Computer
Direct	Face-to-face (paper-and-pencil interviewing)	Computer-assisted personal interviewing	Diary	Computer-assisted self-interviewing
Indirect	Telephone (paper-and-pencil interviewing)	Computer-assisted telephone interviewing	Mail, fax, e-mail	Touch-tone data entry, e-mail survey, web, disk by mail, voice recognition entry

Source: SEPA, 2006, table 9, p. 33.

Each of the inquiry methods has both strengths and weaknesses. Face-to-face interviews provide the respondent with the opportunity to understand the survey scenario in the best possible way, since where it is the case its description may be supplemented by visuals such as photos, maps, diagrams, etc. Face-to-face interviews also result in the highest percentage of answers to be given by the group of respondent among the surveyed sample. On the other hand, it has to be pointed out that the face-to-face interviews are relatively expensive when compared to an inquiry made in a direct way. The presence of the interviewer might result in biases due to phenomena such as a tendency that respondents give answers that they believe will please the interviewer. Telephone interviews and questionnaires distributed by post, although less costly than the face-to-face interviews, typically have lower response rates. The persons who decided to take part in such surveys may appear not representative of the total sample, since they might be deeper involved in the issues presented than the other persons within the sampled group (called self-selection effects).

Pre-testing

Pre-testing is an indispensable stage when carrying out valuation by the CV method. Pre-testing is performed on small respondent groups and is aimed principally at provision of information in framing and designing a CV study and questionnaire survey. Pre-testing serves for elicitation of the respondents' attitudes towards the good under valuation, checking whether this good is well described by the scenario, finding the forms of payment preferable by respondents, i.e. whether they are willing to pay for the good in question, and how much would they be willing to pay. Pre-testing is carried out as a rule in two stages: in form of the focus groups, and then as the pilot surveys.

The focus group testing is carried out by a moderator on 2 to 10 people groups. The respondents participating discuss the issues which relate to both the good being valued and the method proposed for its delivery. One-to-one interviews, is however rather seldom used, and could be consider alternative to the focus groups. Verbal protocols are another form applied instead the focus groups, where the respondents read aloudl the survey scenario and give their oral answers, including any comments and thoughts they had in the course of this task.

The pilot surveys are carried out on bigger groups than those in the focus group surveys. They are as a rule groups of 25 to 100 people. Those are the "trial" groups for testing the questionnaire. The pilot surveys serve the purpose of fine-tuning the questionnaire and sometimes they are used to train the interviewers.

WTP elicitation formats

In the CV surveys, asking the questions about the respondents' WTP (or WTA) for a given good may be done in several ways. Selection of the question format may be decisive for the results to be obtained. However, none of these ways could be recommended as the best one at the present state of the art. They all have their advantages and disadvantages.

In the beginning, so called open question format was used when querying the WTP in CVM surveys, i.e. respondents were simply asked their maximum WTP as a single number response. At present, a tendency to desist of such type of question formats has been noted. All other elicitation formats involve monetary amounts that the respondent is asked to consider. Their advantage is that those are closer to the market choices which the respondents encounter everyday. Some of these formats provide for respondent's choice of his/her WTP from various amounts proposed (payment card). In other cases, the respondent has only one amount to consider whether he/she will be, or will not be, willing to pay (closed-ended questions, ”yes”/”no” answers). The amount (the “bid”) is varied among different respondents, which means that respondents’ “yes”/”no” answers together give information on WTP distribution (SEPA, 2006).

Estimating welfare measure in CV

Both parametric and non-parametric methods may be used to estimate the value of a good in CV surveys. The latter ones involve mainly the calculation of the mean or median WTP (or WTA) value. The mean value is the more adequate measure in view of economic theory, as a cardinal measure of utility the individuals derive from the non-market good. It traditionally applies for cost-benefit analysis. The median, on the other hand (that represents the price for which the probability of the bid rejections equals 0.5) is not so sensitive as the mean to the very high rates which could be suggested by a small respondent group. Additionally, while based on the closed question survey and the acceptance or rejection of the bid proposed, the median corresponds to the amount of money which a one-person-one-vote system would allocate to the policy or public good. Simplicity is an evident advantage of the non-parametric approach. Mean and median can be calculated from raw data without assuming any distribution for the unobserved component of preferences. The calculation can be made without resort to computers (Haab and McConnell, 2002). For example, the mean from a CV survey using the open ended format is a non-parametric estimate, as it is the sum of max WTP across the sample divided by the number of respondents.

However, there are situations where it is desirable to estimate the relations between WTP and other variables, e.g. the socio-economic characteristics of respondents, or the characteristics of a good, the value of which has to be assessed. For example, a knowledge of such relations is necessary when we want to extrapolate our results to the general public. The non-parametric approach allows for surveying such interdependencies to only limited scope. The role of parametric models better fits such cases. This approach involves the estimation of a so-called valuation function as a way of relating the respondents’ answer to the valuation question to various

explanatory variables. The shape of valuation function depends on, inter alia, the framing of the valuation question (SEPA, 2006).

Problem areas associated with CVM

The CV surveys are sensitive to biases which result from a conditional survey scenario. The problem emerges when these biases are of systematic nature and lead to systematic overestimation or underestimation of the real value of a non-market good. Several major types of systematic biases could be distinguished (Hanley and Spash, 1998):

1) Strategic bias – occurs primarily in two situations. The first appears when the respondents underestimate the value of non-market good while being aware that it is a public good and nobody would be excluded from its consumption once it is provided. On the other hand, where the respondents are convinced about hypothetical nature of the questionnaire, they would overestimate the value systematically in their answers. The likelihood of the occurrence of strategic bias may be reduced by means of application of the following procedure:

remove all outliers (those who declare non-proportionally high WTP when compared to other participants to the survey or as percentage of income)

stress that payment by others is guaranteed

conceal other's bids

make the nonmarket good change dependent on the bid (that is, prevent the respondents from taking the change automatically forthcoming irrespective of their bids) (Mitchell and Carson, 1989).

2) Design bias – could relate to choice of payment vehicle. As mentioned above, the respondents could declare a lower WTP reflecting their reluctance to the payment vehicle proposed. Information on whether the payment method is neutral to the respondents may be obtained from pre-testing. The starting point bias is another one in this group. In bidding games, the starting point given to respondents can influence the final bid given. Application of other elicitation formats brings about a solution. The misspecification bias is the last one in this group. It occurs when the respondent does not understand the scenario as researcher intends it to be understood. And again, pre-testing is helpful to avoid this bias.

3) Mental account bias – appears, e.g. when the respondents declare a given amount of money to an environmental good that at the same time they are in position to spend for the whole protection of the environment, and hence, they do not consider any other options of expenses in their decisions, because such options have not been considered also in the research scenario. Where it is the case, a two-stage valuation could bring about solution, i.e. wider-context question is asked first, and then another one about the good as itself follows.

A1.3 Choice experiments

What is CE?

Application of the choice experiment (CE) method, (named also the contingent choice method, stated choice method, or attribute-based method) provides for eliciting the consumer preferences by means of their participation in a survey containing hypothetical choice sets. CE allows to model consumers' preferences, provides an insight into which attributes consumers see the most important. Based on these, a researcher is able to model demand and predict welfare or market share changes resulting from implementing a policy. In particular, the choice experiment method provides for modelling of the utility function, hence, the formal description of interdependencies between the features of the alternatives available to the consumer and the socio-demographic

variables which are specific for him/her, on the one hand, and the choices made by the consumer and the utility (satisfaction) which the choices (or choice set) could generate, on the other hand.

A **choice set** always appears when the consumer is confronted with more than one **alternative**. Those could be both the simple, everyday choices, and the serious decisions which involve multi-year consequences. The choice experiment method consists in presenting to the consumers the respectively prepared, hypothetical choices. The choices they make provide and insight into their preferences. The choice experiment method consists in that each of the alternatives may be precisely and fully described by means of a number of **attributes**. These attributes may be any characteristic of the goods or situations which the consumers have chosen. Hence, particular alternatives could differentiate each other by levels of the attributes. Irrespective of whether the alternatives concern the choice of goods, services, or any other situations (hereafter "the goods") which could impact the consumer, his/her decisions reveal the importance which particular attributes of the goods feature by to satisfy (i.e. provide usefulness to) the consumer. Once having in place a respectively abundant collection of such information, the usefulness function of typical consumer may be outlined, the significance of particular attributes may be specified, the combinations of the attribute levels being mostly desirable to consumer may be estimated, and also the choices which the consumer could make, may be predicted.

In practice, the choice experiment method appears extremely simple and flexible thanks to hypothetical nature of the choices being presented to the consumers. Therefore, it has been continuously more commonly applied in economic, marketing, transport, environmental, health protection, and other studies. Where a researcher is interested in choices being made by consumers (or any other entities) the choice experiment method can be applied to identify and analyse the factors which have influenced the choices. The most frequent applications of this method include the simulation of the effects of changes in the levels of certain attributes, the calculation of the final substitution rates between the attributes, the estimation of their values when one of the attributes (e.g. cost) is measured by monetary units, and the modelling of the usefulness function.

The research carried out by the choice experiment method are as a rule being performed in form of questionnaire survey where those questioned are asked to make certain choices. Therefore, the questioning must meet a number of requirements in order to secure that the conclusions to be drawn up thereupon are representative and significant. Moreover, given the hypothetic nature of the choice sets being presented to the respondents, the questionnaires must be so designed that the information provided by the respondents minimise any difference between the answers obtained to hypothetic questions, and the behaviour the consumers would have assumed under real choice sets. This requires that the survey be prepared following a specific methodology – application of the technique which cause that the respondents' answers are significant. The outlay of the choice sets, including the choice alternative's attributes and their levels, as presented to the respondents is essential for the final survey result. Often, several or a dozen of the alternatives have to be chosen from the infinity of potential ones that the respondent could be in position to choose only those adequate which will include the most possible information on his/her preferences. Finally, the data collected by the choice experiment method is subject to statistical analysis. A lot of statistical tools are available which provide for obtaining information interesting to researcher. Selection of a proper model for analysis of data acquired under survey is also of essential importance for general methodological correctness of the survey.

CE in practice

The survey by the choice experiment method may cover any group of consumers. The features of the population in question are usually the focus of researcher, since definition of the population has to be the primary step when designing a survey. Where the features of a specific good are considered, there for instance, its users or the individuals bearing the cost of its acquisition could be the populations (while these groups are not necessarily the same ones).

The population subject to survey is, as a rule, so numerous that surveying all its members is unfeasible. That causes the need to surveying a respective sample of this population the will represent is as the whole. From the statistical point of view, this involves the need to provide for, firstly, avoiding any burden which could affect the results (i.e. the survey results to be generated on a representative sample have to be free of any burden in relation to such results which would be obtained in case when the whole population undergoes surveying); and secondly, the sample has to be so selected that the variance be minimised (that will provide for the results sufficiently precise enough in relation to the real features which characterise the population). Apart form the sampling error, i.e. that eventually resulting from the fact that just the sample, but not the whole population is surveyed, yet the non-response error could be generated on the grounds that certain respondents selected to questioning have not participated (e.g. due to their refusal or unavailability).

Two basic - non-probabilistic and probabilistic - sampling methods are practiced. Those in the former group are easier and cheaper, and they are particularly useful for the preliminary survey or that aimed at elicitation of certain general interdependencies. The probabilistic sampling methods are usually applied in cases where the higher accuracy of the results is required. Its benefits include the opportunity to use statistics for the purpose of setting out the features of the estimators obtained upon the sample, the design of the credibility intervals, as well as the correction of the non-response error and the sample-selection bias.

The non-probabilistic sampling methods include the convenience samples which are the least accurate, but the most easily available. Such a sample is taken on a random basis and hence without any control over the process of selecting the participants to questioning. A questionnaire survey carried by a tutor among students may be exemplification of such type of sampling, where he expects that the conclusions to be drawn be characteristic for all students of the university, or at the country scale. The judgement sample, named also the purposive sample, could provide for slightly higher accuracy where the respondents are so selected that they would represent the major groups of the population covered by the survey. Finally, by the quota sampling method, the participants to the survey are so controlled by the researchers that the sample includes definite proportions of particular types of respondents, by their characteristic features (e.g. sex, age, income, provenience, etc.).

Among the probabilistic methods, the random sampling method is the simplest one by which the identical likelihood to participate in given survey is attributed to every member of the population. Under another method, i.e. stratified sampling, the target population is divided into non-overlapping subgroups, each of them being called a stratum, and respectively - two or more subgroups are named strata. (With known size of each stratum, the strata may differ by specific features.). Then, a random sample is taken from each stratum. For the proportionate stratification, the sample size of each stratum is proportionate to the population size of this stratum. This means that each stratum has the same sampling fraction (while, the sampling fraction is the proportion of a population to be included in a sample; and the sampling fraction is equal to the sample size divided by the total population size). For the disproportionate stratification, the sample size of each stratum does not have to be proportionate to the population size of the stratum. This means that two or more strata will have different sampling fractions.

The results obtained on each of the samples are then respectively weighted in order to provide for drawing the conclusions concerning the whole population. Finally, among the probabilistic methods, the cluster sampling is to be mentioned here that consists in preliminary stratification of the population, and then one stratum is selected on a random basis for surveying all the representatives of this stratum by use of a questionnaire.

Several ways are possible when conducting the questionnaire survey by the choice experiment method. Those mostly often applied ones include distribution of questionnaires by post, telephone interviews, face-to-face interviews, group interviews and publishing the questionnaires on the Internet. Each of these methods has some advantages and disadvantages. Application of either method influences the size of the measurement error (due to receiving the various percentage of

the sample-selection bias, the researcher's influence on the results etc.), the cost of questioning, the opportunity to use additional materials and the quantity of data collected. The face-to-face interviews are considered the most reliable (and suggested by the NOAA Panel; Arrow et al. 1993), but also the most costly ones, and are recommended for carrying out at the respondent's place or in the research centres. Meanwhile, the Internet-published questionnaires are considered the most difficult with regard to the feasibility of controlling the sample, but those are mostly cost-effective, instead. Selection of each of the questionnaire implementation method inseparably involves the balance to be retained between its particular features, on one hand, and the need to its adjustment to the research objective, on the other hand.

The choice of the method for sample selection and implementation of the questionnaires influences the minimum sample size, the choice of which has always been a compromise between the survey cost and the accuracy thereof. The final sample size depends upon the quantity and the size of the population strata, for which the estimation of the results is to be known, the required estimation accuracy (the maximum tolerance credibility interval), and the differentiation of the population under survey with regard to the features being surveyed. The statistical methods are available which depending upon those parameters provide for setting out the minimum sample size as necessary to achieve the specific research objectives. The final sample size applied in a survey has to take due account of the answers which (e.g. when incomplete) do not fit the purpose of the further analysis, or are non-responding, or are so called opponents' answers.

In the valuation research, the most frequently encountered sample sizes for the contingent valuation method reach 250-500 for open format questions and 500-1,000 for closed format questions. When surveying by the choice experiment method, the sample size could be lesser, since the more information can be elicited from single respondent and he/she may be yet invited to take part in a more than one choice set.

The way by which the questionnaires are prepared is of essential importance for the quality of data collected. Well designed questionnaire should present in a manner clear, concise and eligible to respondent all the relevant aspects related to the choice. As the surveys show, the sole manner by which the questions are formulated in the questionnaire influences the answers provided by the respondents. Therefore, both the phrasing of the question and the vocabulary used in the questionnaires has to be applied intentionally to secure the maximum objective response data. Also, such aspects are essential as formulation of questions in an open or closed form, avoiding double questions, optimum form of questions on the respondent's activity in the past, etc. The issues of the optimum formulation of questions in questionnaires are broadly addressed in literature (Sudman and Bradburn 1982; Sheatsley 1985; Converse and Presser 1986).

Finally, the outlay of the questionnaire and sequencing of questions is important. The most intimate questions are usually placed at the end of the sequence with the aim to avoid the risk that the interview could be desisted of when filling in the questionnaire. However, such initial questions involving the basic information which could make the respondent further interested and introduced into the survey issues are place at the beginning. Placing the choice set which is the essence and culmination of the questionnaire must be preceded by delivery of all information required to this end, so that the choices being made by the respondent are full of awareness and significance an that the respondents could understand the choice set in a manner stemming form the researcher's intention. In order to keep the respondent concentrated and interested, the longer portions of the information presented have to be diversified with extra- questions (or even quizzes) and presentation of supplementary materials, such as photos, diagrams, etc.

Preparation of the final version of a questionnaire that will meet the goal assumed by the researcher is a time-consuming process. This is because the qualitative analysis has to be preformed with regard to testing various solutions on particular stages of its designing. The analysis is usually being carried out in form of one-on-one surveys and/or verbal protocols with respondents. Finally, such multi-stage process of refining the questionnaires will provide for obtaining the results as required. Carrying out pilot questionnaire survey, hence proven final

version of the questionnaires on a sample sized lesser than the target sample, is also a practice often applied, for instance to verify the correctness of the thresholds assumed for the closed questions. The questioning phase, as itself, is only the final stage of this process.

A broader discussion of the issues pertaining to designing the questionnaires and their application in carrying out research by the choice experiment method may be found at Bateman et al. (2004), Champ (2004), Champ and Welsh (2007), and Dillman et al. (2008).

Incentive compatibility and survey design for the choice experiment method

The research mechanism is considered correct in terms of motivation if its principles provide that participants are stimulated by the respective incentives which cause them to reveal their real preferences, being yet complete. Designing a motivation-correct questionnaire or laboratory testing aimed at elicitation the respondents' willingness to pay for certain goods is theoretically possible, however designing it for the choices including two or more alternatives brings about a lot of difficulties, or even becomes unfeasible. While some studies show that under certain circumstances the absence of the motivation correctness that is caused by, inter alia, the hypothetical nature of the questions asked, must not be any relevant problem, it poses however an essential objection against carrying out surveys by the choice experiment method. The basic implications are discussed below which relate to the optimum design of the research scenarios for the choice experiment method, as regards the provision of the motivation correctness.

When carrying out a survey by the choice experiment method, the hypothetical bias and the free riding effect are the factors primarily influencing the authenticity of the respondents' answers. The former effect causes that, given the hypothetical nature of the questions asked; the respondent could give other answers, than he/she would when the choices made by him/her would have caused the real effects. The consequence of the latter is that the respondent while believing that the goods will be in any case delivered is motivated rather to reducing in the answers his/her willingness to pay for these goods. In practice, it can be hardly resolved which of these results has the stronger impact. Hopefully, there are the methods which provide for minimising the impacts of these effects on the answers being given by the respondents (Carson and Groves 2007).

Fixing the payment method is the basic way to minimise the free riding effect, where, in case when a project is to be implemented or the goods delivered which all the users or all members of a given group will be obliged to pay for, irrespective of the answers they have given. An increase in a commonly levied tax for financing the provision of certain public good is the exemplification of such a form of payment. Unfortunately, some common forms of payment involve certain level of reluctance on part of those participants which could consider them unfair or reveal other negative emotions towards them, as reflected in the answers they have given.

Designing the survey that enables for elimination of the burden imposed by the hypothetical nature of the choices being presented to consumers is yet a more complex challenge. It appears that in the most cases the "hypothesised" burden cannot be entirely eliminated. Nevertheless, as the studies show, its impact in case of the respectively designed surveys could be made insignificant. Two basic methods to minimise the "hypothesised" burden include a priori calibration of the research instrument, and ex post statistical calibration of the results obtained.

The first of these methods consists primarily in suitable choice of the phrases and instructions being used in surveying. As the studies show, depending on the survey entourage, the results could more or less deviate from the decisions being, in reality, made by the respondents under the same circumstances. Unfortunately, it is very difficult to asses a priori what type of entourage will cause

that the impact of the "hypothesised" burden be minimised. Therefore, the surveys performed by the choice experiment method are as a rule conducted in course of a time-consuming process of testing and refining the research instrument. The choice of suitable phrasing is made primarily upon the focus research, verbal protocols, pilot surveys and laboratory tests all enable for making comparisons of the answers to hypothetical questions against those received in result of the motivation-correct mechanisms feasible to apply only at the laboratory scale (such as e.g. Vickrey auction, Groves-Clarke mechanism, BDM procedure, etc.). Interesting effects stem, amongst others, from making the respondents informed on the problems which occur in case of the majority of them as regards overestimating their willingness to pay (cheap talk), reiterated reminding them about their budgetary limitations, and enabling them to respond while being aware of the credibility interval provided, which they attach to an answer.

Statistical calibration is another method to correct the "hypothesised" burden. It assumes that the results obtained from the respondents include true information, being however affected by such burden. The issue in question consists then in evaluation of the burden function which would provide for such a correction of the answers received that they could better reflect the true respondents' preferences. Again, this method requires additional testing, in particular, the application of laboratory tests in order to compare the answers received with those obtained under fully correct motivation mechanisms. The credibility interval, as determined by the respondents that relates to the answer they provide, is an essential predictor of the degree of the "hypothesised" burden.

One necessary precondition underpinning the motivation correctness of eliciting the preferences is that the participants thereto be convinced that the final results of these preferences are significant for their usefulness. For example, if a participant to a questionnaire survey believes that his/her behaviour influences implementation of a specific alternative, while implementation of this alternative is of importance for his/her wellbeing, such participant will be adequately motivated to give true answer. So called epsilon-truthfulness is a slightly more powerful and the more frequently encountered assumption under which, if a respondent sheers towards indifference towards both laying and truthfulness, he/she will choose the latter (i.e. true) option. However, pertinence of the grounds for this assumption still remains an open research question (Harrison 2007).

Well designed survey has to make the respondent convinced that: (1) the survey objective is of importance from the social point of view and that the effects of this survey influence wellbeing of a population (i.e. the effects being either decisive for implementation of a specific project, or at least, will provide a supportive output); (2) the respondent's answers are significant for the output of the survey performed (the respondent have to consider positive the likelihood of him/her being a decisive voter); (3) the vote of a respondent when drawn by lot is essential for representativeness of the population segment he/she represents (while being essential especially in a questionnaire survey when encouraging the respondent to participate to questioning, and when aiming at enhancement of the response rate); (4) the respondent's answers be anonymous.

Also, the quantity, the quality of and the method for delivering information about the scenario, the choice set, the attributes and their levels are of special importance for the results to be produced by the survey carried out by the choice experiment method, since the respondents will give answers based primarily on the aforementioned information types. If the answers to be provided are to be significant, one has to make sure that the bulk of indispensable information has been respectively accepted, understood and processed by the respondent. However, too huge information quantity or to lengthily survey duration may be boring, and this, in turn, could have led to raising objections against the reliability of the results produced. Hence, the optimum quantity of information and its delivery method have been inseparably linked to the preliminary survey and the iterated refining of the research instrument (Mathews et al. 2007).

The opportunity to address a wide spectrum of respondents is an essential feature of surveying by the choice experiment method. Hence, one has to be aware that in many cases also those will be among the respondents who have neither university education nor technical knowledge. Therefore,

the language applied in designing the questionnaires, the manner of phrasing information included therein and the assumptions concerning the preliminary information have to be tailored to the context of the research.

The adequacy of information being delivered to respondents is an essential issue. It must be not only eligible by them (i.e. expressed in a simple way), but also conforming to the current state-of-art and reliable, since on the basis of just this information the respondents will make their choices first and foremost. If the information included in the survey distorts the truth, the survey results will not adhere to the reality.

The method for, the quantity and quality of the information provided play hence an essential role in surveys carried out by the choice experiment method. Unfortunately, one can hardly decide a priori on the way to matching the information. Therefore, again the importance of testing and refining the instrument has to be emphasised. The analysis of the rationale of the respondents' answers is one method to verify whether the information was adequately provided by them. This may be done by means of verifying the monotonousness of their preferences (the higher levels of desirable attributes of the goods should be preferred over the lower ones), their transitivity (where the consumer preferred A in relation to B and B over C, than he/she should prefer A more than C), and stability (i.e. the respondents' preferences should not vary over the duration time of an individual survey).

Designing the choice set

Performing research by the choice experiment method involves a series of variants. The most popular ones include: the discrete choice where the respondents are asked to chose mostly preferred alternative from a set of two or more alternatives differing in the attribute levels of the goods; the contingent ranking where the respondents are asked to line up the alternatives from the most to the least preferred ones; and the contingent rating where the respondents are additionally asked to specify, how much do they prefer a given alternative, pursuant to a synthetic, scored scale. Irrespective of the methodology variant used, the respondents' choices undergo statistical analysis which enables for determination of the form and parameters of the usefulness function matching the best the choices observed. Drawing up the consumers' (or their sub-groups') usefulness function provides a widespread field for the further analysis, since that enables for reading out: the attributes which are relatively most relevant, the variability of the consumers' usefulness stemming from change in their levels, or whether the individual attributes and their levels are mutually interrelated, as well as what are the effects of the respondents' choices made upon their individual socio-demographic features.

Likewise in case of the contingent valuation method, the choice experiment method uses certain scenario introducing the respondent into the choice which has to be made, and therefore it requires prior careful planning, testing and implementation aimed at delivery of correct results. Nevertheless, since this method requires that the respondents make a relative comparison of the alternatives, instead expressing the acceptance for only one scenario, the contingent valuation method provides for considerably higher flexibility of making conclusions based upon the results obtained.

Undoubted advantages of the choice experiment method include that it enables setting out both the effect of the hypothetical change in certain attributes of the goods, as the whole, and their specific constituent components. Moreover, it is believed that many respondents consider the situation in which they have the opportunity to declare their preferences on relative basis, e.g. choosing the most preferable alternative, as the easier one, and the more comfortable and natural, than any other direct setting out the value of the goods in monetary units.

Research based upon the contingent valuation method requires rather not mostly detailed description of a single scenario, under which the changes in characteristics of analysed goods are proposed in a comprehensive manner, but a description of many choices possible which differ

mutually by particular attributes. This approach applies various and carefully designed series of changes in the features to be presented to the respondent when asking him/her to make a choice of a preferable set. Therefore, the choice experiment method requires precision and of the attributes, the changes of which have to describe a new situation.

The fundamentals of the choice experiment method consist in that each good could be characterised by means of respective chosen series of the attributes describing it (Lancaster 1966). That has to be started from identifying the series of all essential attributes (including manipulated variables, factors, independent variables, explanatory variables) and then their number has to be confined to only such ones which could be considered in parallel, at the same time, by an average respondent. Then, an adequate mode of quantification has to be identified for each of the attributes that means a functional unit which enables for their description. The attribute levels (or factor levels, treatments) may be described by both their physical values (e.g. weight – in kilograms, cost – in monetary units), or descriptive values (e.g. comfort – in a descriptive or score scale). Now, recalling the survey objective a definite numbers of the attribute levels have to be identified, by which the various variants of the goods will be presented to the respondents.

Further, the experimental design is to be developed. The choice presented to the respondent consists of several alternatives which are described by means of various attributes (i.e. their levels). The number of alternatives in single choice set may differ, as a rule between 2 (i.e. paired comparison) to 4, since the respondent could hardly compare a higher number of them at once (Batsell and Louviere 1991). Principally, the number of 2 or 3 alternatives is sufficient enough to describe the status quo and various opportunities to change. The choice design consists in creation of so called treatment combinations, or profiles which could provide alternatives to the choice (or sets thereof).

The process of matching the levels of attributes under particular alternative to be presented in the survey, as well as the sets of alternative to be presented for one choice set is merely complicated. This is because the researcher's goal is to find an optimum between the highest possible quantity of information gathered on a single choice set (therefore, the alternatives have to present possibly close usefulness values), and the least possible variance of the parametric estimates being obtained (since, when the alternatives are mutually too close with regard to their usefulness, then they could cause that the respondents will be not in position to select apparently the best one, or will make their choices on a random basis, or refuse participation to the survey, at all).

The full factorial design is the simplest method for designing the choice set, under which the alternatives created feature by all possible combinations of all the attribute levels. However, this method features by two major disadvantages. First, it is ineffective, since a part of the alternatives prepared in that way would be never chosen by the respondents, whereas, in turn, the other ones could be always chosen, and that is the reason why a part of the choice set does not involve the information which could be of use for the further modelling. Second, already with several attributes at several levels, the quantity of all possible combinations considerably exceeds the number of the alternatives which could be presented to the respondents.

Having said the above, only certain possible combinations of the attribute levels fit the selection needs of the survey, and they are being finally chosen. Such type of design is called fractional design. The choice of certain combinations of the attribute levels must however feature by adequate statistical characteristics, as indispensable for the further development of the model and estimation of its parameters (e.g. the parameters which reflect the significance of particular attribute levels in the consumer usefulness function). To this end, the orthogonal factorial design is the method applied most frequently nowadays. The essence of this method consists in noncolinear occurrence of the changes in particular attribute levels under various alternatives, hence the analysis of various alternatives provides for independent estimation of the influence of each of them on the consumer choice.

Application of the orthogonal factorial design enables to reduce to a dozen or several dozens the number of alternatives used for surveying. However, it has to be noted that many options of the orthogonal factorial design exists that could yet mutually differ in their effectiveness. The comparison of the effectiveness is possible thanks to so called effective partial design, which encompasses a wide group of approaches to designing the choice sets those while using the more or less precise expectations concerning the form and parameters of the usefulness function enable for a priori creation of the choice sets which are capable of maximising so called D, A, C and S effectiveness types; while, with the D-effectiveness, the matrix determinant of the model parameters variances and co-variances matrix is minimised, hence so are also the variances and co-variances of the parameters; with the A-effectiveness, the trace of the variance-co-variance matrix is minimised, hence so are also the variance parameters); with the C-effectiveness, the variance of specific parameters is minimised, being usually those used to setting out the marginal rate of substitution, i.e., for instance, the willingness to pay for a specific attribute level; and finally, with the S-effectiveness, the sample size is minimised that enables for obtaining specific statistical features of the parameters, or any mix thereof. While this approach theoretically provides for reduction of the number of observations (or increase in the quality of the estimations obtained), it inseparably links to certain assumptions concerning the form and parameters of the usefulness function that as a rule are unknown prior to commencing the survey.

Application of several subsequent sets of choice for a single respondent is the factor which distinguishes between the choice experiment method and the contingent valuation method. And it is not necessary that the number of the choice set presented to single respondent be equal to the total number of the sets of choice prepared. In case when the lesser number the choice set is presented, the blocking the design is applied (i.e. blocking the choice sets) in order to aggregate them into packages, so that only one package be presented to individual respondent. Once the choice design is complete, the survey scenario can be developed to provide "casing" for the design, and then the model will be estimated, once collection of data is complete.

A1.4 Other valuation methods

In addition to the three primary valuation methods discussed above, there are three methods that are less frequently used to value non-timber forest benefits: (1) The hedonic method, (2) The damage cost methods, and (3) The replacement cost method. We will briefly review these methods below, and provide a few examples.

The hedonic method

The hedonic method (HM) is a revealed preference method which uses information about prices of goods people buy to infer the marginal value of different characteristics or attributes of that good. Typically, a good consists of many attributes the consumer values when purchasing that good. If two goods differ only along one dimension, for example two cars that have similar sizes, colours, designs etc, except for the power of the engine, the price difference between the two goods can be assumed to be due to the difference in that particular characteristic. Given data of market prices of tradable goods which has variation in prices and types of characteristics we are interested in, the marginal values of each characteristic can be derived. So, why would this approach be relevant for valuing NTFBs?

The HM has been used in many areas of consumer research, but importantly in environmental economics in two main areas: (1) Valuing environmental amenities based on price data for houses; (2) Valuing risks based on wage differentials between safe and more risky jobs, to derive a measure for value of statistical life. The latter measure is typically used in cost-benefit analysis to rank policy interventions that save (statistical) lives, e.g. improved road standards.

The first application, using property market data, is based on the simple idea above that the price of a house can be explained by (1) Characteristics of the house itself and its lot (number of rooms,

size, number of bedrooms, floor etc); (2) Characteristics of the neighbourhood (e.g. quality of schools, level of crime, environmental health etc); (3) Characteristics of the property's location, e.g. proximity to a recreational area. Some of the characteristics can be called "environmental amenities" and will have implicit prices valued by people through the market for properties.

Many types of amenities can be valued, such as noise, air pollution, odour, views, proximity to forests and green space (e.g. parks) etc. HM has been used both for recreational properties and for urban properties. The HM involves collecting a fairly extensive dataset of public records of house prices (which typically includes the variables describing the house characteristics). This dataset is then coupled with statistics and sometimes GIS data on the attributes of neighbourhoods and environmental quality and amenity data – that often has to be crudely proxied. In comparison with the stated preference methods (CV and CE) and TCM, HM can be laborious and expensive.

Given sufficient data on house prices and the amenities and characteristics explaining the market prices, implicit amenity prices can be derived using statistical methods. An important condition making this possible is that the data contains sufficient variation in amenitity levels. Through a second step, aggregate welfare measures for the environmental amenities can be derived, e.g. for environmental changes such as increasing the green spaces in a city, reducing noise from traffic etc. These are benefits of proposed policies which in turn can be compared with costs in a cost benefit analysis.

A few studies use the HM method to value forested areas within and around cities, for example Tyrväinen (1998) and Tyrväinen and Miettinen (2000). Houses near forests typically have higher prices than otherwise similar properties located away from forests. The HM method can only value so-called use values, as house owners directly benefit from the amenities they pay for. It is not easy to disentangle which NTFBs that people value through this method, as data is not detailed enough to give implicit prices for different NTFBs. It can be assumed that it is particularly recreational aspects of the forest that are important, but also presence of birds and other wildlife, views and other benefits related to a forest proximity.

Although the HM is relatively popular, particular in the USA, for valuing water quality, noise and other environmental amenities (and disamenities), forests and NTFBs are still relatively rarely explored in HM applications (see Annex for studies conducted in Europe). A good reference for further discussion of the MH is Taylor (2003).

The damage cost method

The damage cost method aims to estimate direct and indirect economic costs caused by environmental pollution. Air pollution, for example, will cause health problems for people (especially particulate emissions and sulphur dioxide), create damage to buildings and cultural monuments, damage crops and sometimes forests. When used to value people's health, the method estimates cost of illness, which includes all outlays people have related to disease caused by pollution (e.g. medicines), lost working days and productivity etc, and increased likelihood of premature death. Increase in disease prevalence is typically estimated using so-called dose response functions.

In a similar way, damage to growth and quality of forests (and their NTFBs) from different types of pollution, can be estimated using dose response functions from the literature. The acid rain problem in many areas of Europe a few decades ago, for example, had an economic costs per tonne sulphur emitted. This cost could be approximated with the value of trees for the timber values, but had a significant cost also in terms of NTFBs. The NTFBs would have to be estimated using some of the other methods discussed above.

Currently, acid rain is less of a problem, but global warming has taken over as the main global environmental concern. When trees that bind carbon are cut, that has a cost, which is equal to the damage the carbon that was bound to that tree, has when instead released into the atmosphere.

Typically, as no better estimate is available, this cost would be approximated using the price of carbon in international markets.

The replacement cost method

A method sometimes used, when time and budgets for primary valuation studies are short, is the replacement cost method. If a forest is cleared, the value of that forest can be approximated with what it would cost to plant and maintain a similar forest somewhere else. This method strongly assumes that all types of habitats can be replaced without loss of functions or values – in physical and biological terms and in the eyes of people. The more unique and complex a habitat is, the harder it is to justify the use of this valuation method, as it would be almost impossible (almost by definition) to copy and replace the habitat in question. However, if a forest is a monoculture (plantation) it may still be important and valuable in terms of some core ecosystem functions and as a recreational area for people, and valuing it using the replacement cost method may be a useful approximation.

ANNEX 2: Summary of forest valuation studies in Europe[4]

A brief summary of most European forest externalities studies is presented in this paragraph (Annex 1). Meaning of the acronyms and a brief summary of the used descriptors is provided below (descriptors names in capital letters).

AUTHOR - author and year of publication

COUNTRY - country where the study took place

FOREST NAME

VALUATION METHOD

CVM – contingent valuation method, a method determining money measures of change in welfare by describing a hypothetical situation to respondents and eliciting how much they would be willing to pay either to obtain or to avoid a situation.
CBM – contingent behaviour method, CB studies present individuals with scenarios in which they are asked about what they would do if they were faced with a hypothetical situation.
CE – choice experiment - a stated preference technique for valuing ecosystems or environmental resources that presents a series of alternative resource or ecosystem use options, each of which is defined by various attributes including price, and uses the choices of respondents as an indication of the value of attributes. In CE exercise respondents are asked to select the most preferred alternative. Choice experiments do not directly ask for willingness to pay; this is inferred from tradeoffs that include cost as an attribute

CR - Contingent Ranking, is a variant of CE; instead of selecting one most preferred alternative, respondents are asked to order them.

TCM – Travel Cost Method, derives values by evaluating expenditures of recreators. Travel costs are used as proxy for price in deriving demand curves for the recreation site. There are different variants of TCM, two most popular ones are:
ITC – Individual Travel Cost (dependant variable: trips to a site by individual people)

ZTC – Zonal Travel Cost (dependant variable**:** trips to a site by classes of people)

AE/MP – Actual Expenditure/ Market price

HP – Hedonic pricing - Derives values by decomposing market prices into components encompassing environmental and other characteristics through studying property values, wages and other phenomena. The premise of the approach is that the value of an asset depends on the stream of benefits derived, including environmental amenities.

ELICITATION METHOD

DC - Dichotomous choice – (or referendum style) presents respondents with a single bid value that they can either accept or reject. There are following variants of DC elicitation method: **DB-DC Double bounded dichotomous choice** – if respondent answered Yes/No to first question is asked to accept or reject a higher/lower bid; **OOHB - One and One half bound Dichotomous Choice** variant of DB-DC in which respondents only approximately in 50% cases are asked second valuation question; **MB-DC is** like DB-DC with the only difference that valuation question is repeated more than two times.

[4] Source: Review of instruments and valuation methods for multifunctional forest policy, Econ Report No. 2008-157. Econ Pöyry, Warsaw Ecological Economics Center, Norwegian University of Life Sciences, Forest Research Institute

IB - Iterative bidding game - respondents are asked whether they would be willing to pay a given amount. Depending upon whether the respondent says yes or no to the initial amount, it is successively doubled or halved until the respondent switches his response from inclusion or exclusion (or vice versa)
OE - Open ended – approach in which respondents are asked to state their maximum willingness to pay.
PC - payment card – respondents are presented with a range of values and are asked to choose their maximum willingness to pay out of it.

MEAN WTP,

In case of both revealed and stated preference studies, obtained estimates of WTP or CS depend on different factors: functional form, including or excluding some variables, assumptions with respect to the error term and many others. Since main aim of this chapter is to give a general overview, only ranges of estimates are reported, without specifying methodological details. In case of some studies mean WTP or CS was derived for more than just one forest. Also in these cases only ranges of estimates are reported.

YEAR, year in which WTP or CS measure were derived

CURRENCY

WHAT IS VALUED, brief description of the valuation object

WTP - Willingness To Pay: Maximum amount of money one would give up to buy some good.

CS - Consumer Surplus : the difference between what a person would be willing to pay and what he actually has to pay to buy a certain amount of a good

WHO PAYS

p/pers/v – per person per visit
p/housh – per household, one-off payment
p/pers - per person, one-off payment
p/pers/m – per person per month
p/pers/y - per person per year

RECREATION

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
Hanley and Ruffell (1991)	UK	Aberfoyle	CVM/ZTC	OE	0,93-2,19	GBP	91	Entrance fee	p/pers/v
Bishop (1992)	UK	Derwent Walk	CVM	OE	0,42 - 0,54	GBP	89	WTP per visit	p/pers/v
ibid.	UK	Derwent Walk	CVM	OE	0,97-1,34	GBP	89	WTP to ascertain option demand for conserving the site for future use	p/pers/v
ibid.	UK	Derwent Walk	CVM	OE	18,53 - 27,03	GBP	89	WTP for unlimited access to the site	p/pers/y
Willis and Benson (1989a)	UK	New Forest, Cheshire, Loch Awe, Brecon, Buchan, Newton Stewart, Lorne, Ruthin	CVM	OE	0,43 - 0,73	GBP	88	WTP per visit	p/pers/v
ibid.	UK	Ibid.	CVM	OE	0,63 - 1,18	GBP	88	WTP per visit + option value	p/pers/v
Willis et al. 1988	UK	Castle Douglas, South Lakes, North York Moors (Dalby), Durham, Thetford, Dean	CVM	OE	0,37 - 1,03	GBP	87	WTP per visit	p/pers/v
ibid.	UK	Mean for all forests	CVM	OE	36%.			Share of WTP dedicated to wildlife	p/pers/v
ibid.	UK	Mean for all forests	CVM	OE	34%.			Share of WTP dedicated to landscape	p/pers/v
ibid.	UK	Mean for all forests	CVM	OE	16%.			Share of WTP dedicated to information center and facilities	p/pers/v
ibid.	UK	Mean for all forests	CVM	OE	14%.			Share of WTP dedicated to recreation	p/pers/v
Bateman (1996)	UK	Thetford	CVM	PCL/PCH	1,21 - 1,55	GBP	90	WTP per visit	p/pers/v
Willis and Garrod (1991)	UK	Brecon, Buchan, Cheshire, Lorne, New	ITC		0,66 - 2,32	GBP	88	Consumer surplus	p/pers/v

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
		Forest, Ruthin							
Bateman (1996)	UK	Thetford	ITC		1,07 - 1,32	GBP	93	Consumer surplus	p/pers/v
Benson and Willis (1992)	UK	New Forest, Cheshire, Loch Awe, Brecon, Buchan, Durham, North York Moors (Dalby), Aberfoyle, South Lakes, Newton Stewart, Lorne, Castle Douglas, Ruthin, Dean, Thetford	ZTC		0,93 - 2,66	GBP	88	Consumer surplus	p/pers/v
Hanley (1989)	UK	Aberfoyle	ZTC		15,13 - 0,32	GBP	87	Consumer surplus	p/pers/v
ibid.	UK	Aberfoyle	CVM	OE/PC	0,81 - 0,89	GBP	87	WTP for the addition of a 'hide' from which visitors to the forest could watch wildlife;	p/pers/v
ibid.	UK	Aberfoyle	CVM	OE/PC	1,58 - 1,59	GBP	87	WTP for entrance to a forest drive	p/pers/v
ibid.	UK	Aberfoyle	CVM	OE/PC	0,74 - 0,85	GBP	87	WTP to avoid felling of trees around the David Marshall Lodge	p/pers/v
ibid.	UK	Aberfoyle	CVM	OE/PC	1,24 - 1,25	GBP	87	WTP to avoid the forest being sold to a private company which would deny public access	p/pers/v
Everett (1979)	UK	Dalby	ZTC		0,41	GBP	76	Consumer surplus	p/pers/v
Willis and Benson (1989b)	UK	Thetford	ZTC		1,26 - 2,51	GBP	87	Consumer surplus	p/pers/v
ibid.	UK	Thetford	ZTC		(31,2% - 43,6%)	GBP	87	Share of CS dedicated to Wildlife	p/pers/v
ibid.	UK	Thetford	ZTC		(28,6% - 37,4%)	GBP	87	Share of CS dedicated to Landscape	p/pers/v
ibid.	UK	Thetford	ZTC		(9,6% - 15,9%)	GBP	87	Share of CS dedicated to Recreation facilities	p/pers/v

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
ibid.	UK	Thetford	ZTC		(13,1% - 17,6%)	GBP	87	Share of CS dedicated to Information centre / Museum	p/pers/v
Christensen, J.B.	UK	Gwydyr Forest	ZTC		0,38 - 7,29	GBP	80	Consumer surplus	p/group/v
ibid.	UK	Gwydyr Forest	ZTC		0,37	GBP	80	Consumer surplus	p/group/v
H.M. Treasury (1972)	UK	Dean/New Forest	TCM		0,35	GBP	70	Consumer surplus	p/pers/v
Maxwell, S. (1992)	UK	Marston Vale Community Forest (planed forest)	CVM	OE	1,34	GBP	92	WTP per visit	p/pers/v
Tranter et al. (1994)	UK	Windsor forest (urban fringe woodland)	CVM	IB	1,18	GBP	93	WTP for creating new woodland paths	p/pers/v
Scarpa et al. (2000)	UK	Tollymore	CVM	DB-DC	0,31 - 2,62	GBP	92	Predicted WTP for a single visit	p/pers/v
Scarpa, R. et al. (2000)	UK	Belvoir	CVM	DB-DC	0,66 - 2,20	GBP	92	Predicted WTP for a single visit	p/pers/v
Scarpa R. (2003)	UK	Delamere, New Forest, Brenin, Thetford, Dartmoor, Epping, Sherwood)	CVM	DC/OE	1,66 - 2,78	GBP	02	WTP for entrance to a forest.	p/pers/v
Christie et al (2005)	UK	Glentress, Thetford, Rothiemurchus, Cwm Carn, New Forest, Dyfnant	ITC		14,97	GBP	05	CS for cyclists	p/pers/v
ibid.	UK	Ibid.	ITC		14,20	GBP	05	CS for horse riders	p/pers/v
ibid.	UK	Ibid.	ITC		7,90	GBP	05	CS for nature watchers	p/pers/v
ibid.	UK	Ibid.	ITC		14,51	GBP	05	CS for walkers	p/pers/v
ibid.	UK	Ibid.	ITC		14,99	GBP	05	CS for others	p/pers/v
Moons, E. (1999)	BE	Zonienwoud forest	ITC/CBM		407 - 469	BEF	98	Consumer surplus	p/pers/v
Giergiczny M. (2006)	PL	Bialowieza	ZTC		105	PLN	03	Consumer surplus	p/pers/v
Bartczak A. et al..	PL	10 forests in Poland	ITC		4,17 -	EUR	05	Consumer surplus	p/pers/v

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
(2008)		(Puszcza Bialowieska, Forest Barbaka, Kampinoski NP., Swierklaniec, Zielona Gora, Forest Piatkowski, Krzeszowice, Kudypy, Kozienice, Bory Tucholskie			6,93				
ibid.	PL	Ibid.	CVM	PC	0,64 - 4,69	EUR	05	WTP for visit in the forest	p/pers/v
Melichar J. (2007)	CZ	Jizerske hory	ITC		324 - 1276	CZK	05	Consumer surplus	p/pers/v
Šišák, L. et al. (1997)	CZ		CVM	OE	0,09 - 0,95	EUR	97	WTP for visit in the forest	p/pers/v
Melichar J. (2001)	CZ	Šumava	ITC		3317	CZK	01	Consumer surplus	p/pers/v
J. Bojö (1985)	SE	Vålådalen	CVM/TCM	DC	27	SEK	86	WTP for protecting the Vålådalen	p/pers
G. Bostedt and L. Mattson (1991)	SE	Resibo	CVM	OE	986	SEK	91	WTP for experiencing forest nature in Resibo	p/pers/v
G. Bostedt and L. Mattson (1995)	SE	Harasjörmåla	CVM	OE	386	SEK	92	Recreational value of the forest nature in the area	p/housh/v
ibid.	SE	Arjeplog	CVM	OE	418	SEK	92	Recreational value of the forest nature in the area	p/housh
Fredman, P. and L. Emmelin (2001)	SE	Femundsmarka-Rogen-Långfjället	CVM	OE	520	SEK	98	CS related to the visit in the forest	p/pers/v
B. Kriström (1989)	SE		CVM	OE/DC	1014 - 2074	SEK	87	WTP for preserving 11 primary recreational areas	p/housh
Chuanzhong Li and L. Mattson (1995)	SE	Västerbotten	CVM	DC	8578 - 75485	SEK	92	WTP for using, visiting, and experiencing the forest environment	p/pers/y

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
Chuanzhong Li (1996)	SE	Västerbotten	CVM	DC	9375	SEK	92	WTP for using/experiencing the non-timber commodities	p/pers/y
L. Mattsson and C,Z, Li (1994)	SE	Västerbotten	CVM	OE	2195	SEK	92	WTP for using/experiencing the non-timer commodities	p/pers/y
Olsson Christina (1993)	SE	Nörsjö	CVM	OE	2068	SEK	93	WTP for experiencing forest and nature in Nörsjö	p/pers/v
Huhtala, A. (2004)	FI	State recreational sites or national parks	CVM	PC	111	FIM	98-00	WTP for recreation service derived from state recreational sites and national parks	p/pers/y
Ovaskainen, V., et al. (2001)	FI	Luukkaa + Salmi + Pirttimäki	TCM		70-72	FIM	90	Consumer surplus	p/pers/v
M. Rekola, Eija Pouta (2005)	FI	Loppi	CVM	DC	9,25 - 13,29	EUR	96	WTP for a proposed cutting regulating plan of private forest area	p/housh
L. Tyrväinen (2001)	FI	Joensuu/Salo	CVM	PC	387 - 872	FIM	95	WTP for recreational use	p/pers/y
Hoen, H.F. And Veisten, K. (1994)	NO	Oslomarka	CVM	OE	235 - 286	NOK	92	WTP for a more cautious forest management	p/housh/y
Sandsbråten, Lars (1997)	NO	Oslomarka	CVM	DC	272 - 311	NOK	97	WTP for a more cautious forest management in private forests	p/housh/y
Bjørner, T, et al.. (2000)	DK	Tokkekøb Hegn	CVM	OE	215	DKK	99	WTP for access to nature area Tokkekøb Hegn	p/housh/y
Dubgaard, A.(1998)	DK		CVM	OE	128	DKK	94	WTP for an unlimited access to all Danish forests	p/pers/y
Anders Busse Nielsen, et al.	DK		CE		1939	DKK	04	WTP for change to nature-based forest	p/housh/y

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
(2007)								management practices	
J. Mogas and P. Riera (2003)	SP	Catalonia	CE		8,63	EUR	99	Compensation for visitors because of the allowance of driving a car through the new forests	p/pers/y
ibid.	SP	Catalonia	CE		5,77	EUR	99	WTP for picking mushrooms	p/pers/y
ibid.	SP	Catalonia	CE		4,35	EUR	99	Picnicking	p/pers/y
P. Riera, C. Descalzi and A. Ruiz (1995)	SP	Catalan Pyrenees (Pallars Sobirà)	TCM		1394	PTE	94	Consumer surplus	p/pers/v
A. Caparrós Gass and P. Campos Palacín (2002)	SP	Segovia (Valsin y Lozoya)	TCM		2350	PTE		Consumer surplus	p/pers/v
ibid.	SP	Segovia (Valsin y Lozoya)	CVM	DC	712	PTE		WTP for forest visit	p/pers/v
D. Rebolledo and L. Pérez y Pérez (1994)	SP	Dehesa del Moncayo	CVM	Mix (DC+OE)	610 - 869	PTS	94	WTP for forest visit	p/pers/v
C. León (1994)	SP	central Gran Canaria	CVM	OE/DB-DC	843 - 1368	PTS	93	WTP for forest visit	p/pers/v
P. Campos et al. (1996)	SP	Monfragüe	CVM	Mix (DC+OE)	1328	PTS	93	WTP for forest visit	p/pers/v
S. Del Saz (1996)	SP	L'Albufera (Valencia)	CVM	Mix (DC+OE)	590 - 759	PTS	95	WTP for forest visit	p/pers/v
L. Pérez, et al. (1996)	SP	Señorio de Bertiz (Navarra)	CVM	Mix (DC+OE)	1029	PTS	95	WTP for forest visit	p/pers/v
J. Barreiro et al. (1997)	SP	Ordesa y Monte Perdido	CVM	DB-DC	897 - 1175	PTS	95	WTP for forest visit	p/pers/v
L. Pérez y Pérez (1997)	SP	Posets-Maladeta	CVM	Mix (DC+OE)	824	PTS	96	WTP for forest visit	p/pers/v
R. Mavsar and P. Riera (2007)	SP	Mediterranean area	CE		7,02	EUR	07	forest access	p/pers/y
Bazzani G.M. (1998)	IT	Tonezza del Cimone	CVM	OE	14304,5	LIT	93	WTP for daily hunting permit	p/pers/v

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
Bellù L.G., Cistulli V.	IT	Liguria aggregated	ITC		9071	LIT	94	Consumer surplus	p/pers/v
ibid.	IT	Liguria aggregated	CVM	DC	11795	LIT	94	WTP for access	p/pers/v
Bernetti I., Romano S. (1996)	IT	Parco Nazionale del Pollino	CVM	IB	24093	LIT	95	WTP for access to a hypothetic faunal park	p/pers/v
ibid.	IT	Parco Nazionale del Pollino	CVM	IB	17961	LIT	95	WTP for access to a hypothetic botanic garden	p/pers/v
ibid.	IT	Parco Nazionale del Pollino	CVM	IB	18567	LIT	95	WTP for access to a hypothetic natural museum	p/pers/v
ibid.	IT	Parco Nazionale del Pollino	CVM	IB	18814	LIT	95	WTP for access to a park with self-guiding paths	p/pers/v
ibid.	IT	Parco Nazionale del Pollino	CVM	IB	141824	LIT	95	WTP for creating fauna park	p/pers/s
ibid.	IT	Parco Nazionale del Pollino	CVM	IB	93470	LIT	95	WTP for creating botanical garden	p/pers/s
ibid.	IT	Parco Nazionale del Pollino	CVM	IB	82473	LIT	95	WTP for creating natural museum	p/pers/s
ibid.	IT	Parco Nazionale del Pollino	CVM	IB	92890	LIT	95	WTP for creating self-guiding paths	p/pers/s
Cooper J.C., et al. (2002)	IT	Riserva Naturale Cavagrande del Cassibile	CVM	OOHB	8317	LIT	96	WTP daily entrance ticket	p/pers/v
Cooper J.C., et al. (1997)	IT	Foresta Regionale Garda Orientale	CVM	OOHB	4,96	EUR	97	WTP for entrance fee to improve the quality of management and preservation of the area	p/pers/v
ibid.	IT	Foresta Regionale Garda Orientale	CVM	OOHB	2,73	EUR	97	WTP for a daily entrance fee	p/pers/v
ibid.	IT	Foresta Regionale Garda Orientale	CVM	OOHB	21,1	EUR	97	WTP for annual fee to preserve the area for the future generations	p/housh/y
ibid.	IT	Foresta Regionale	TCM		4,35	EUR	97	Consumer surplus	p/pers/v

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
		Garda Orientale							
Corsi A., Novelli S. (2005)	IT	Area Alpina Pra' Catinat (TO)	CVM	DC	40,44	EUR	02	WTP for daily access	p/pers/v
De Fano, G. and Grittani, G(1992)	IT	Parco naturale di Portoselvaggio	ZTC		7849,5	LIT	88	Consumer surplus	p/pers/v
Gatto, P. (1988)	IT	Parco Dolomiti bellunesi	ZTC		1621 - 2327	LIT	88	Consumer surplus	p/pers/v
ibid.	IT	Parco Dolomiti bellunesi	CVM	DC	2560 - 2636	LIT	88	WTP for daily entrance	p/pers/v
Marangon, Gottardo .(2001)	IT	Foresta Regionale di Fusine in Valromana	ITC	PC	10441 - 17803	LIT	99	Consumer surplus (hikers)	p/pers/v
ibid.	IT	Foresta Regionale di Fusine in Valromana	ITC	PC	10441	LIT	99	Consumer surplus (tourist)	p/pers/v
ibid.	IT	Foresta Regionale di Fusine in Valromana	CVM	PC	5773 - 5900	LIT	99	WTP for daily entrance (tourist)	p/pers/v
Marangon F et al. (2002)	IT	RCD Prealpi Pordenonesi	CVM	DC	169 - 303,42	EUR	02	WTP for annual hunting permit	p/housh/y
Marinelli, A., L. Casini, D. Romano (1990)	IT	Parco naturale dell'Orecchiella	ZTC		2788	LIT	87	Consumer surplus	p/pers/v
ibid.	IT	Parco naturale dell'Orecchiella	ZTC		25587	LIT	87	Consumer surplus	p/pers/v
ibid.	IT	Parco naturale dell'Orecchiella	CVM	OE	17871	LIT	87	WTP for daily entrance	p/pers/v
Marinelli A., D. Romano (1984)	IT	Foresta Umbra	ZTC		650	LIT	84	Consumer surplus	p/pers/v
Merlo, M. (1982)	IT	Pineta demaniale Trieste	ZTC		796	LIT	81	Consumer surplus	p/pers/v
Merlo, M. (1982)	IT	Foresta di Tarvisio	ITC		15000	LIT	81	Consumer surplus	p/pers/v
Merlo M., Signorello G. (1989)	IT	Altopiano del Cansiglio	ITC		8546 - 13394	LIT	89	Consumer surplus	p/pers/v
ibid.	IT	Altopiano del Cansiglio	ZTC		6195	LIT	89	Consumer surplus	p/pers/v
ibid.	IT	Altopiano del Cansiglio	CVM	OE	10653,7	LIT	89	WTP for daily entrance	p/pers/v

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
Notaro S., Raffaelli R., Gios G. (2001)	IT	Paesaggi del Lago di Garda	CVM	PC	1,11	EUR	03	WTP for improvement of the health status of the trees	p/pers/v
Notaro S., Signorello G. (1999)	IT	Alpine area of Trentino	CVM	DB-DC/MB	4421 - 8285	LIT	98	WTP for daily entrance	p/pers/v
Nuvoli, F., S.M. Pittalis, P. Pulina (1997)	IT	Pineta di Platamona	CVM	DC	85288	LIT	96	WTP for conservation of the site	n.a.
Perali F.	IT	Foresta Demaniale Gardesana Occidentale	CVM	OOHB	6,74 - 14,96	EUR	97	WTP for daily entrance	p/pers/v
ibid.	IT	Foresta Demaniale Gardesana Occidentale	ITC		34,01 - 38,04	EUR	97	Consumer surplus	p/pers/v
Romano D., Rossi M. (1994)	IT	Grande Escursione Appenninica (casentinese)	ZTC		9156 - 33370	LIT	91	Consumer surplus	p/pers/v
ibid.	IT	Grande Escursione Appenninica (casentinese)	CVM	DC	67112 - 69286	LIT	91	WTP for daily entrance	p/pers/v
Signorello G. (2005a)	IT	Bosco "Ballarò" (Mineo, Catania)	CVM	MB/PC	43 - 74	EUR	05	WTP for rehabilitation project	p/pers/s
Signorello G. (2005b)	IT	Riserva Naturale Monte Soro	CVM	OE	11,3	EUR	05	WTP for daily entrance	p/pers/v
Signorello G. (2005c)	IT	Pineta demaniale di Randello	CVM	OE	2,22 - 3,56	EUR	05	WTP for daily entrance	p/pers/v
Signorello G. (2005d)	IT	Bosco di Rossomanno nel Parco di Ronza (Enna)	CVM	DC	1,61	EUR	05	WTP for daily entrance	p/pers/v
ibid.	IT	Bosco di Rossomanno nel Parco di Ronza (Enna)	ZTC		3,3	EUR	05	Consumer surplus	p/pers/v
Tempesta T. (1996)	IT	Bosco della Fontana (Mantova)	CVM	IB/DC	6630 - 8231	LIT	95	WTP for daily entrance	p/pers/v
ibid.	IT	Bosco della Fontana (Mantova)	ZTC		3741	LIT	95	Consumer surplus	p/pers/v
Tempesta T., Thiene M. (1998)	IT	Parco naturale dell'Adamello	ITC		37159 - 541246	LIT	98	Consumer surplus	p/pers/v

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
Tirendi D. (2003)	IT	Bosco di Capodimonte (NA)	CVM	IB	3612 - 4077,26	LIT	99	WTP for daily entrance	p/pers/v
Scherrer S. (2003)	FR	Lake Der	TCM		19-43	EUR	03	Consumer surplus	p/pers/v
ibid.	FR	Lake Der	CVM	OE	1,13 - 13	EUR	03	WTP for entrance fee	p/pers/v
Glück, Kuen (1977)	AT	Grosser Ahornboden	TCM		59,51	ATS	75	Consumer surplus	p/pers/v
Bergen, Löwenstein (1992)	DE	southern Harz	TCM		43,68 - 55,92	DM	88	Consumer surplus	p/pers/v
Klein (1994)	DE	Haardtwald/Ruhr (urban)	CVM	OE	129,29	DM	93	WTP right to enter forests for recreation purposes	p/housh/y
Löwenstein (1994)	DE	southern Harz	CVM	OE	4,56	DM	92	WTP for right to stay in the forest	p/pers/d
ibid.	DE	southern Harz	TCM		2,28 - 8,77	DM	92	Consumer surplus	p/pers/v
Schwatlo (1994)	DE	Mühlheim-Ruhr (urban)	CVM	OE	1,54 - 2,28	DM	94	WTP to enter the site	p/pers/d
Schüssele (1995)	DE	Kaufunger Wald	CVM	OE	3,37	DM	95	WTP for right to stay in region	p/pers/d
Uflacker (1995)	DE	Kaufunger Wald	CVM	OE	5,1	DM	95	WTP for right to stay in region	p/pers/d
Best, Hornbostel, Klein (1996)	DE	Thüringen	CVM	OE	39,38	DM	96	WTP for right to enter forests for recreation	p/pers/v
Elsasser (1996)	DE	Hamburg (urban)	CVM	OE	28,51 - 114,07	DM	92	WTP for right to enter forests for recreation	p/housh/y
ibid.	DE	Hamburg (urban)/Pfälzerwald	TCM		0,95 - 18,63	DM	92	Consumer surplus	p/pers/v
Kosz (1996)	AT	Wien (urban)	CVM	IB	6,97 - 9,53	ATS	93	WTP for forest visit	p/pers/v
Schönbäck, Kosz, Madreiter (1997)	AT	Donau-Auen	CVM	OE	78,1	ATS	93	WTP for right to enter national park	p/pers/v
Franzen, Hungerbühler, Wild-Eck,	CH	Switzerland	CVM	OE	5,97	SFR	97	WTP for forest visit	p/pers/v

Author (year)	Country	Forest name/Forest location	Valuation method	Elicitation method	Mean value	Currency	Year	What is valued	Who pays
Zimmermann (1999)									
Elsasser (2001)	DE	Germany	CVM	OE	100,23 - 128,68	DM	95	WTP for right to enter forests for recreation	p/housh/y
Bernasconi, Schroff (2003)	CH	Bern	CVM	OE	84	SFR	01	WTP for forest recreation	p/housh/y
Ott, Baur (2005)	CH	Switzerland	ITC		12,13 - 29,47	SFR	97	Consumer surplus	p/pers/v
Bernath (2006)	CH	Zürich (urban)	CVM	OE	118 - 123	SFR	04	WTP for right to enter forests for recreation	p/pers/v
ibid.	CH	Zürich (urban)	TCM		5,3 - 18,3	SFR	04	Consumer surplus	p/pers/v
L. Mattsson and C,Z, Li (1993)	SE	Västerbottn	CVM	OE	2234	SEK	91	WTP for using, visiting, and experiencing the forest environment	p/pers/y
ibid.	SE	Västerbottn	CVM	DC	5856	SEK	91	WTP for using, visiting, and experiencing the forest environment	p/pers/y

Warsaw Ecological Economics Center. Warsaw, Poland
Forest Research Institute, Warsaw, Poland
Norwegian University of Life Sciences, Ås, Norway
Econ Pöyry, Oslo, Norway

---

www.polforex.wne.uw.edu.pl

List of authors:

Marianne Zandersen - Econ Pöyry and Neri
Anna Bartczak, Warsaw Ecological Economic Center
Mikołaj Czajkowski, Warsaw Ecological Economic Center
Marek Giergiczny, Warsaw Ecological Economic Center
Mette Termansen - Econ Pöyry and Neri

Supported by a grant from Iceland, Liechtenstein and Norway through the EEA Financial Mechanism and the Norwegian Financial Mechanism and funding by Polish Ministry of Science and Higher Education from science funds