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FINAL REPORT

Project: "RECOGNIZING NATURA 2000 BENEFITS AND DEMONSTRATING THE ECONOMIC BENEFITS OF CONSERVATION MEASURES"

Development of a Tool for Valuing Conservation Measures

Client: European Commission

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Project description

The project aims to investigate the economic benefits of conservation measures carried out in Natura 2000 areas. Therefore a specific tool has been developed which was tested in practice by site managers. This document contains the tool and a number of case studies and gives recommendations to site managers as well as government agents.

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Summary

0.1 Purpose

The **purpose** of this **'Tool on Conservation Measures'** is **to guide appraisal** of the **economic impacts of conservation measures** taken to manage **Natura 2000 sites** in the EU. It clearly **demonstrates** the **numerous links** between concrete **conservation measures** and the affected **ecosystem services**. In this way it builds further on the 'Toolkit for Practitioners' (Kettunen et al., 2009). The main focus of the Toolkit for Practitioners is to help assessing and communicating socio-economic benefits generated within established Natura 2000 sites. It clarifies the links between ecosystems within Natura 2000 sites and ecosystem services, but not how conservation measures contribute to a higher economic value of the site.

There are several reasons why it is very useful to have a clear insight in the wider benefits of conservation measures:

- Conservation measures need **finance**. As budgets are always limited it is important to use the right arguments to convince politicians. In this way it is highly relevant not only to mention the biodiversity conservation objective but also to emphasize the **economic returns that nature conservation measures deliver to society**!
- Conservation measures contribute to the preservation of **cultural values** eg. traditional living patterns in rural areas.
- Conservation measures often imply **land use change**. Creating acceptance from local stakeholders requires a clear picture of the **benefits of different types of land use**. For example, what are the implications for biodiversity and related ecosystem services when forests are converted to heathland or when grasslands are converted to a wetland? These questions require a detailed analysis of costs and benefits of the alternative land uses.
- Understanding the distribution of costs and benefits is necessary to design incentives and charging schemes (e.g. payment for ecosystem services (PES) schemes).

The working Tool on Conservation Measures has been developed by eftec and ARCADIS under a project for DG Environment managed by ARCADIS Belgium, and with the support of ECNC (European Centre for Nature Conservation). It is based on the application of cost-benefit analysis (CBA), using material based on concepts for ecosystem services analysis (e.g. TEEB, 2011) and value transfer techniques (eftec, 2010), to specific changes occurring as a result of conservation measures at Natura 2000 sites.

The approach used for the analysis is based on how conservation measures in Natura sites can influence ecosystem goods and services. The Tool on Conservation Measures describes a process for carrying out economic valuation of changes in ecosystem goods and services arising from those conservation measures. **Conservation measures** are defined as **all measures to enhance the ecosystem quality** in order to reach **favourable conservation status (FCS)**.

The **intended users** of the Tool on Conservation Measures can be from a variety of disciplines, ideally working together, **involved in management decisions affecting Natura 2000 sites**. The purpose of using the Tool on Conservation Measures is to help its users establish the net economic impacts of a particular marginal change to a Natura 2000 site (either an enhancement to condition or a 'defensive' action). 'Net' economic impacts are benefits minus costs. Where costs are not known, gross benefits can be assessed, and this can still be a useful input to decision-making.

0.2 Methodology

The baseline for the analysis is the expected condition of the site, and its level of provision of ecosystem services and other economic benefits, reflecting 'business as usual' (e.g. after designation as a Natura 2000 site). The Tool on Conservation Measures combines several approaches to economic evaluation of environmental impacts. It is based on a CBA framework, uses an ecosystem services approach to identify how changes to the natural environment will affect humans, and draws on valuation evidence generated from a variety of market and non-market methods. Market data include the prices of goods and services produced as a result of conservation measures, such as agricultural products from grassland management or commercial fish catches supported by marine habitats. Non-market data is drawn from studies using both revealed preference and stated preference techniques (Eftec & Environmental Futures, 2006). Where evidence does not originate directly from the Natura site in question, but is relevant to the site's ecosystem services changes analysed, it is applied to using value transfer techniques. This provides a systematic approach to utilising the available valuation evidence, with appropriate adjustments, adapting economic value evidence taken from studies of certain sites to new sites where the evidence is needed (eftec, 2010).

The guidance is organised around **nine steps** following the structure of cost-benefit analysis. This approach is shown in Figure 1 below. The steps form a clear and logical framework within which knowledge and data about the Natura 2000 site can be set out and used to construct an economic appraisal of likely ecosystem service changes as a result of conservation measures. The steps are:

1. Defining the baseline and its level of providing ecosystem services and other economic benefits (expected situation in absence of new management measures)
2. Identifying new conservation measures in order to reach FCS (additional management options)
3. Identifying impacts of management changes on ecosystem goods and services
4. Identifying human populations affected by impacts
5. Economic valuation of ecosystem service changes
6. Calculation of discounted costs and benefits
7. Accounting for non-monetised impacts
8. Sensitivity analysis
9. Reporting

The economic values of ecosystem service changes can be an important input to decision making, but must not be seen as replacing the need for deliberation. In particular, there will always be important uncertainties, whether physical, ecological or economic. And there will be some ecosystem service changes to which we cannot ascribe monetary values. Finally, to the extent that other factors – moral obligations, intrinsic values - are considered relevant to decision making, they must be taken into account in other ways, alongside the results of economic analysis. This certainly applies to Natura 2000 sites where the primary goal is to achieve FCS.

It should be noted that although the process is based on economic analysis, and monetary values are sought wherever possible, it is unlikely to be possible to value all important impacts. Therefore, consideration is also given to non-monetary values (e.g. accounted for in Step 7) and these should be taken into account in reporting (Step 9) and other Steps.

The tool has been tested with 11 sites reflecting a range of the different geographies, habitat types and socio-economic circumstances across the EU and candidate countries. The following sites participated in the study: Kalkense Meersen (Belgium), Lomovete (Bulgaria), Muntanya de Montserrat (Spain), Telascica (Croatia), Krkonose Mountains (Czech Republic), Ehrenburg und Katzenköpfe (Germany), Elatia Forest (Greece), Naardermeer (The Netherlands), Haaksbergerveen (The Netherlands), Vindelfjallen (Sweden), Humber Estuary (UK).

Although the scope of the Tool on Conservation Measures are the Natura 2000 sites the overall approach can perfectly be applied in all types of nature areas, even non protected areas. The only difference is the fact that in Natura 2000 sites, there is a clear geographical boundary for the actions covered by the analysis, and the conservation objectives for the protected species and habitats need to be achieved.

0.3 Main results

Applying the tool to the case studies has provided a number of insights into the challenges of producing economic values for conservation measures in Natura 2000 sites:

- The **tool** is able to provide the **best possible insight** in the economic value **wider benefits of conservation measures**, although it is not always an accurate picture (see below).
- The tool can **operate successfully** through the **combined inputs** of **site managers and environmental economists** to value the ecosystem service changes resulting from conservation measures. Site managers inputs are generally based on information that is part of site management plans. The tool links this information to changes in ecosystem services. The success of the valuation of the ecosystem services is dependent on understanding of changes in ecosystem services, and suitable economic valuation evidence (or relevant value transfer) those changes. The value of ecosystem service changes can be compared to the costs of the conservation measures in question, resulting in a net present value.
- The **ecosystem services approach** provides the **most suitable method** for identifying **economic values associated with conservation measures in Natura 2000 sites**.
- For the majority of the sites participating in the study, the tool has produced results with a **moderate level of confidence**. Few of the case studies result in robust and complete net present value estimates. The moderate confidence level of the obtained results is because of a:
  - lack of scientific information linking changes in habitats to changes in ecosystem services; sometimes, the data required is simply not available despite the will of stakeholders to engage in the process and to provide it; understanding of ecosystem services is improving, but for applying the tool, specific evidence is needed on how services to people will change as a result of conservation measures taken in certain habitats/ areas; many **gaps** in the **scientific data** still remain;
  - lack of economic evidence on the value of ecosystem service changes;
  - lack of accurate information on costs of conservation measures; in many cases there is a significant uncertainty regarding the real costs of conservation measures; however, cost information is more likely to relate to market impacts; therefore the availability of data in relation to costs, while subject to uncertainties, is usually better than that for benefits; benefits data has to rely on a wider range of sources and therefore has a weaker evidence base (e.g. in relation to non-market data); this can skew comparisons and hinder accurate calculation of net present value.

- The ability to cover a sufficient selection of ecosystem services to make the tool more accurate will depend on progress in approaches and methods of environmental economics (e.g. MEA, TEEB, value transfer) and further development of a scientific evidence base linking changes in environmental management to changes in ecosystem services. Therefore, the confidence in the results obtained using the tool is expected to improve over coming years.
- Not all **stakeholders** in the management of sites do yet appreciate the features of the ecosystem services approach and its relevance to them even when some evidence suggests otherwise (e.g. local water agencies may prefer engineered solutions and not see the role of catchment management in their business model; tourism agencies may not regard nature-based tourism as a priority). Without the cooperation of stakeholders it can be difficult to gather the data necessary to undertake valuation. **Awareness raising** (e.g. face to face meetings, demonstration projects) and **capacity building** (e.g. training) may be the only way to change this.
- Despite simplifying processes like ecosystem service identification in the project's tool, the concepts underpinning the tool remain complex because they reflect complex real-world situations. For example, flexibility is needed in the approach to valuing management measures and the combinations of ecosystem services they affect. Some impacts on services can be discreet (e.g. changes to grazing affects food production), but others cannot be disaggregated (e.g. management of forest and grassland areas can affect food production, visitors use values and the non-use value landscapes). Therefore, the tool cannot reduce the valuation of these services to a simple formula, but requires judgements to shape its use as it is applied.
- The **conservation measures** for Natura sites considered in the case studies are judged to be **typical of those across the network**. The tool links these measures to economic valuation literature dealing with similar environmental changes. However, in comparison to economic valuation studies, Natura conservation measures often involve more subtle impacts. For example valuation studies often consider large environmental changes (e.g. the landscape-scale effects of an agri-environment scheme, or avoiding damage to the key features of a site). Designated Natura sites are protected (in principle) from further damage, and the scale of changes to ecosystem services from conservation measures (which are motivated by nature conservation requirements) are often smaller than those covered by economic valuation evidence. Value transfer is able to overcome this only in some cases.
- As well as enhancing genetic and species diversity, in general, the conservation measures studied:
    - enhance cultural ecosystem services, including non-use value for landscapes and biodiversity, and visitor values,
    - sometimes increase carbon storage, although evidence that could be applied was limited to intertidal and forest habitats,
    - are expected to have positive impacts on regulating services; this area often lacks specific evidence (e.g. on air quality or erosion control), but some water quality and quantity regulation benefits could be valued,
    - can sometimes reduce provisioning services (e.g. reducing agricultural intensity) and sometimes increase them (e.g. maintaining or introducing grazing to maintain specific habitats).
- Indeed, not all the changes in ecosystem services identified had positive benefits. In several cases reductions in intensity of provisioning services (e.g. agricultural outputs, timber) were a cost. However, when wider ecosystem services evidence (e.g. regulating services like carbon storage, and cultural services like landscape value) were taken into account, net positive values could be assessed for undertaking conservation measures.

- It is important to keep in mind that not all benefits were assessed for each of the investigated Natura 2000 sites, as the tool has only been applied on a selected number of conservation measures and a selected number of ecosystem services related to these conservation measures!

0.4 Recommendations

The following recommendations can be made:

- A good definition and description of the applied conservation measures is a key prerequisite for applying the tool. Site managers refer to the measures described in the site's management plan and this is fine as far as they define them well. We observed however huge differences in the way conservation measures are categorized. This is partly due to the lack of a uniform classification system of conservation measures at EC level. An upscaling of ecosystem services benefits due to the implementation of conservation measures from site level to regional, national and even European level would highly benefit from such a uniform classification. Therefore it might be useful to develop a common typology which could be applied in Natura 2000 management plans throughout the EU.
- The same applies to cost accounting. It was our observation that site managers often had limited insight in the exact cost figures of conservation measures. It is the expectation however that site managers in a context of decreasing government budgets will be increasingly forced to apply cost management techniques and therefore will pay more and more attention to cost accounting of conservation measures. The development of a uniform cost accounting model for conservation measures in protected areas might be a very useful measure. Another advantage of this uniform approach is that site managers will be able to carry out cost effectiveness analysis of conservation measures based on data of numerous sites. This is also very useful in the context of delivering the objective under Target 2 of the EU Biodiversity Strategy[1]
- There is still potential for improving the user friendliness of the tool by means of using appropriate software. This could link together information, reducing repetitiveness of analysis, and automate some aspects of the calculations.
- A widespread application of this Tool on Conservation Measures would not only be advantageous for many site managers throughout the EU, but would contribute significantly to increasing the database of economic appraisals related to Natura 2000 management measures. The range of habitats and conservation measures in Natura sites is reasonably well understood, and therefore the ecosystem services that need to be valued can be predicted. The development of a central 'value transfer' database at EC level, and sponsoring additions to it, would be very supportive for an efficient application of the tool.
- To make best use of the tool, it should be promoted to site managers with careful guidance about when it can be best used and what it can achieve. Training of site managers, government officials responsible for Natura 2000 management should be organized.
- Application of the tool requires input from environmental economists. Their input to application of the tool can be encouraged through appropriate training and awareness raising. However, getting the necessary input from environmental economists can be difficult, as they are a scarce resource and may not be aware of relevant valuation evidence. Therefore, and efficient approach could be to provide an ongoing helpdesk function for valuation. This helpdesk could advise sites on whether to apply the tool (scoping), locate appropriate valuation evidence, and support sites to bid for resources when they complete management plans.

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[1] "By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems."

1 Introduction

1.1 Aims and Objectives

The purpose of this Tool on Conservation Measures is to assess the impacts (benefits and costs) associated with marginal changes to Natura 2000 sites, induced by the implementation of conservation measures. The assessment will aim to identify the total additional benefits (gross benefits) and the additional benefits net of costs (net benefits). This assessment will use an ecosystem services framework to assess the impacts of the marginal changes to Natura 2000 sites.

The **objectives** of this study are **threefold:**

1. Relevant authorities in the Member State should be made aware about the **benefits of conservation measures for Natura 2000 provide in order to recognize them at an early stage** in the formulation of the wide range of projects that they will consider. The **working Tool on Conservation Measures for decision-makers** described below is designed for this purpose.
2. As conditions of many habitats and species within the Natura2000 network are unfavourable, they will require **active restoration measures implying significant costs**. The results of analyzing cases should **quantify the potential economic benefits arising from such investments** and offer the ability to assess different ‘options’ of the actions *(to be translated in economic benefits of the actions)*.
3. This analysis will help develop a set of **general recommendations on measures and approaches that optimize the economic benefits for Natura2000 while also fulfilling their primary goal for the favourable conservation status** of species and habitats of the EU

Through this work to develop a Tool on Conservation Measures and applying it to a set of conservation measures, two more general objectives of the contract are fulfilled:

- Awareness raising for different audiences (authorities, decision-makers, conservation managers, project developers) - a guidance document in plain/understandable language (in English) is produced.
- Demonstrating the economic benefits of conservation measures by means of case studies – allowing an assessment of benefits at the earliest possible stage and supporting the aim of achieving positive solutions recognizing and supporting the Natura 2000 network (as well as preventing deterioriation and disturbance).

1.2 Link with previous and parallel EC studies on ecosystem services

The European Commission wants to investigate the economic value of the Natura 2000 network in Europe. The idea is that Natura 2000 sites generate a number of benefits for society, in addition to the preservation of biodiversity (which is the first objective). Information about the economic value of these benefits is essential in order to convince politicians and decision-makers of the importance of the Natura 2000 network.

A first important study has been carried out in 2009, the so-called **'Toolkit for Practitioners' (Kettunen et al., 2009[2])**. The main focus of the toolkit for practitioners is to help assessing and communicating socio-economic benefits related to the designation of existing and established Natura 2000 sites (against a baseline of 'no site designation'). However, the questions that conservationists (e.g. Natura 2000 site managers) often face are related to the **benefits of conservation actions within existing sites** (against a baseline of the existing condition of the site). These questions can have two forms:

- **Identifying the benefits of taking conservation measures** on existing sites, to improve or protect their biodiversity value; and
- **Comparing the benefits of conservation to the benefits arising from other types of land use**. For example, what are the implications for biodiversity and related ecosystem services when forests are converted to heathland or when grasslands are converted to a wetland? This question requires a knowledge of the costs and benefits of the alternative land uses. Our tool helps comparison of the costs and benefits of conservation measures with those from alternative land uses, and where possible these opportunity costs of alternative activities are included in the scope of our study.

The 'Toolkit for Practitioners' (Kettunen et al., 2009) contains already plenty of very useful information regarding ecosystem services in protected areas (general concept of ecosystem services, detailed description of each type of ecosystem service, methodology for rapid identification of ecosystem services etc.). We strongly recommend to use the Toolkit for Practitioners as a background document during the application of this working Tool on Conservation Measures. Moreover on several occasions the working Tool on Conservation Measures will refer to the Toolkit for Practitioners. As a result our working Tool on Conservation Measures builds further on the 'Toolkit for Practitioners'.

In parallel to the contract on the benefits of conservation measures in Natura 2000 areas the Commission has ordered 2 other studies with regard to this issue:

- **"Estimating the overall economic value of the benefits provided by the Natura 2000 network".** The aim here is to set out an approach that can be applied across the Natura 2000 network for economic evaluation of the quantifiable benefits of the network. It uses the previous study on costs and benefits of the Natura 2000 network as a baseline, and further applies different approaches to develop overall, well justified, estimates of the economic benefits (both the gross and net benefits) connected with the whole Natura 2000 network.
- **"Estimating the economic value of the benefits provided by the tourism/recreation and employment supported by Natura 2000".** In this study specific approaches for socio-economic evaluation of the quantifiable benefits in 2 selected fields are defined and tested: 1/ tourism/recreation connected with the whole Natura 2000 network; and 2/ employment created/supported/conditional to the Natura 2000 network. Further on, it aims to calculate the overall

[2] Kettunen, M., Bassi, S., Gantioler, S. & ten Brink, P. 2009. Assessing Socio-economic Benefits of Natura 2000 – a Toolkit for Practitioners (September 2009 Edition). Output of the European Commission project Financing Natura 2000: Cost estimate and benefits of Natura 2000.

benefits for 4 scenario's (gross and net benefits for all Natura 2000 areas and for the incremental impacts of Natura 2000 designation).

Evidently there are a number of links between this study on benefits of conservation measures and both other studies:

- The evidence used in this study has been coordinated, as far as is relevant, with the material drawn on for the first study. For example, the marginal values for the cost of carbon used in the analysis in this study are drawn from the analysis in the first study.
- An interesting feature of the case studies was the significant number for which visitor management was an important conservation measure (to reduce visitor impacts of disturbance and litter). None of the sites wanted to reduce visitor numbers, they just wanted to implement available low-cost measures to manage their locations, which could be combined with measures like information provision that could enhance the visitor experience.
- The analysis of conservation measures using the Tool can include how values to visitors to the sites change as a result of conservation measures (e.g. increased value per visit due to the site being in better ecological condition). This element of the work links to the third study on the value of visitor activity associated with Natura 2000 sites. Visitor values arise for both local visitors and those from outside the local area (e.g. tourists). The values that tourists gain from visiting sites will be partly reflected in the money they spend on accommodation, food and other goods and services in the local economy around the site.
- Conservation measures that increase values to site visitors may result in increased tourism activity associated with the site, and therefore increased value to the local economy. However, assessing the impacts of a site, and of conservation measures to manage it, on a local economy is complex. Any increase in local economic activity does not directly equate to an increase in total economic value – this must take into account whether the increased activity/value is really new, or is simply displaced from other locations. Also, an increase in visitor numbers is not always due to the results of conservation measures but might be enhanced by many other factors too eg. marketing efforts, attractiveness of side activities which are offered by the site. Such issues are beyond the scope of the tool, but the third project estimates the impact of increased visitor spending in Natura 2000 sites in the overall European Union. Nevertheless, there are links between the tool and economic activity involving visitors. Information identified in using the tool in relation to recreational visitors (e.g. numbers of visitors, how they will change in response to conservation measures in terms of amount of spending, of willingness to pay, of frequency of visits, and substitute sites) can be used to help with analysis of the impact on local economies of visitors to Natura 2000 sites.

2 Conservation measures and ecosystem services

2.1 Ecosystem services

The Toolkit for Practitioners (Kettunen et al., 2009) describes how protected areas, such as Natura 2000 sites, contain biodiversity and ecosystems of high conservation value. These areas provide a range of benefits (direct and indirect) to our societies and economies. These benefits are often referred to as **ecosystem services** (see Box 1). These services include an array of natural resources (e.g. timber, crops, fish, game and medicinal products) and several valuable ecosystem processes, such as an ecosystems' ability to regulate floods and climate, purify water and secure the pollination of crops. In addition, nature forms an important basis for maintaining human health, both physical and mental, and creating opportunities for recreation and tourism. Biodiversity and ecosystems are also essential in forming our cultural characteristics and values. Consequently, it has been widely acknowledged that living nature is fundamental for human wellbeing and furthermore it also plays an essential role in supporting the functioning of our societies and economy. A more extensive description of the concept of ecosystem services can be found in the 'Tool for Practitioners' (Kettunen et al., 2009) as well as in the TEEB reports (The Economics of Ecosystem services and Biodiversity)[3] and the Millenium Ecosystem Assessment[4]. This Tool on Conservation Measures itself provides an extensive list of the range of ecosystems that are currently distinguished (part of Step 1).

Box 1: Ecosystem services

Ecosystem services are the benefits that people obtain from ecosystems. According to the widely used classification developed by the Millennium Ecosystem Assessment (2005) these services can be categorised as follows:

1. **Provisioning services**, such as food, fibre, fuel and water.
2. **Regulating services**, i.e. benefits obtained from ecosystem processes that regulate our natural environment, such as the regulation of climate, floods, disease, wastes, and water quality.
3. **Cultural services** such as recreation, aesthetic enjoyment and tourism.
4. **Supporting services**, i.e. services that are necessary for the production of all other ecosystem services, such as soil formation, photosynthesis, and nutrient cycling.

Source: Kettunen et al. (2009) from: *Millennium Ecosystem Assessment. 2005. Ecosystems and Human Wellbeing: Biodiversity Synthesis. World Resources Institute, Washington, DC. 100 pp.*

[3] http://www.teebweb.org/Home/tabid/924/Default.aspx
[4] http://www.maweb.org/en/index.aspx

2.2 Conservation measures and their impacts

This Tool on Conservation Measures is concerned with economic appraisal of "**conservation measures**" undertaken at Natura 2000 sites. In the context of this working Tool, conservation measures are defined as all measures to enhance ecosystem quality in order to reach favourable conservation status (FCS). Legal measures as restrictions regarding project development with potential adverse effects on site integrity (Art. 6(3) and 6(4) of the Habitat Directive) are not considered as conservation measures and are therefore not considered in this tool. It would be possible to adapt the tool to analyse such cases, but doing so is beyond the scope of this study.

The key factor for use of this Tool on Conservation Measures is that there is a clearly defined action or set of actions that improve the condition of the site compared to how it would be otherwise (the counterfactual). Establishing this counterfactual or baseline is in fact the first step in the Tool. This relationship is shown in Figure 1, which reproduces a diagram from the parallel study on the value of the Natura 2000 network (see 1.2).

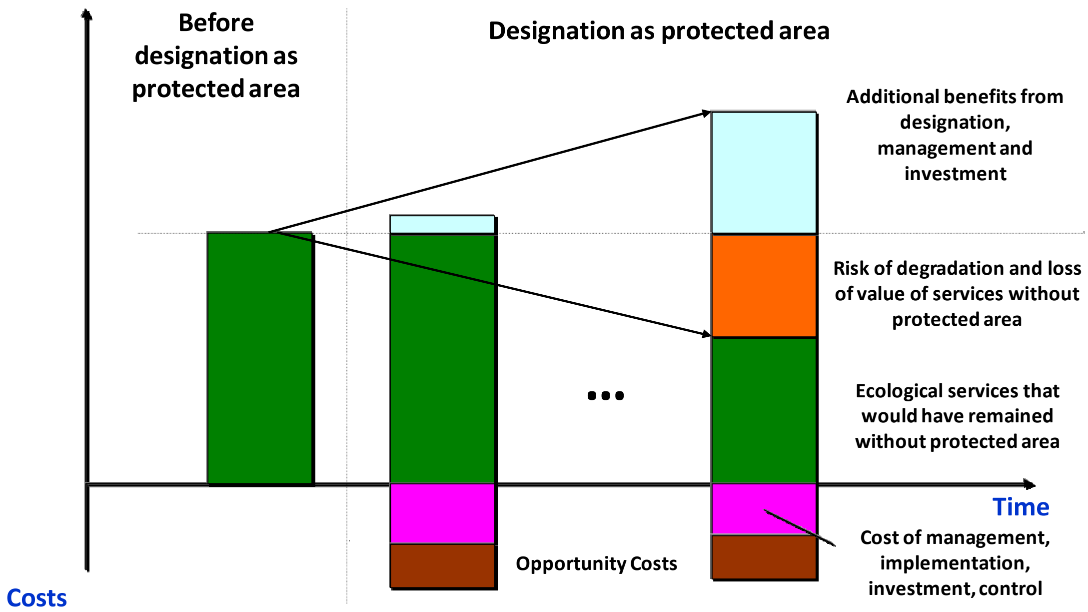

Figure 1 : Schematic for analysing the added value of Natura 2000 designation (Gantioler S., 2011)

This diagram illustrates the valuation of Natura 2000 site designation. Following designation, the baseline can be either to the sloping lines (when no further measures are taken, only designation 'on paper') or the horizontal line from before designation. For this study, the question is whether additional or new conservation measures can avert the risk of degradation of the site (orange area) or increase the additional benefits of the site (light blue area).

The following comments have to be made in relation to the scheme presented in figure 2:

- In the vertical axis the impacts are presented; these impacts can be positive (benefits) and negative (costs)
- This figure clearly shows that the new conservation measures will lead to additional costs and additional benefits

- This scheme represents the situation where conservation measures will generate additional benefits (in terms of value of ecosystem services); it might happen that conservation measures result in a decrease of some benefits in particular in situations where the site before designation was managed for mainly economic purposes (e.g. intensive forestry or agriculture).
- The total costs of conservation measures (staff and capital costs of management, implementation and monitoring) need to be taken into account.
- Opportunity costs are caused by not allowing anymore certain plans and projects which might significantly affect site integrity, in this way creating an economic loss; however plans and projects not significantly affecting site integrity might be allowed in Natura 2000 sites; therefore opportunity costs might be minimized if project developers and decision makers are dealing with project development in Natura 2000 in a smart way, i.e. by avoiding significant impacts by means of nature friendly design.

Figure 2 gives an overview of different possible scenarios based on the variables 'health of ecosystem' and 'protection level'.

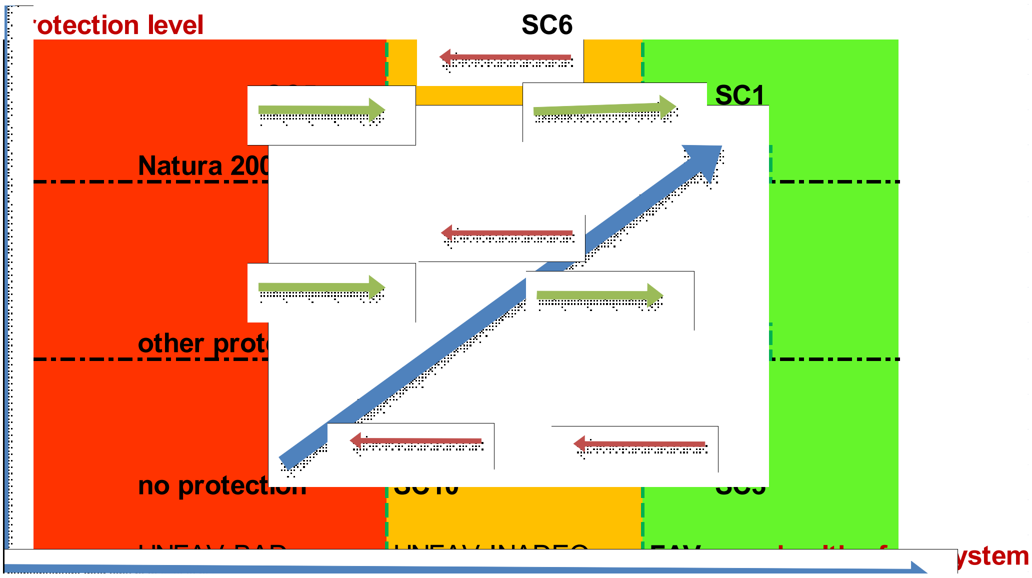

Figure 2: Relation between protection level and health of ecosystem

The three colored columns represent the three categories of conservation status which are distinguished in Natura 2000 sites (unfavorable – bad, unfavorable – inadequate, favorable) whereas the horizontal layers represent the level of legislative protection. For the purposes of this schematic we assume that a Natura 2000 designation is a higher degree of protection in comparison with most other protection regimes (there are exemptions). The general assumption is that ecosystem health improves when the protection level increases (blue arrow). The horizontal arrows represent the evolution in ecosystem health within the same protection level. In sites without any legal protection in most cases the ecosystem health is expected to decrease. The opposite is expected in sufficiently protected areas. However even in protected areas ecosystem health might decrease due to external factors (eg climate change) or due to absence or non implementation of management plans. For the purposes of our study we are particularly interested in the impacts on ecosystem services associated with the designation or the non designation of a site as part of the Natura 2000 network. This is described in Table 1.

Scenario	Description of scenario	Impacts of Natura 2000 designation	Impacts of no designation as Natura 2000
SC1	**the conservation status is already favorable in the baseline situation**	1°/ more guarantee to preserve benefits 2°/ increased management and opportunity costs 3°/ potential to increase benefits	
SC2	the conservation status is 'favorable' (in terms of Natura 2000 definitions) although the protection regime is less strict		1° / risk of degradation and loss of benefits 2°/ risk on increased costs of losing, artificially replacing or restoring ecosystem services
SC3	the conservation status is 'favorable' (in terms of Natura 2000 definitions) although there is no protection regime in place; many remote 'wilderness' areas have excellent conservation status although not protected		see SC2, but risks higher
SC4	**due to Natura 2000 designation FCS is reached**	1°/ potential to increase benefits 2°/ increased management and opportunity costs	
SC5	**due to Natura 2000 designation progress is being made towards achieving FCS**	1°/ potential to increase benefits 2°/ increased management and opportunity costs	
SC6	**although designated as Natura 2000 ecosystem health is decreasing, but not to the same degree as without designation**	1°/ slowing down the rate of degradation and the decrease of benefits	
SC7	other protection regime might also lead to similar ecosystem health level as in Natura 2000 site		depending on how strict the protection regime is (see SC1 if very strict, see SC2 if less strict)
SC8	other protection regime leads to improvement of ecosystem health, however not the same level as in Natura 2000 sites		1°/ underexploitation of potential of ecosystem services benefits 2°/ risk of degradation and loss of benefits 3°/ risk on increased costs of losing, artificially replacing or restoring ecosystem services
SC9	ecosystem health decreases although a protection regime is in place		depending on how strict the protection regime is (see SC6 if very strict, see SC2 if less strict)
SC10	ecosystem health decreases as no protection at all		1°/ uncontrolled loss of benefits 2°/ increased costs of losing, artificially replacing or restoring ecosystem services

Table 1: Impact of Natura 2000 on ecosystem benefits - comparison of different scenarios

It is important to emphasize that the Tool on Conservation Measures is not intended to substitute guidance documents[5] on implementation of Art 6.3[6] and 6.4[7] of the Habitats Directives (appropriate assessment).

[5] Available guidance:

While an appropriate assessment focuses on the potential impacts of plans and projects on site integrity (which is a purely 'biodiversity' issue), our Tool on Conservation Measures focuses on ecosystem benefits (services that benefit people).

Project developers and decision makers should be aware about both issues: early recognition of Natura 2000 and biodiversity values as well as their associated ecosystem service benefits (!) in the project planning and development process will result in better designed plans and projects taking fully into account the economic benefits of conservation measures which might be applied within the context of this 'project. Good examples can be found in the mining sector. An existing mining company in a Natura 2000 site can restore the quarry in such a way that high quality habitats are created which might contribute to the achievement of the site conservation goals. However in some cases there might be several options to restore high quality habitats, even within the limits of site level conservation goals. The quarry can be filled with water to create an open lake surrounded by reed beds, or the quarry can be restored into a wet grassland area. Both options will generate different ecosystem services (eg. recreational values, provisioning services). Insight in the benefits of these different land uses might be enhanced by benefits assessment of ecosystem services in this stage of the project planning and by involving local stakeholders ("what are local people interested in?"). Doing so will provide useful additional information to the project developer and decision-maker (planning and/or permitting authority).

- European Union (2001), Assessment of plans and projects significantly affecting Natura 2000 sites: methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC
- Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission. January 2007

[6] **Article 6.3 Habitats Directive**: Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.

[7] **Article 6.4 Habitats Directive**: If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.

3 The Tool on Conservation Measures

This chapter starts with a clarification of the purpose if the tool. As the tool is based on a step-by-step approach the overall 9-step scheme is presented together with a first short explanation of the purpose of each step. Finally for some general issues (covered time period, beneficiaries, economic valuation approaches, classification of conservation measures) we go into more detail.

3.1 Purpose of the Tool on Conservation Measures

Environmental economics techniques and methods are now widely applied to environmental resource management issues, including in relation to biodiversity conservation and ecosystem services. A good example of this is the Toolkit for Practitioners developed by IEEP (Kettunen et al.; 2009) for the valuation of Natura 2000 sites, which aims to estimate the total socio-economic value of a Natura site (against a baseline of no Natura site).

As mentioned before this study builds on the IEEP Toolkit for Practitioners identifying the potential benefits of Natura 2000 in terms of ecosystem services, in order that the purpose of this study's tool is to enable an **economic valuation** of the ***changes*** **resulting from these conservation measures**. The Tool on Conservation Measures takes the current management of the site, and the condition this will produce, as the baseline, and analyses changes relative to this. It therefore is of relevance to site managers, developers and decision-makers concerned with these potential changes. It aims to enable site managers to understand how the level of benefits from a site will depend on, inter alia:

- the services that the ecosystems provide
- the way conservation measures affect these ecosystem services
- who benefits from these services

3.2 Target users of the Tool on Conservation Measures

This Tool on Conservation Measures is designed for use by those involved in management decision about conservation measures on Natura 2000 sites. These can range from site managers, involved in planning management measures for features within sites, to planners, private developers and public decision-makers looking at infrastructure development projects.

The Tool on Conservation Measures is designed to be in a format that is understandable and possible to read by people with no specific knowledge of environmental economics and ecosystem benefits assessments. However, the Tool on Conservation Measures is best used and implemented by a group or set of practitioners collaboratively. Its full use requires knowledge of the following factors which will be best gained from different sources:

- Site managers, and scientists involved in conservation and ecosystem services must provide information on the site's main habitats and features, their condition, the ecosystem services the habitats and features support, the management measures required at the site, their effects on the condition of habitats and features and likely changes to ecosystem services from them.
- Economists must identify the populations affected by the ecosystem services that are changing, and interpret economic evidence on the value of these changes.
- Decision-makers and other local stakeholders must provide inputs on the context for the analysis, and verify assumptions about beneficiary populations.

As a consequence, before starting with the application of Tool on Conservation Measures it is worth carrying out a **pre-assessment** to find out if indeed you are in a good position to implement the Tool on Conservation Measures. Therefore the following issues should be carefully considered:

- Why would you apply the Tool on Conservation Measures?
  - If you want to collect evidence on the additional benefits to society of conservation measures to be implemented on your site, if you want to collect hard figures on the economic benefits, if you want to convince decision-makers to attribute sufficient funding for the management of your site, … the Tool on Conservation Measures is a very suitable instrument!
- Do you have sufficient capacity in terms of time and people to apply the Tool on Conservation Measures?
  - Workload to apply the Tool on Conservation Measures to your site might be estimated at 8 to 10 mandays, to be divided on a 50/50 basis between the site manager and an environmental economist; If you can find these resources, the answer to this second question is positive. If you want to improve the confidence level of the outcomes, you can organize a stakeholder meeting to get even better view on (interests of) beneficiaries, or you can carry out a WTP[8] survey, but these will require additional time and means.
- Do you have sufficient input data?
  - Be aware that you should have access to some essential information to input into the Tool on Conservation Measures (basic data on conservation management, affected beneficiaries, yields of provisioning services, market prices for some provisioning and regulating services, valuation data from comparable sites for value transfer (see Section 3.6), costs of conservation measures, …); if you are confident all or most these data can be found (even estimates are acceptable) than you can start applying the Tool.

3.3 Steps in Valuing Conservation Measures in Natura 2000 Sites

When valuing ecosystem services there are key steps that a valuation process needs to follow (Defra 2007). The Tool on Conservation Measures has been developed according to a stepwise approach, based on the principles of cost benefit analysis and the eftec study “Valuing Environmental Impacts: Guidelines for the Use of Value Transfer” for Defra (eftec, 2010).

Below, we set out a 9-step process that includes these steps, and extends it to include sensitivity analysis and reporting stages. This is tailored to the specific analysis of management measures for Natura 2000 sites, with the baseline, management measures and expected changes in ecosystem services defined in site management terms (such as designated features and conservation status).

Valuation of environmental changes is a data intensive and complex process and it is of course only possible here to give a tool applying general principles to Natura 2000 sites. It is important to note that to complete many of the following steps, and in particular steps 1 to 4, the user should discuss difficulties and caveats with others, gather information from stakeholders, and the work should be iterative (time permitting).

The key assumptions and uncertainties used in the analysis should be recorded at every step, as an input to sensitivity analysis (Step 8) and reporting (Step 9). Where there are uncertainties, it is appropriate to use ranges of data to reflect this and illustrate the level of confidence in the results.

[8] WTP: willingness to pay (a technique based on questionnaires or interviews, to find out economic value of eg. cultural services) (see eftec & Environmental Future Ltd, 2006)

The approach is shown in

Figure 3 below. The steps form a clear and logical framework within which knowledge and data about the Natura 2000 site can be set out and used to construct an economic appraisal of likely ecosystem service changes as a result of conservation measures. The steps are divided in three parts:

Part I: CONSERVATION MEASURES AND ECOSYSTEM SERVICES

- STEP 1: Defining the baseline and its level of providing ecosystem services and other economic benefits (expected situation in absence of new management measures)
- STEP 2: Identifying new conservation measures in order to reach FCS (additional management options)
- STEP 3: Identifying impacts of management changes on ecosystem goods and services

Part II: ECONOMIC VALUATION

- STEP 4: Identifying human populations affected by impacts
- STEP 5: Economic valuation of ecosystem service changes
- STEP 6: Calculation of discounted costs and benefits
- STEP 7: Accounting for non-monetised impacts

Part III: INTERPRETATION AND REPORTING

- STEP 8: Sensitivity analysis
- STEP 9: Reporting

The Tool on Conservation Measures is added in Annex A. In principle it has been elaborated as a 'stand-alone' tool which can be applied without this guidance document. Therefore the tool contains background information on economic valuation techniques. However we recommend the tool to be applied together with this guidance document. The draft of the Tool on Conservation Measures has been tested in 33 case studies within 11 Natura 2000 sites (see Chapter 4) and subsequently refined.

Below the purpose of each step is explained in a concise way.

STEP 1: Defining the baseline situation

In Step 1 the baseline situation is defined. The baseline is the condition (conservation status) of the main features and habitats of the Natura 2000 site currently and expected in the future, if known. Main ecosystems types and species and their corresponding ecosystem services are identified.

STEP 2: Identification of conservation measures

In Step 2 the most important conservation measures are identified as well as the expected or observed changes in the ecosystem types, resulting from the implementation of the management plan. There is a whole range of types of conservation measures. In general they could be divided into enhancing measures and defensive measures.

STEP 3: Defining impacts on ecosystem services

In Step 3 the changes in the ecosystem services as a result of the application of the conservation measures are identified. The purpose is to identify the effects of key changes in extent, quality and/or quantity of ecosystem services.

STEP 4: Identifying human populations affected by impacts

In Step 4 the affected area and the affected people are identified. The affected people are those who will benefit or loose from a change in the ecosystem services as identified in the previous step.

STEP 5: Economic valuation of ecosystem service changes

In Step 5 the relevant market and non-market values for the changes in the ecosystem services are identified. In order to aid comparisons between the different impacts of conservation measures, monetary values should be placed on costs and benefits. Economic valuation of the changes to ecosystem services identified in Step 3 is based on the data that quantify changes. Valuation needs to place a monetary cost or benefit against a unit of that change.

STEP 6: Calculation of discounted costs and benefits

In Step 6 the costs and benefits of the changes in the ecosystem services are calculated. The impacts identified in Step 3 need to be compared on a consistent basis to provide information to decision-makers. This step aggregates the values identified in Step 5, across the relevant people affected by the impacts identified (in Step 4).

STEP 7: Accounting for non-monetised impacts

In Step 7 key non-monetised impacts are assessed. The analysis should provide detailed assessment of the effects that cannot be given a monetary value. This can be quantitative or qualitative, depending on data and knowledge available. The key point is to ensure that all impacts are covered in the reporting stage, and in particular to ensure that the fact that no monetary value has been applied, does not mean that the value is zero.

STEP 8: Sensitivity analysis

In step 8 a sensitivity analysis is carried out to see how the results could change if the data or assumptions used are changed. The parameters and assumptions to be tested should be identified throughout the Steps of the tool. The scope and level of effort of sensitivity analysis is case-specific

STEP 9: Reporting

In Step 9 guidance is provided for final reporting. Net present values may be presented for each ecosystem service separately. By presenting ranges, uncertainties of the results can be reflected in the calculations. Non-monetised changes should be fully reported.. While reporting you should review the key issues from each of the preceding eight Steps.). Reporting should also reference sources of data, justify assumptions and describe calculations of economic values.

3.4 Timescale for economic analysis

The Tool on Conservation Measures deals with the impacts of conservation measures relative to the baseline situation (which may be changing, for example if a site is deteriorating from lack of management, or due to climate change impacts) at sites. The impacts of conservation measures should be considered over relatively long timescales. This is because many of the impacts of biodiversity conservation can be long-term (e.g. 25 to 50 years). However, such timescales are challenging for economic analysis, which usually looks at 5 to 10 years. The case studies applied the tool over 20 years, but other time periods can be chosen based on the characteristics of the site, conservation measures, and available information. Applying the tool necessitates the use of discounting to compare the values of different impacts over time on a consistent basis.

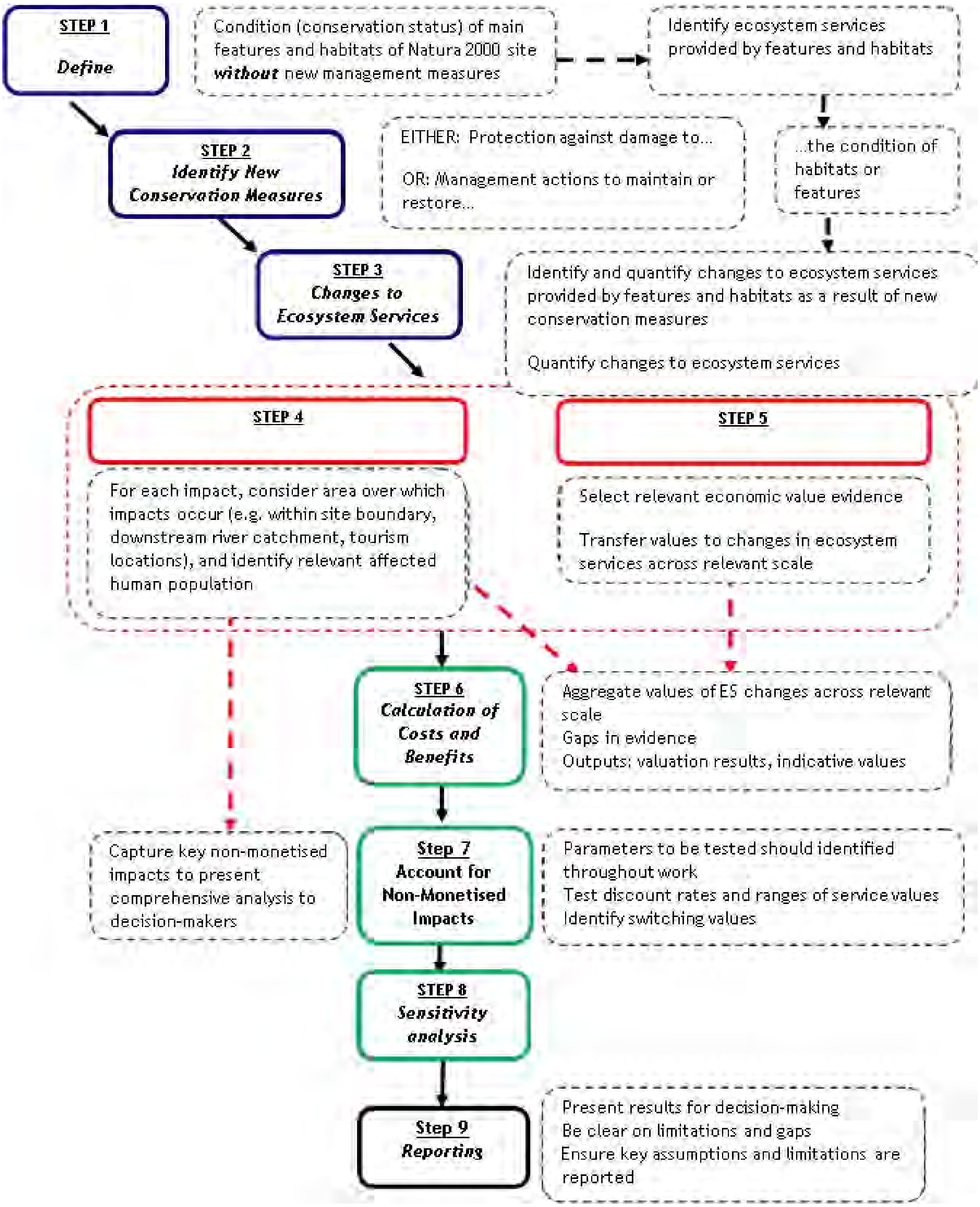

Figure 3: 9 step approach for the Tool on Conservation Measures in Natura 2000 sites

3.5 Geographical scale for the analysis

The analysis is concerned with conservation measures taken in Natura 2000 sites. However, the impacts of these measures can be over a much wider area, and hence it's important to define the scale for each of the impacts analysed. The relevant scale or human population can be inside and/or outside the site, and can range from very local (e.g. a specific group of farmers operating within a site, or certain tourism businesses located nearby) to regional (e.g. people living in a water catchment which benefits from rainfall filtered through the Natura site), national or global (e.g. those benefiting from the knowledge that nationally or globally endangered species are conserved, and the global benefits of carbon sequestration in natural habitats).

Different relationships between the area generating ecosystem services and the beneficiaries of those services are shown in Figure 5. The theory behind ecosystem services (ES) provides key information for structuring the analysis of benefits in the Tool on Conservation Measures. For example it will identify decision-making contexts and spatial scale issues. Decision-making contexts include the institutional, legal and social considerations that play an important role in payments for ecosystem services opportunities (PES) and barriers (e.g. Fisher et.al. (2009)). Spatial scale is a key determinant of ES structure, through variations in the spatial distribution of the provision (P) and benefits (B) of ecosystem services. Distributions where the beneficiary area is the same or greater than the provisioning area are illustrated in Figure 5, below. Note that sometimes the beneficiary area may be a subset of the provisioning area. Analysis of the appropriate spatial scale of delivery of ecosystem services is required to understand the distribution of different users/beneficiaries and how synergies and trade-offs between different ecosystem services can be taken into account.

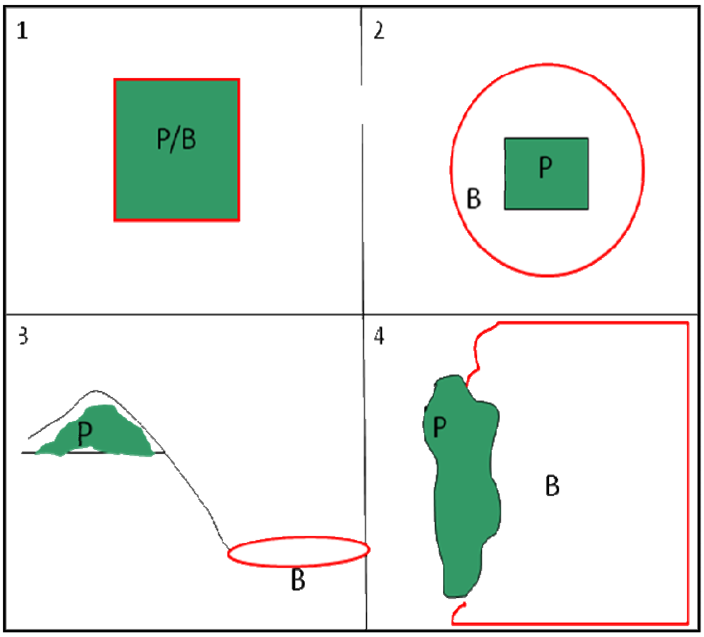

Figure 4: Spatial interactions between provision and beneficiaries of Ecosystem Services (Key: **P=Provision, B=Benefits) (**Source: Fisher et al., 2009)

A final factor to consider in the geographical scope is the political or decision-making scale (e.g. from which public finances may be used to support conservation measures).

3.6 Methodologies for economic valuation of ecosystem services

The analysis inputs described above from site managers and decision-makers are important to this Tool on Conservation Measures but must be locally derived. Guidance on the information needed and its use is provided throughout the tool (e.g. definitions of affected populations, ecosystem services typology). Gaining this information must be based on best available local knowledge and expertise, as well as scientific understanding (e.g. of carbon sequestration rates in different habitats).

The impacts analysed in the Tool on Conservation Measures are identified using the ecosystem services framework as described in Sections 2.1 and 2.2. More background on this approach is provided in the Toolkit for Practitioners (Kettunen et al. 2009). An overview of ecosystem services associated with conservation measures is provided in Appendix B of the Tool on Conservation Measures.

The economic analysis required by the Tool on Conservation Measures can be delivered using established economic techniques. The main ones that are expected to play a part in the tool are described in more detail in 'Key Insights in Economic Valuation of Ecosystem Services', an explanatory introduction to Part II of the Tool. The analysis will use the Total Economic Value (TEV) framework to identify economic value evidence to describe these welfare changes. The TEV framework covers:

- direct use values (e.g. benefits derived from eating food, using timber or enjoying recreational activities);
- indirect use values (e.g. processes that contribute to services such as climate regulation, water purification and pollination);
- non-use values (e.g. pleasure derived from the existence of a resource);
- option values (e.g. preserving for future generations ecosystem services not providing benefits today).

Some of the analysis will use market-based economic data (i.e. based on market prices). For other parts of the analysis it is likely that value transfer techniques will be needed to apply existing valuation evidence on non-market impacts.

Economic valuation of ecosystem services is a complex process, involving qualitative and quantitative assessments of ecosystems and how changes in them affect the services they provide for human benefit, and monetary valuation about what this means for people. Valuation methods need to deal with absence of data and uncertainty. Valuations should be based on final services to avoid double counting of intermediate or supporting services.

Use of economic valuation studies in primary research is time-consuming and relatively expensive. Value transfer (or benefits transfer) can be a practical, faster and less expensive way to get an estimate of the value of local ecosystems, particularly when the aim is to assess a large number of diverse ecosystems. Methodologies for value transfer now exist (eftec, 2010) that aim to ensure best use of available data by allowing for the characteristics of the ecosystem and the beneficiaries of the services that it provides. As with any other approach, the limitations of both primary valuation and value transfer must be reflected in the presentation of results to policy-makers. For example, application of valuation data must bear in mind whether ecosystem functions are irreversible (whether the impacts considered will be able to be reversed e.g. is species loss local or does it risk bringing extinction?) and/or non-linear (whether the impacts will lead to a step-change in the ecosystem service). The presence of these factors can significantly affect the value of changes in ecosystem services to people.

3.7 Ecosystems and conservation measures

The process to assess the different ecosystem services provided by Natura 2000 sites can start with identifying the area and current condition of the site's main **ecosystem types**. For the purposes of this tool we distinguished the following main ecosystem type groups as they allow to group the associated Natura 2000 habitat types of Annex I of the Habitats Directive (see also Appendix B in the Tool)[9]:

- Forests
- Grasslands
- Wetlands
- Rivers and lakes
- Coasts and estuaries
- Dunes
- Heath and scrub
- Rocks and caves

So in order to simplify the tool as much as possible we will use 'ecosystem types[10]' as a main parameter instead of 'habitat types'.

With regard to conservation measures there appears to be no uniform classification system for nature conservation measures at EU level. As a result the typology of conservation measures or the way conservation measures are described in Natura 2000 management plans varies widely. The Tool on Conservation Measures however is flexible in this regard. It's up to the user to define the conservation measures to be investigated on its impacts on ecosystem services. In general we distinguish at least the following categories of conservation measures:

1. Conversion of habitats (land use change)
2. Agri-environment measures
3. Sustainable Forestry Management measures (SFM)
4. Change in hydrological regime (ground water level, surface water level)
5. Control of external pollution
6. Flood management measures
7. Artificial habitat restoration (river banks, sea shores, …)
8. Invasive species control
9. Species recovery and reintroduction programmes
10. Defragmentation measures (construction of ecoducts, fish passages, …)
11. Visitor management (construction of facilities, zonation measures, awareness raising, …)
12. Restrictive measures (hunting and fishing restrictions, …)

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[9] BISE (Biodiversity Information System for Europe) applies a slightly different categorization : agro-ecosystems and grasslands, coastal, forest, ice/rock/polar, islands, lakes/rivers/wetlands, marine, mountains, heath and scrub, urban. As mentioned above this classification is not very suitable for use in this tool, as the link with habitat types is not always obvious (eg 'islands' can have a wide variety of different habitat types).

[10] combining a number of similar or associated habitat types

This categorization is only an example. It illustrates the wide variety of conservation measures. Overlaps are difficult to avoid, eg. sustainable forestry management includes invasive species control and might include a change in hydrological regime. Another problem is to which level of detail the categorization should be made, eg. is it sufficient to focus on agri-environmental measures or should a differentiation between reduction in fertilizer use, reduction in pesticide use, mowing, … be made. It becomes even more complex when the links between conservation measures and changes in ecosystem services have to be identified. Some changes in ecosystem services are due to the combined effect of a set of conservation measures where the specific contribution of each conservation measures is very difficult to estimate. Other measures are not only impacting one or two ecosystem types but have an influence on the whole site (eg. visitor facilities). Therefore the Tool on Conservation Measures allows for a flexible and pragmatic categorization of conservation measures reflecting differences in current practices between sites.

Recurring and one-off measures should be taken into account.

4 Case studies

4.1 Participating Natura 2000 sites

Table 2 lists the participating cases. They were selected based on an extensive search in which more than 90 site managers were contacted. Each of them received a questionnaire. On the basis of their response we asked a limited number of sites if they were willing to participate in the test phase. Finally 11 site managers participated in the testing phase of the tool.

NATURA 2000 SITE	COUNTRY	BIOGEOGRAPHIC REGION	TYPE	SURFACE (ha)
Kalkense Meersen	Belgium	atlantic	SCI/SPA	100
Lomovete	Bulgaria	continental	SAC/SPA	32500
Muntanya de Monserrat	Spain	mediterranean	SAC	7270
Telascica	Croatia	mediterranean	Proposed marine site	7050
Krkonose Mountains	Czech Republic	continental	SCI/SPA	54980
Ehrenburg und Katzenkopfe	Germany	continental	SAC	906
Elatia Forest	Greece	mediterranean	SAC	7441
Naardermeer	The Netherlands	atlantic	SCI/SPA	1152
Haaksbergerveen	The Netherlands	atlantic	SCI	592
Vindelfjallen	Sweden	alpine	SAC/SPA	555500
Humber Estuary	UK	atlantic	SAC/SPA	37000

Table 2: Participating Natura 2000 sites in test phase of Tool on Conservation Measures

These cases offer a representative picture of the variety within the Natura 2000 sites throughout the EU, covering 4 biogeographic regions and demonstrating a wide range in surface. Also a marine site is included.

4.2 Results Step 1 - 3

All participating site managers were able to apply the first 3 steps of the tool without significant support from the helpdesk team. Completing steps 1-3 helps site managers provide information that supports application of the ecosystem services approach to value impacts of conservation measures. A general comments is that tables should be linked to each other in a more automatic way in order to enhance user friendliness of the tool (eg. many columns are repeated in different tables, so completing a column should be done only once instead of repeating this work when completing other tables). Therefore a simple excel table has been elaborated which provided substantial added value to a number of site managers. However ideally a performant IT-tool should be developed, but this was not the subject of this contract (see also Section 5.2 Recommendations). Another comment was to provide an exemplary completed row in each table to illustrate the way tables should be filled in.

In the sections below we list our main findings for each step.

4.2.1 Step 1: Define the baseline

This worked well based on site managers existing knowledge. The concepts involved were understood, which is important in identifying appropriate data in subsequent steps. The methods involved are already established in environmental management work, and work like the MEA and economic tools (e.g. IEEP's natura tool) are something some site managers are aware of.

In some cases FCS is already achieved but needs to be maintained by means of specific conservation measures. In this case FCS is to be considered as the baseline and conservation measures are to be considered as an absolute prerequisite to avoid deterioration of the site. So, a good method to quantify the benefits of these conservation measures avoided costs will have to be defined (to be elaborated in Step 5).

4.2.2 Step 2: Identify new conservation measures

This worked well based on site managers knowledge and management planning information. Definitions of conservation measures were not uniform, nor can they be. However, the different definitions did not pose any problems for the tool (see 3.7).

The same comment as made under 4.2.1 regarding the continuation of conservation measures that are already in place can be made here. So, these are not 'new' conservation measures strictu sensu but if they won't be continued benefits will be lost.

4.2.3 Step 3: Changes to ecosystem services

Also the application of Step 3 worked well, although not all site managers understand ecosystem services aspects accurately. Process was helped significantly by a table linking management measures in habitats to ecosystem services. This could be researched further, and kept up to date as understanding develops, by ecosystem services experts.

The tool does need some flexibility in how it classifies management measures and the ecosystem services combinations that are impacted. Sometimes measure-service combinations are discreet (e.g. flood storage = flood damage reduction), but many are not (e.g. forest & grasslands = landscape, tourism) (see 3.7). Furthermore to be pragmatic the tool must link relevant changes in services to available value evidence (step 5). Therefore there cannot be a fixed list of management measures and ecosystem services changes. As a result double counting must be assessed through expert judgement.

Natura 2000 site management measures are often subtle, either visually to visitors or in terms of changes of site use (e.g. timber extraction reduced). Valuation studies often relate to stocks of, or larger changes in, environmental goods (e.g. valuing a larger landscape, such as under a landscape scale agri-environment program; or significant damage to a site). Only a proportion of valuation studies relate to the kind of improvements brought about by environmental legislation (e.g. WFD status improvements).

For Natura 2000 sites the initial value of a site is usually high (reflecting the reasons why it was designated). Therefore, there is a mismatch between the larger changes often covered in valuation evidence, and the more subtle changes brought about by management measures on Natura 2000 sites. Value transfer needs specific data to adjust values to take this into account, and even when such data are available, the process is still subject to uncertainty. Some specific primary studies valuing typical changes to Natura 2000 sites as a result of management measures would be useful, both in themselves, and for collective comparison to the wider valuation literature.

4.3 Results Step 4 – 9

4.3.1 Selection of conservation measures and ecosystem services

From Step 5 onwards additional expertise in environmental economics is required to be able to go through the steps. But also for identifying the potentially affected stakeholders (Step 4) support was desirable. This expertise was delivered by the consultants helpdesk team. Some site managers managed to involve also local environmental economists. In order to focus efforts on a limited number of well elaborated cases for each of the 11 sites a selection was made of the most relevant conservation measures and of the main ecosystem services that were affected by these conservation measures. The elaboration of each case was conducted mainly by the consultants helpdesk team on the basis of data provided by the site managers. This process turned out to be very interactive.

The selection of conservation measures and associated ecosystem services was based on the following considerations and approach:

- the outcomes of Step 1 – 3 provided a good insight in the range and importance of the conservation measures which were implemented within the sites as well as the main affected ecosystem services
- a discussion with the site managers during a workshop in Brussels[11]
- the logic to list conservation measures according to the different ecosystem types
- the condition of having at least 30 cases i.e. 30 conservation measures carried out in 30 different cases) , as was required by the Commission
- the need to limit the total number of combinations in order to be time and budget efficient (as each combination required data collection and careful economic valuation)
- the need to include a variety of ecosystem services and not to limit them to the most predominant ones.

A final selection was made based on the feed-back made by site managers and the Commission. Some minor amendments were made during the completion of the next steps of the tool.

Table 3 provides an overview of the investigated case studies. They represent 31 conservation measures with an average of 2,5 associated ecosystem services for each case. This makes a total of 75 elaborated combinations. The following comments can be added:

- all main ecosystem types within the Natura 2000 habitat classification, except dunes, are represented; forests and grasslands represent the majority of the ecosystem types within the investigated cases, which is very representative for the actual situation[12]
- a wide variety of conservation measures has been included in the test phase; some conservation measures are applicable in different ecosystem types eg. visitor management; in fact visitor management measures are often not restricted to only one or a few ecosystem types but have an impact on the whole site
- a wide variety of ecosystem services is covered too; the services which have been assessed most frequently are food provision, climate change regulation (by means of carbon sequestration), genetic and/or species diversity and the cultural services 'ecotourism/recreation' and 'landscape amenity values'.

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[11] Within the framework of the project a workshop has been organised on 15 and 16 June 2011 to discuss the draft tool with the participating site managers

[12] Forests account for 32,5% and grasslands for 12,7% of the total surface of terrestrial Natura 2000 in Europe (ten Brink et al., 2011)

	Conservation measures per ecosystem type	Natura 2000 site	number of conservation measures	Comments	Change in ecostem services														Number of ES
					Provisioning services					Regulating services							Cultural services		
					Food	Timber	Fuel	Wool	Reed	Climate	Air quality	Water regulation	Water purification	Erosion control	Human health	Genetic/ Species diversity	Ecotourism/ Recreation	Landscape/ Amenity	
	FORESTS		**8**		1	4	0	0	0	6	2	1	0	2	0	2	2	3	**23**
1	***sustainable forestry management***	GR Elatia Forest	2	**split in 2 combinations, peat bog conservation included**		1				1						1	1		4
		GE Ehrenburg und Katzenkopfe	1			1				1									2
		BU Lomovete	1			1				1									2
		CZ Krkonose Mountains	1							1				1					2
2	***visitor management***	GE Ehrenburg und Katzenkopfe	1	**also grasslands**													1	1	2
3	***wildfire prevention measures***	ES Muntanya de Montserrat	1		1	1				1	1	1		1				1	7
		HR Telascica	1	**also heath and scrub**						1	1					1		1	4
	GRASSLANDS		**13**		7	1	1	1	0	1	1	2	2	0	0	7	3	7	**30**
4	***floodplain restoration***	BE Kalkense Meersen	1									1				1			2
		BU Lomovete	1									1	1					1	3
5	***preserving high nature value grasslands against succession***	GR Elatia Forest	1		1													1	2
		HR Telascica	1		1													1	2
		ES Muntanya de Montserrat	1			1				1	1								3
		GE Ehrenburg und Katzenkopfe	1		1											1		1	3
		CZ Krkonose Mountains	2	**split in 2 combinations**	1		1									1	1	1	5
6	***extensive grassland management***	NL Naardermeer	2	**split in 2 combinations (Galloways, sheep)**	2			1								1	1		5
		BE Kalkense Meersen	1		1											1		1	
7	***visitor management***	BU Lomovete	1	**also forests, rocks and caves**												1	1		2
8	***reducing external pollution***	BE Kalkense Meersen	1										1			1		1	3

	Conservation measures per ecosystem type	Natura 2000 site	number of conservation measures	Comments	Change in ecostem services														Number of ES
					Provisioning services					Regulating services							Cultural services		
					Food	Timber	Fuel	Wool	Reed	Climate	Air quality	Water regulation	Water purification	Erosion control	Human health	Genetic/ Species diversity	Ecotourism/ Recreation	Landscape/ Amenity	
	WETLANDS		**3**		0	0	0	0	1	1	0	1	0	0	1	1	2	0	**7**
9	***peat bog conservation/restoration***	NL Haaksbergerveen	1							1		1					1		3
10	***reed bed management by delinquents***	NL Naardermeer	1						1						1	1			3
11	***visitor management***	NL Haaksbergerveen	1														1		1
	RIVERS AND LAKES		**2**		1	0	0	0	0	0	0	0	1	0	0	2	1	0	**5**
12	***fishing restrictions***	SW Vindelfjallen	1		1											1	1		3
13	***nutrient control in lake***	NL Naardermeer	1										1			1			2
	COASTS AND ESTUARIES		**1**		1	0	0	0	0	1	0	1	0	0	0	0	0	0	**3**
14	***managed realignment***	UK Humber estuary	1		1					1		1							3
	MARINE		**2**		1	0	0	0	0	0	0	0	0	0	0	1	1	0	**3**
15	***fishing restrictions***	HR Telascica	1		1														1
16	***visitor management***	HR Telascica	1													1	1		2
	HEATH AND SCRUB		**1**		0	0	0	0	0	0	0	0	0	0	0	1	1	1	**3**
17	***species reintroduction measures***	SW Vindelfjallen	1													1	1	1	3
	ROCKS AND CAVES		**1**		0	0	0	0	0	0	0	0	0	0	0	0	1	0	**1**
18	***visitor management***	ES Muntanya de Montserrat	1	also forests													1		1
	TOTAL		**31**		11	5	1	1	1	9	3	5	3	2	1	14	11	11	**75**

Table 3 : Overview of selected conservation measures and ecosystem services

All case studies are included in Annex B. The main outcomes of the case studies are commented in the next sections.

4.3.2 Analysis of overall results of the monetary valuation exercise

The following tables give an overview of the minimum, mean and maximum values of the selected ecosystem services for the 11 cases.

Minimum values (in m €):

Ecosystem service	Kalkense Meersen - Belgium	Lomovete - Bulgaria	Telascica - Croatia	Krkonose Mountains - Czech Republic	Katzenkopf - Germany	Elatia Forest - Greece	Montserrat - Spain	Vindelfjallen - Sweden	Naarder-meer - The Netherlands	Haaks-bergerveen - The Netherlands	Humber Estuary - United Kingdom
Food production	-6,22		45,67	14,12			1,10	-0,29	0,19		4,30
Climate regulation			4,43		0,70	1,45	9,20				1,02
Water regulation	9,10						0,30				39,57
Fiber (timber)						-1,03					
Genetic/species diversity	11,00				1,26			13,74	0,59		
Ecotourism and Recreation			2,05	11,72	0,97	0,45		15,15	0,02	0,39	
Landscape/Amenity	3,07	0,03	2,28	0,26	0,13	0,26	34,80				
Water purification		0,90							0,00		
Air Quality											
Fuel											
Erosion control							22,80				
SUM					245,5						

Maximum values (in m €):

Ecosystem service	Kalkense Meersen - Belgium	Lomovete - Bulgaria	Telascica - Croatia	Krkonose Mountains - Czech Republic	Katzenkopf - Germany	Elatia Forest - Greece	Montserrat - Spain	Vindelfjallen - Sweden	Naarder-meer - The Netherlands	Haaks-bergerveen - The Netherlands	Humber Estuary - United Kingdom
Food production	-6,22		45,67	14,12			1,50	-0,16	0,22		40,16
Climate regulation			8,24		1,04	2,18	20,10				2,31
Water regulation	23,51						0,80				39,57
Fiber (timber)						-1,03					
Genetic/species diversity	11,00				1,26			16,66	1,14		
Ecotourism and Recreation			5,12	23,45	0,97	0,45		15,00	0,02	0,48	
Landscape/Amenity	3,07	0,03	2,28	0,62	0,13	0,26	34,80				
Water purification		0,90							0,02		
Air Quality											
Fuel											
Erosion control							30,40				
SUM					340,1						

Mean values (in m €)

Ecosystem service	Kalkense Meersen - Belgium	Lomovete - Bulgaria	Telascica - Croatia	Krkonose Mountains - Czech Republic	Katzenkopf - Germany	Elatia Forest - Greece	Montserrat - Spain	Vindelfjallen - Sweden	Naarder-meer - The Netherlands	Haaks-bergerveen - The Netherlands	Humber Estuary - United Kingdom
Food production	-6,22		45,67	14,12			1,30	-0,23	0,20		22,23
Climate regulation			6,34		0,87	1,82	14,65				1,67
Water regulation	16,31						0,55				39,57
Fiber (timber)						-1,03					
Genetic/species diversity	11,00				1,26			15,20	0,87		
Ecotourism and Recreation			3,59	17,59	0,97	0,45		15,08	0,02	0,44	
Landscape/Amenity	3,07	0,03	2,28	0,44	0,13	0,26	34,80				
Water purification		0,90							0,01		
Air Quality											
Fuel											
Erosion control							26,60				
SUM					292,8						

A quick view on these tables shows that in some cases (Haaksbergerveen (NL) and Lomovete (BU)) very few monetary values could be assessed. Other cases, such as Kalkense Meersen (BE) and Montserrat (ES), have well elaborated valuation. The most frequently valued services are food production (which impacts are sometimes negative) and ecotourism/recreation (7 of 11 cases) , and climate and landscape (6 of 11 cases). Other services were only valued in three or fewer cases. The inability to value water regulation, water purification and erosion control services in most of the sites is notable and suggests there is an important data gap. The tables also allow to figure out which ecosystem service is of the greatest importance and which are marginal.

Figure 5 gives an overview of the relative contribution of each ecosystem service group to the overall mean value. The most important ecosystem service is food production, followed by water regulation and landscape/amenity value. Ecotourism/recreation, genetic/species diversity and erosion control have more or less the same importance. Fiber, water purification, air quality and fuel are of marginal importance throughout the cases.

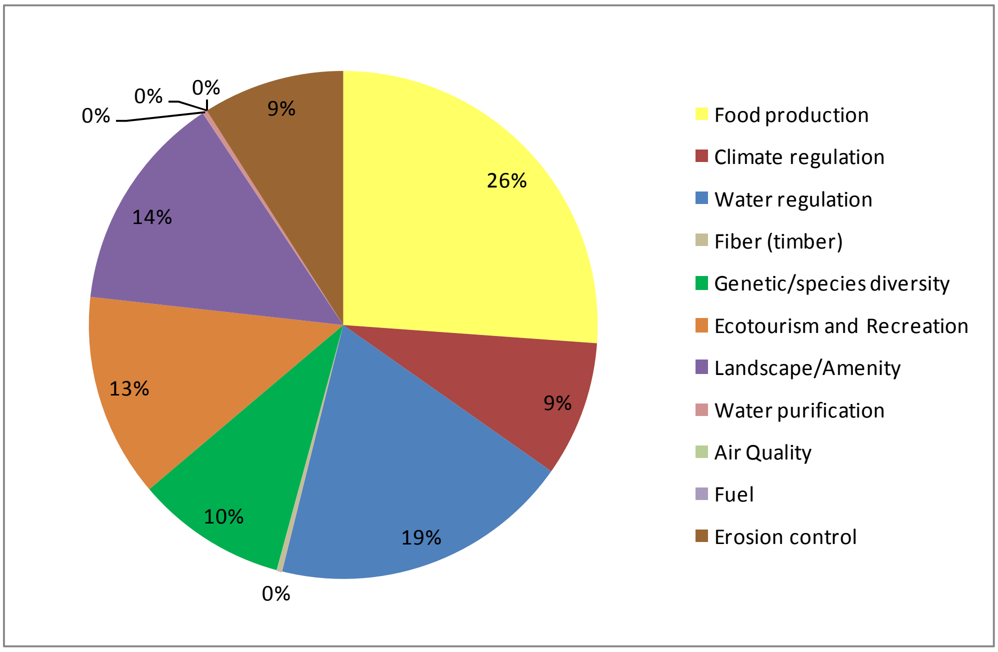

Figure 5 :Importance of each ecosystem service value (mean)

The diagram in Figure 6 groups these ecosystem services into their respective main typology. The regulation services are of major importance, followed by the provisioning and cultural services. The supporting services have a lesser weight.

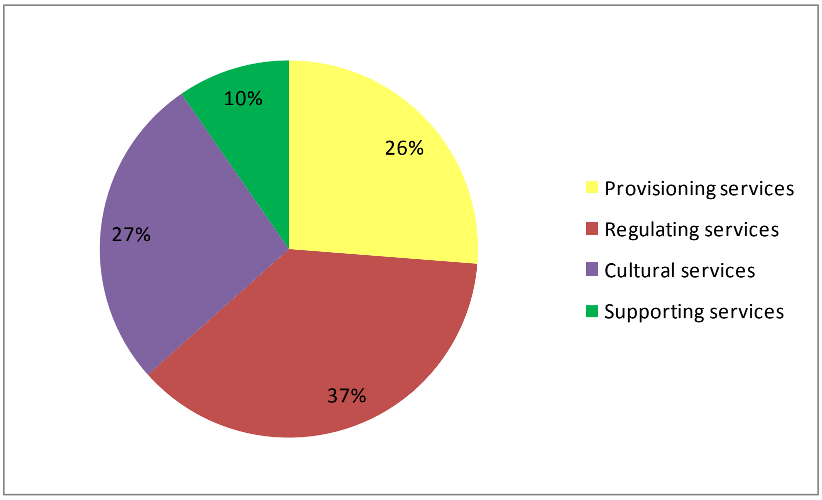

Figure 6: Importance of each ecosystem service typology

If we further analyze the overall result, the outcomes can be divided on the basis of **market and non-market values**. Two thirds of the total benefits are calculated based on market values, resulting in a mean value of 204 m €. The non market values account, with a mean value of 96 m €, for approximately one third of the total value

Subdividing the total values according to the different **valuation methods**, gives the following results:

- 37 % of the total benefits is calculated based on cost based methods
- 30 % is calculated based on stated preference methods
- 33% is calculated based on revealed preference methods

The 3 different valuation methods are more or less equally represented in the cases. It is important to use all these methods to generate values, and to have an approach, such as provided by the tool, in which the values they provide can be combined.

4.3.3 Ecosystem services approach

The use of the ecosystem services approach is judged to be appropriate to the purpose of the tool to value changes resulting from management measures in Natura 2000 sites. This is unsurprising as its effectiveness for such analysis is why it has been used extensively in recent environmental economics work, particularly in relation to the natural environment.

More useful is the observation that it can readily be elaborated using information that is usually available in Natura 2000 site management plans. This combination of site management and economic analysis information reflects the strengths of the ecosystem services approach, and represents an important part of its application to Natura 2000 site management issues.

4.3.4 Use of Value Transfer

The method for value transfer in environmental economics has only recently been developed further (e.g. eftec 2010). Its systematic use in valuations of Natura 2000 site management measures is a relatively new approach. It is judged to have worked successfully in the application of the tool in this project. It has enabled relevant values to be adjusted, with varying levels of confidence, to the ecosystem service changes in question. The tool focuses on the key factors influencing the feasibility and accuracy of value transfer. The factors are presented in a summary table as part of the tool, which enables readers to understand the value transfer process, and the assumptions made to support it, clearly.

4.3.5 Risk of double counting

In most of the cases there is no risk of double counting, as studied ecosystem services and areas are well defined. In some cases there is a risk of double counting between recreation and amenity/species diversity values, in that the latter may include values related to recreational use. The risk of double counting was not significant enough to affect the conclusions of the analysis in any of the cases.

4.3.6 Overall confidence level, and data availability

One fifth of the number of ecosystem services could not be monetized, often genetic/species diversity. From the services which could be valued, 20% of the total value (8 ecosystem services) has been assessed as a sound valuation, with reliable quantification and monetization. The largest share, 80% (36 ecosystem services) is categorized as satisfactory. Both quantification and monetization face some uncertainty (eg. uncertain changes in visitor reaction on conservation measures, uncertain value transfer for non-use value, …). There were important differences between the cases:

- For the cases of Kalkense Meersen (BE) and Naardermeer (NL) there was more than sufficient availability of data and good confidence in the costs data.
- For Vindelfjallen (S) there was less availability of data and confidence in costs data, as some measures were still in an early planning phase (concrete data could not be submitted).
- For Montserrat (ES) detailed costs from visitor management planning could be obtained. For the cases of Ehrenburg und Katzenköpfe (GE), Humber estuary (UK) and Telascica (HR), confidence in the cost data was strong, as the actions are mainly related to market activity (e.g. agricultural practices or capital works) with well-understood costs.
- For Elatia Forest (GR) and Lomovete (BU), there is moderate confidence in the costs information. In Greece, this is because the actions required are fairly modest (e.g. for visitor management information) or relate to maintaining the status quo (for grassland grazing). In Bulgaria, this is because some management actions are not yet planned in detail. Cost data requires engagement in management issues by bodies other than the site management authority. In Krkonose (CZ) an estimate of costs was only available for one part of the necessary actions (grassland management by grazing). However, it should be noted that this site is a very large one, and that therefore costing of management measures is a very complex process, covering many different potential management activities.

4.3.7 Discussion of applicability of steps

4.3.7.1 Introduction to economics, Part II.

Despite being simplified, this theoretical discussion was not clear to all site managers. However, it was understood and helpful to some, and is necessary for the process of using the tool. The technical difficulty with these and similar issues in Steps 5 and 6 are the reason why it is recommended that the tool is used by site managers in conjunction with environmental economists. As a result, examining provision of capacity for environmental economics support is amongst the recommendations.

4.3.7.2 Step 4: Identify people affected

This was understood by site managers, and worked qualitatively, although often data uncertainties in terms of quantification were noticed. It is an important step in value transfer and an important part of the tool is focusing on which groups in society will obtain benefits.

4.3.7.3 Step 5: Valuation of ecosystem service changes

Step 5 is the most technical step and has been undertaken by economic experts. The majority of site managers did understand this step and were able to follow the process, but would not be able to do it unaided. In particular carbon values, that change over time, are very complex.

Identifying valuation evidence that is relevant to the changes in ecosystem services being considered is complex and requires environmental economics knowledge. The task is considerably easier when average EU-country values exist from meta-analysis (e.g. of agricultural landscape amenity). Developing the evidence base to provide further data of this kind would assist with the task of valuing conservation measures at Natura 2000 sites.

Approximately half the sites had alternative means of getting expert environmental-economics input, although sometimes they would need to pay for several days work for someone to use the tool fully.

4.3.7.4 Step 6: Calculation of costs and benefits

This step was undertaken by economists, but with inputs from site managers that demonstrate a good understanding of the calculations. The process of discounting costs & benefits and judgements about additional impacts require economic expertise. Discounting or other calculations can be aided by standardized software, but judgements about assumptions often require discussion between economists and site managers. The majority of site managers did understand this step and were able to follow the process, but would not be able to do it unaided.

4.3.7.5 Step 7: Account for non-monetised impacts

The tool helps to identify these and clearly report them. It is important to retain a reporting format that allows them to be clearly presented and given sufficient weight in conclusions.

4.3.7.6 Step 8: Sensitivity analysis

The tool helps to identify key issues and report sensitivity. Sensitivity analysis demonstrated the importance of assumptions used in value transfer, such as about populations of beneficiaries or adjustment of unit values.

4.3.7.7 Step 9: Reporting

Discussion with site managers and internal peer review suggests the reporting format works well. The approach adopted to presenting figures has been designed not to portray a too high degree of confidence in the figures, with results in calculations presented to 2 decimal places (d.p.) but conclusions presented to 1 d.p. For many services different assumptions result in a presentation of a range of values (e.g. reflecting high and low estimated for the value of carbon), reflecting the uncertainty in some of the calculations.

4.3.8 Discussion of applicability of valuation approaches

4.3.8.1 Provisioning services

Food

Generally good market price information, based on rather detailed knowledge of farming systems, but it is unclear to which degree available market prices are supported by EU subsidies. In some cases the decline in food production is valued via transfer from non market CVM studies, which lowers the reliability of the outcomes.

The economic analysis should adjust values to remove the effects of transfer payments (e.g. subsidies). In the use of the tool, this is particularly relevant to costs and benefits of agricultural activities that contribute to conservation measures. Direct subsidy payments are recognized as potential management costs in the case studies, which is in line with good practice.

However, other subsidies, such as area-based payments and price support can also affect the economics of changes to agricultural management. In some of the cases (e.g. Humber, Krkonose), the influence of price supports has been investigated and does not influence the values calculated. However, for other sites this is harder to establish, and this is not always an area of expertise for site managers (it might be better understood by local environmental-economists, if they were supporting use of the tool). Therefore there is a risk that some of the analysis includes the influence of agricultural price support subsidies. However, determining whether this is the case, and adjusting the analysis accordingly, is complex.

Materials (Timber/Wool)

Generally good market information, based on good knowledge of forestry systems (value of lost production is mainly reflected in subsidy payments to compensate for lower revenues). In the case of harvesting wood for local use, no quantification was possible. The output of wool can be regarded correctly monetized.

Fuel, medicines

Not analysed in detail. These services do not change significantly as a result of most management measures.

4.3.8.2 Regulating services

Climate/carbon

Requires detailed data on expected additional carbon storage as a result of conservation measures, which is not always available. Then values can be applied. Value data was received from Helen Ding (University of Venice, pers com, 13/9/11), a member of the team analyzing the overall value of the Natura 2000 network in a parallel study (see Section 1.2).

Water regulation and water purification

Only valued in a minority of cases because dependent on complex site-specific data (e.g. reduction in flood risk due to flood storage). Some water purification data were available, but influence of this on water supplies for human consumption is extremely complex.

Erosion control

Present at a number of sites but economic analysis in most of the cases was impossible due to lack of data on the change to the service as a result of management measures (i.e. how much would erosion be reduced).

Wildfire mitigation

Good analysis possible at one site, but uncertainty due to unpredictability of fire risks and future climate change variation.

Pollination

Considered at a number of sites but not analysed. One site with data on bee-keeping showed it to be a subsistence/hobby activity. More significant values would be expected to relate to non-market value of pollination of commercial crops, rather than to market production of honey. Insufficient data to analyse non-market value.

Avalanche/storm damage, **biological control** and **human health** were not analysed.

4.3.8.3 Cultural services

Tourism and recreation

Could be valued using value transfer in five case studies. For this service predicting increase in numbers and/or values of visitors is very difficult as nature-based recreation is hard to measure, and finding studies that relate visitor activity to conditions at Natura sites is difficult (although it was possible at some sites). For this service, Step 4 on populations affected is also particularly important.

Landscape and amenity values

The valuation of this service is, in some cases, aided by the existence of meta-analyses that provide average EU-country values for forest and agricultural landscapes. Nevertheless the scale of the change to this service resulting from conservation measures is sometimes very different to the scale of the changes that studies look at (as discussed above). In the case of Vindelfjallen (S), no relevant studies were found for value transfer. For Kalkense Meersen (BE), 2 local studies were considered applicable for the amenity value of clean water and extensive grasslands.

A difficulty with applying non-use values is the assessment of how people's values decrease the further they live from the site. In other words, it is difficult to decide how many households do we need to multiply the individual values with.

4.3.8.4 Supporting services

Genetic/species diversity

This is unsurprisingly one of the most important ecosystem services benefiting from Natura 2000 site management measures. Its benefits are usually non-market in nature, and so its valuation generally requires value transfer. This is hampered by a limited availability of valuation studies, and by their specific nature – many studies relate to specific biodiversity resources (species and/or habitats), and therefore transferring their values to other habitats/species is difficult or not possible. Sufficient primary studies and a meta-analysis of EU biodiversity conservation values would provide evidence that would strengthen any economic analysis of the benefits for the Natura 2000 network, including through use of this study's tool.

5 General conclusions and recommendations

5.1 Conclusions

Applying the tool to the case studies has provided a number of insights into the challenges of producing economic values for conservation measures in Natura 2000 sites:

- The **tool** is able to provide the **best possible insight** in the economic value **wider benefits of conservation measures**, although it is not always an accurate picture (see below).
- The tool can **operate successfully** through the **combined inputs** of **site managers and environmental economists** to value the ecosystem service changes resulting from conservation measures. Site managers inputs are generally based on information that is part of site management plans. The tool links this information to changes in ecosystem services. The success of the valuation of the ecosystem services is dependent on understanding of changes in ecosystem services, and suitable economic valuation evidence (or relevant value transfer) those changes. The value of ecosystem service changes can be compared to the costs of the conservation measures in question, resulting in a net present value.
- The **ecosystem services approach** provides the **most suitable method** for identifying **economic values associated with conservation measures in Natura 2000 sites**.
- For the majority of the sites participating in the study, the tool has produced results with a **moderate level of confidence**. Few of the case studies result in robust and complete net present value estimates. The moderate confidence level of the obtained results is because of a:
  - lack of scientific information linking changes in habitats to changes in ecosystem services; sometimes, the data required is simply not available despite the will of stakeholders to engage in the process and to provide it; understanding of ecosystem services is improving, but for applying the tool, specific evidence is needed on how services to people will change as a result of conservation measures taken in certain habitats/ areas; many **gaps** in the **scientific data** still remain;
  - lack of economic evidence on the value of ecosystem service changes;
  - lack of accurate information on costs of conservation measures; in many cases there is a significant uncertainty regarding the real costs of conservation measures; however, cost information is more likely to relate to market impacts; therefore the availability of data in relation to costs, while subject to uncertainties, is usually better than that for benefits; benefits data has to rely on a wider range of sources and therefore has a weaker evidence base (e.g. in relation to non-market data); this can skew comparisons and hinder accurate calculation of net present value.
- The ability to cover a sufficient selection of ecosystem services to make the tool more accurate will depend on progress in approaches and methods of environmental economics (e.g. MEA, TEEB, value transfer) and further development of a scientific evidence base linking changes in environmental management to changes in ecosystem services. Therefore, the confidence in the results obtained using the tool is expected to improve over coming years.
- Not all **stakeholders** in the management of sites do yet appreciate the features of the ecosystem services approach and its relevance to them even when some evidence suggests otherwise (e.g. local water agencies may prefer engineered solutions and not see the role of catchment management in their business model; tourism agencies may not regard nature-based tourism as a priority). Without the cooperation of stakeholders it can be difficult to gather the data necessary to undertake valuation. **Awareness raising** (e.g. face to face meetings, demonstration projects) and **capacity building** (e.g. training) may be the only way to change this.

- Despite simplifying processes like ecosystem service identification in the project's tool, the concepts underpinning the tool remain complex because they reflect complex real-world situations. For example, flexibility is needed in the approach to valuing management measures and the combinations of ecosystem services they affect. Some impacts on services can be discreet (e.g. changes to grazing affects food production), but others cannot be disaggregated (e.g. management of forest and grassland areas can affect food production, visitors use values and the non-use value landscapes). Therefore, the tool cannot reduce the valuation of these services to a simple formula, but requires judgements to shape its use as it is applied.
- The **conservation measures** for Natura sites considered in the case studies are judged to be **typical of those across the network**. The tool links these measures to economic valuation literature dealing with similar environmental changes. However, in comparison to economic valuation studies, Natura conservation measures often involve more subtle impacts. For example valuation studies often consider large environmental changes (e.g. the landscape-scale effects of an agri-environment scheme, or avoiding damage to the key features of a site). Designated Natura sites are protected (in principle) from further damage, and the scale of changes to ecosystem services from conservation measures (which are motivated by nature conservation requirements) are often smaller than those covered by economic valuation evidence. Value transfer is able to overcome this only in some cases.
- As well as enhancing genetic and species diversity, in general, the conservation measures studied:
    - enhance cultural ecosystem services, including non-use value for landscapes and biodiversity, and visitor values,
    - sometimes increase carbon storage, although evidence that could be applied was limited to intertidal and forest habitats,
    - are expected to have positive impacts on regulating services; this area often lacks specific evidence (e.g. on air quality or erosion control), but some water quality and quantity regulation benefits could be valued,
    - can sometimes reduce provisioning services (e.g. reducing agricultural intensity) and sometimes increase them (e.g. maintaining or introducing grazing to maintain specific habitats).
- Indeed, not all the changes in ecosystem services identified had positive benefits. In several cases reductions in intensity of provisioning services (e.g. agricultural outputs, timber) were a cost. However, when wider ecosystem services evidence (e.g. regulating services like carbon storage, and cultural services like landscape value) were taken into account, net positive values could be assessed for undertaking conservation measures.
- It is important to keep in mind that not all benefits were assessed for each of the investigated Natura 2000 sites, as the tool has only been applied on a selected number of conservation measures and a selected number of ecosystem services related to these conservation measures!

5.2 Recommendations

The following recommendations can be made:

- A good definition and description of the applied conservation measures is a key prerequisite for applying the tool. Site managers refer to the measures described in the site's management plan and this is fine as far as they define them well. We observed however huge differences in the way conservation measures are categorized. This is partly due to the lack of a uniform classification system of conservation measures at EC level. An upscaling of ecosystem services benefits due to the implementation of conservation measures from site level to regional, national and even

European level would highly benefit from such a uniform classification. Therefore it might be useful to develop a common typology which could be applied in Natura 2000 management plans throughout the EU.

- The same applies to cost accounting. It was our observation that site managers often had limited insight in the exact cost figures of conservation measures. It is the expectation however that site managers in a context of decreasing government budgets will be increasingly forced to apply cost management techniques and therefore will pay more and more attention to cost accounting of conservation measures. The development of a uniform cost accounting model for conservation measures in protected areas might be a very useful measure. Another advantage of this uniform approach is that site managers will be able to carry out cost effectiveness analysis of conservation measures based on data of numerous sites. This is also very useful in the context of delivering the objective under Target 2 of the EU Biodiversity Strategy[13]
- There is still potential for improving the user friendliness of the tool by means of using appropriate software. This could link together information, reducing repetitiveness of analysis, and automate some aspects of the calculations.
- A widespread application of this Tool on Conservation Measures would not only be advantageous for many site managers throughout the EU, but would contribute significantly to increasing the database of economic appraisals related to Natura 2000 management measures. The range of habitats and conservation measures in Natura sites is reasonably well understood, and therefore the ecosystem services that need to be valued can be predicted. The development of a central 'value transfer' database at EC level, and sponsoring additions to it, would be very supportive for an efficient application of the tool.
- To make best use of the tool, it should be promoted to site managers with careful guidance about when it can be best used and what it can achieve. Training of site managers, government officials responsible for Natura 2000 management should be organized.
- Application of the tool requires input from environmental economists. Their input to application of the tool can be encouraged through appropriate training and awareness raising. However, getting the necessary input from environmental economists can be difficult, as they are a scarce resource and may not be aware of relevant valuation evidence. Therefore, and efficient approach could be to provide an ongoing helpdesk function for valuation. This helpdesk could advise sites on whether to apply the tool (scoping), locate appropriate valuation evidence, and support sites to bid for resources when they complete management plans.

[13] "By 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15 % of degraded ecosystems."

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Annex A: Working Tool on Conservation Measures

WORKING TOOL ON CONSERVATION MEASURES

Elaborated within the EC Project:

“RECOGNIZING NATURA 2000 BENEFITS AND DEMONSTRATING THE ECONOMIC BENEFITS OF CONSERVATION MEASURES”

31-10-2011

Part I

CONSERVATION MEASURES AND ECOSYSTEM SERVICES

Part I consists of Step 1 to 3:

- In Step 1 the baseline situation is defined. The baseline is the condition (conservation status) of the main features and habitats of the Natura 2000 site currently (or at the moment of designation) and expected in the future if known. Main ecosystems types and species and their corresponding ecosystem services are identified.

- In Step 2 the most important conservation measures are identified as well as the expected or observed changes in the ecosystem types resulting from the implementation of the management plan.

- In Step 3 the changes in the ecosystem services as a result of the application of the conservation measures are identified.

STEP 1 – DEFINE BASELINE

- *Describe the main features and habitats of the Natura 2000 site*
- *Identify ecosystem services provided by features and habitats*

Step 1 contains the following sub-steps:

⇒ STEP 1 - 1: Main baseline characteristics of the site

⇒ STEP 1 – 2: Main ecosystem types and current condition

⇒ STEP 1 – 3: Main ecosystem services associated with ecosystem types and main species

⇒ STEP 1 – 4: Current and expected future status of ecosystem services (baseline situation)

⇒ STEP 1 – 5: Summary of most important ecosystem services in the baseline situation

A clear baseline is the basis for using the tool, which looks at impacts of conservation measures compared to the baseline. The baseline can be thought of as the current condition (conservation status) of the site, but be aware that the condition of the site may change over time rather than being stable.

STEP 1 - 1: Main baseline characteristics of the site

The characteristics of the site and expected changes in them can be recorded in Table 1. As illustrated in the case studies in Annex B other baseline characteristics can be added (map, pictures, details of managing authority and contact person, …).

Table 1. Baseline characteristics

Characteristics of site	Current	Future expectations	Notes
Area (ha)	Insert text or type space	Insert text or type space	Insert text or type space
Population	Insert text or type space	Insert text or type space	Insert text or type space
Human Activities	Insert text or type space	Insert text or type space	Insert text or type space

STEP 1 – 2: Main ecosystem types and current condition

The process to assess the different ecosystem services provided by Natura 2000 sites can start with identifying the area and current condition of the site's main **ecosystem types** using Table 2. In Appendix B to this tool the main ecosystem type groups are presented with a reference to the associated Natura 2000 habitat types of Annex I of the Habitats Directive. So in order to simplify the tool as much as possible we will use 'ecosystem types[1]' as a main parameter instead of 'habitat types' .

If within the same ecosystem type (e.g. forests) some habitat types have a favourable and others an unfavourable **condition,** please add the required rows to clarify this. The baseline condition should be described in accordance with the Habitats Directive Art. 17 reporting requirements:

- unfavourable – bad (UNFAV-BAD),
- unfavourable – inadequate (UNFAV-IN)
- favourable (FAV),
- unknown (U).

With regard to **protected species (**Habitats and Birds Directives) you can add some rows for the main species for which conservation measures are foreseen. It is anticipated that the site's current condition is recorded in **existing site data** (eg. Standard Data Forms). Where this is not the case, it can be assessed based on **expert judgment.**

[1] combining a number of similar or associated habitat types

Table 2. Main ecosystem type/s and species

Ecosystem type	Area (ha)	Condition	**Notes**
Forest	Insert text or type space	Insert text or type space	Insert text or type space
Grasslands	Insert text or type space	Insert text or type space	Insert text or type space
Wetlands	Insert text or type space	Insert text or type space	Insert text or type space
Rivers and lakes	Insert text or type space	Insert text or type space	Insert text or type space
Coasts and estuaries	Insert text or type space	Insert text or type space	Insert text or type space
Dunes	Insert text or type space	Insert text or type space	Insert text or type space
Heath and scrub	Insert text or type space	Insert text or type space	Insert text or type space
Rocks and caves	Insert text or type space	Insert text or type space	Insert text or type space
Species	**Population (ind.)**	**Condition**	**Notes**
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space

STEP 1 – 3: Main ecosystem services associated with ecosystem types and main species

Identify the main ecosystem services associated with the ecosystem types and main protected species identified in Table 2.

The site habitat and species information should be used to identify which ecosystem services are or might be delivered by the site. The analysis can proceed without a comprehensive analysis of ecosystem services at this stage, but providing the best information possible on ecosystem services will facilitate subsequent analysis. Table 3 shows a typology of ecosystem services. Further clarification is provided in Box 1. Indicate in the second column which ecosystem types are most relevant for delivering these services. Don't mention the ecosystem types that don't contribute much to the ecosystem service.

Table 3. Typology of ecosystem services and ecosystem types or species delivering these ecosystem services

Ecosystem services	Ecosystem types where these ecosystem services might be relevant (see Table 2)
PROVISIONING SERVICES	
☐ Food (e.g. crops, fruit, livestock, wild berries, fungi, game)	Insert text or type space
☐ Fibre/materials (e.g. wool, skins, leather, plant fibre, timber, cork)	Insert text or type space
☐ Fuel (e.g. biomass, firewood)	Insert text or type space
☐ Natural medicines	Insert text or type space
☐ Ornamental resources (e.g. wild plants, wood for handcrafts, seashells)	Insert text or type space
☐ Biochemicals and pharmaceuticals	Insert text or type space
☐ Water	Insert text or type space
CULTURAL AND SOCIAL SERVICES	
☐ Ecotourism and recreation	Insert text or type space
☐ Cultural values and inspirational services (e.g. education, art and research)	Insert text or type space
☐ Landscape and amenity values	Insert text or type space

REGULATING SERVICES	
☐ Climate/climate change regulation	Insert text or type space
☐ Water regulation (e.g. flood prevention, aquifer recharge)	Insert text or type space
☐ Water purification and waste management	Insert text or type space
☐ Air quality regulation	Insert text or type space
☐ Erosion control	Insert text or type space
☐ Avalanche control	Insert text or type space
☐ Storm damage control	Insert text or type space
☐ Wild fire mitigation	Insert text or type space
☐ Biological control	Insert text or type space
☐ Pollination	Insert text or type space
☐ Regulation of human health (physical and mental)	Insert text or type space
SUPPORTING SERVICES	
☐ Production	Insert text or type space
☐ Nutrient cycling and decomposition	Insert text or type space
☐ Water cycling	Insert text or type space
☐ Weathering/erosion	Insert text or type space
☐ Ecological interactions	Insert text or type space
☐ Evolutionary processes	Insert text or type space
☐ Genetic/species diversity maintenance (e.g. protection of local and endemic breeds and varieties)	Insert text or type space

Box 1: Categorisation of ecosystem services

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

- Food: Ecosystems provide the conditions for growing food - in wild habitats and in managed agro-ecosystems.
- Raw materials: Ecosystems provide a great diversity of materials for construction and fuel.
- Fresh water: Ecosystems provide surface and groundwater.
- Medicinal resources: Many plants are used as traditional medicines and as input for the pharmaceutical industry.

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

- Local climate and air quality regulation: Trees provide shade and remove pollutants from the atmosphere. Forests influence rainfall.
- Carbon sequestration and storage: As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues.
- Moderation of extreme events: Ecosystems and living organisms create buffers against natural hazards such as floods, storms, and landslides.
- Waste-water treatment: Micro-organisms in soil and in wetlands decompose human and animal waste, as well as many pollutants.
- Erosion prevention and maintenance of soil fertility: Soil erosion is a key factor in the process of land degradation and desertification.
- Pollination: Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee.
- Biological control: Ecosystems are important for regulating pests and vector borne diseases.

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

- Recreation and mental and physical health: The role of natural landscapes and urban green space for maintaining mental and physical health is increasingly being recognized.
- Tourism: Nature tourism provides considerable economic benefits and is a vital source of income for many countries.
- Aesthetic appreciation and inspiration for culture, art and design: Language, knowledge and appreciation of the natural environment have been intimately related throughout human history.
- Spiritual experience and sense of place: Nature is a common element of all major religions; natural landscapes also form local identity and sense of belonging.

Supporting Services underpin almost all other services. Ecosystems provide living spaces for plants or animals; they also maintain a diversity of different breeds of plants and animals.

- Habitats for species: Habitats provide everything that an individual plant or animal needs to survive. Migratory species need habitats along their migrating routes.
- Maintenance of genetic diversity: Genetic diversity distinguishes different breeds or races, providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock.

STEP 1 – 4: Current and expected future status of ecosystem services (baseline situation)

At this stage of the analysis, it is usually sufficient to describe the baseline in terms of current status and trends (e.g. anticipated major changes such as the impacts of climate change and sea level rise on coastal environments). Where the dynamics are important and where quantitative projections are feasible, this will need to be taken into account at Step 3.

For the ecosystem services identified in Table 3, the current and expected future condition in the absence of new management measures can be recorded in Table 4. The current status can reflect any known problems with the ecosystem service (e.g. habitat degradation). It should reflect the condition of the main habitats providing that service. If expected changes in ecosystem services are not known, it may be possible to get a group of experts on the site to make a qualitative assessment.

The future expectations should reflect expected changes to the habitats providing the service (e.g. if management is already increasing the area of the habitat and/or its condition, then there would be an expectation that the service would increase). It is useful to record the expected timescale of the changes, and given the uncertainty in knowledge of ecosystem services, the level of confidence in the information.

If GIS is available which sub-divides the site into ecologically or economically meaningful units, then mapping can be used to overlay habitats, species, services and changes. The level of effort that is proportionate with the decision context should be considered. In any event, assessment can start simple, with complexity added later when found necessary and justifiable.

Table 4. The template for defining the baseline ecosystem services

Ecosystem service	Current status	Future expectations	Timescale for changes (if any)	Notes, including level of confidence
From Table 3				
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
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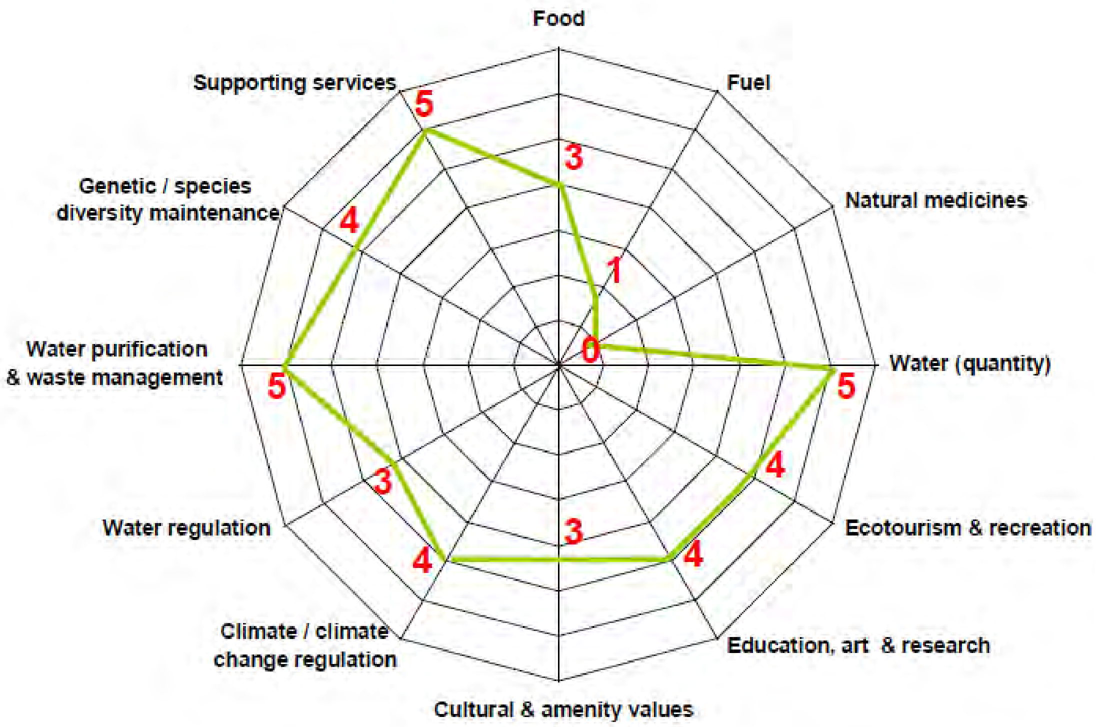
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space

It is important to keep in mind that this step is about characterising the *baseline*. The “future expectations” column in Table 4 is for changes that might be expected to occur over time in the baseline scenario not in the “new conservation measures” scenario(s) to be considered at Step 2. Expected changes will include numerous externally driven changes: climate change, changes in the policy environment, profitability of different crops (including timber) and the development of plans and projects (e.g. wind farms) will all be relevant.

STEP 1 – 5: Summary of most important ecosystem services in the baseline situation

It is possible to summarize the levels of current and expected ecosystem services, using the spider diagram shown below. The 'Tool for Practitioners' (IEEP, 2009) provides clear and concise instructions how to prepare this diagram. This sub-step is not essential for the application of the further steps. It only provides you with a visualization of your own judgment regarding the importance of ecosystem services in your site.

Figure 1 : Overall socio-economic benefits provided by the site (on scale 0-5) (IEEP, 2009)



COMMENTS ON STEP 1

Insert text or type space

STEP 2 – identify new conservation measures

- *EITHER: Protection against damage to…*
- *OR: Management actions to maintain, restore or improve…*
- *…the condition of habitat features*

Step 2 contains the following sub-steps:

⇒ STEP 2 - 1: Identification of conservation measures

⇒ STEP 2 - 2: Changes to ecosystem types as a result of conservation measures

STEP 2 - 1: Identification of conservation measures

In the context of this working Tool, conservation measures are defined as all measures to enhance ecosystem quality in order to reach favorable conservation status (FCS). Legal measures as restrictions regarding project development with potential adverse effects on site integrity (Art. 6(3) and 6(4) of the Habitat Directive) are not considered as conservation measures and are therefore not considered in this tool.

This Step defines the **new conservation measures** being analysed through the subsequent steps of the tool. The new conservation measures involve a change in actions to manage the site, relative to the baseline defined in Step 1. Remember that 'new conservation measures' means that the measures are new in the sense that they are additional actions. It does not mean that they are novel actions or have not been tried before. As the future baseline may be dynamic (e.g. reflecting expected site deterioration due to climate change), 'new' conservation measures may involve interventions necessary to maintain current condition.

The tool can be used to analyze a single new conservation measure or a package of new measures. Management measures could range from quite general overarching approaches to very specific, localized interventions. It will be necessary to determine what impacts the management measures expect to have for the condition of habitats and the environmental processes in the site. This is the purpose of Step 3.

There is a whole range of types of conservation measures. It's typically the type of actions which are offered by 'nature conservation or restoration projects'. These measures are interventions to maintain, restore or improve condition of habitats or other features of a site to deliver FCS (Favourable Conservation Status). However, they can also include new measures needed to maintain a site's existing condition in the face of expected deterioration. For instance, where the condition of a site is deteriorating or is expected to deteriorate due to climate change, measures to maintain site condition are needed. Note that they can be undertaken proactively or reactively.

It will be necessary to determine what impacts the management measures are expected to have for the condition of habitats and the environmental processes in the site.

The details of the extent of the conservation measures for the site can be recorded in Table 5. Appendix B to this tool might provide useful support for this exercise. The table in Appendix B lists a number of typical 'problems' (deteriorated current condition) for each ecosystem type and links the most common conservation measures to them. Note that some conservation measures (e.g. visitor management facilities) are not always easily linked with ecosystem types.

STEP 2 - 2: Changes to ecosystem types as a result of conservation measures

For each recorded conservation measure the extent of the affected ecosystem type (very often specific habitat types) should be mentioned as well as the expected change of the affected ecosystem type, and finally the expected timescale of achieving this change. The change of the affected ecosystem type can be a change from one ecosystem type to another ecosystem type (eg forests are converted into grasslands if deforestation is the proper conservation measure to reach FCS) or an improvement of the quality of the ecosystem type (eg. better water quality in wetlands due to prohibiting fertilizer use in the meadows belonging to this wetland area). Evidently the achieved condition is always favorable, so all conservation measures and their corresponding timescale which are necessary to achieve (or maintain) FCS should be described.

The tool can be used to analyze a single new conservation measure or a package of new measures.

For simple habitat area or quality tracking, a table like Table 5 can be used. More generally it may be necessary to create a spreadsheet to keep track of changing areas of different habitat types and/or qualities, especially if dynamics over time are complex. If spatial distribution is important, more formal modelling will be required.

Table 5. Identify the conservation measures and their impact on ecosystem types

Ecosystem type	Area	Problem / Threat	Condition	Conservation measure (s)	Extent of affected ecosystem type (habitat)	Expected change in ecosystem type	Timescale
From Table 2					***Area of habitat the measures affect***		
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
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Ecosystem type	Area	Problem / Threat	Condition	Conservation measure (s)	Extent of affected ecosystem type (habitat)	Expected change in ecosystem type	Timescale
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Main species	**Area**	**Problem / Threat**	**Condition**	**Conservation measure (s)**	**Extent of affected ecosystem type (habitat)**	**Expected change in ecosystem type**	**Timescale**
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
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COMMENTS ON STEP 2

Insert text or type space

STEP 3 – changes to ecosystem services

- *Identify changes to ecosystem services provided by features and habitats as a result of new conservation measures*
- *Quantify and describe changes in ecosystem service*

The purpose of this Step is to identify the changes in the ecosystem services in Table 4, as a result of conservation measures identified in Step 2. This is the main step at which detailed ecological knowledge can be used. Methods for linking management measures to changes in ecosystem services may here be needed.

In this step those changes to ecosystem services will be identified, that result from the key changes to the ecosystem types identified in Table 5. These are the effects on the ecosystem services (identified in Table 4) from the change to each ecosystem or habitat (identified in Table 5) being affected by the new conservation measures (identified in Table 5). Table 6 below can be used to record this information.

The purpose of Table 6 is to identify the effects of key changes in extent, quality and/or quantity of ecosystem services (identified in Table 4) from each ecosystem type or species being affected by the new conservation measures (identified in Table 2). So in this step you need to decide which are these key changes in the ecosystems types . The completion of Table 6 can be guided by the considerations in Box 2. In some cases, additional calculations and more detailed reporting will be needed. This will necessitate the use of a suitable spreadsheet.

The information in Table 6 is a key input into valuation in Step 5. Where changes cannot be valued in monetary terms, the data in Table 6 will need to be fed directly into Step 7.

Table 6. Template for presenting the changes in quality and extent of ecosystem services

Affected ecosystem service	Key ecosystem types	Key changes in ecosystem type	Corresponding Conservation Measures	Type of impact (+ or -)	Qualitative description of impact on ecosystem service	Quantitative description of impact on ecosystem service
From Table 4	***From Table 2***	***From Table 5***	***From Table 5***			
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
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Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Affected ecosystem service	**Key species**	**Expected change in species conservation**	**Corresponding Conservation MeasuresMo**	**Type of impact (+ or -)**	**Qualitative description of impact on ecosystem service**	**Quantitative description of impact on ecosystem service**
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space

Box 2: Considerations in analyzing ecosystem services changes

Define the change qualitatively in terms of its:

- Scale (marginal or non-marginal in comparison to the baseline).
- Nature (change in the quality or quantity of provision).
- Direction (improvement or deterioration)
- Timing (immediate, gradual, limited period, in perpetuity)
- Location

Assess the change quantitatively in terms of:

- Its nature: units of change for quantity changes, parameters of quantity changes
- Risk of a particular change occurring
- What the measurement of the changes means in terms of the ecosystem goods and services that individuals use and/or are aware of – scientific / technical measurements are not always directly valued by individuals. Proxy measures can be used for this purpose (e.g. area of habitat can be a proxy for ecosystem service provision - note the link to areas of habitat identified in Table 2)
- Changes to the production of marketed goods and services (e.g. fish landings)

COMMENTS ON STEP 3

Insert text or type space

Part II

THE ECONOMIC VALUATION

Part II consists of Steps 4 to 7 and deals with the economic valuation:

- In Step 4 the affected area and the affected people are identified. The affected people are those who will benefit or loose from a change in the ecosystem services as identified in the previous step

- In Step 5 the relevant market and non-market values for the changes in the ecosystem services are identified

- In Step 6 the costs and benefits of the changes in the ecosystem services are calculated

- In Step 7 key non-monetized impacts are assessed.

As this part requires some insight in economic valuation techniques, we strongly recommend you to read the next introduction on '**Key Insights in Economic Valuation of Ecosystem Services**' first. It gives you some background on economic value in the context of ecosystem services. It clarifies some terminology which is often applied when talking about economic valuation of ecosystem services (e.g. users and non-users; value-transfer, etc.), and provides a table to help assess the appropriateness of value transfer. For those who want to explore these economic concepts in more detail we refer to the Reference List.

To illustrate the way you can go through steps 4 to 7 you can consult the **11 case studies in Annex B.** These cases are structured according to a specific format which goes through the different steps. A **blank template** which you can use to go through these steps for a number of selected conservation measures is included in **Appendix A of the Tool**. You can easily copy this blank template in order to do the exercise for several conservation measures.

Key Insights in Economic Valuation of Ecosystem Services

1 Background on Economic Value

Economic values are the values placed by individuals on resources, goods and services of any kind. The values are expressed in relative terms based on individuals' preferences for given changes in the quality and/or quantity of resources and services. The unit used for economic valuation is money – as it is a common unit making the comparison of financial and other (environmental, social) costs and benefits possible. Using this unit, preferences are measured in terms of individuals' willingness to pay (WTP) money to avoid a loss or to secure a gain and their willingness to accept (WTA) money as compensation to tolerate a loss or to forgo a gain. What is estimated by economic valuation is the value of a marginal change. In other words, individuals behave according to, or express, their WTP and WTA for a change. For market transactions, the price paid represents buyers' WTP and sellers' WTA. However, even resources, goods and services that are not traded in markets generate economic values. A complete economic analysis should include the changes in both market and non-market values.

Understanding the motivations behind people's preferences (and hence the economic values) helps with identifying the information needs and valuation methods.

People have several motivations for having positive WTP and WTA to protect ecosystem services. These motivations are analysed within the so called Total Economic Value (TEV) typology (Figure 2). The 'total' here refers to the sum of different motivations rather than the absolute value. Use value involves some interaction with the resource, either directly or indirectly:

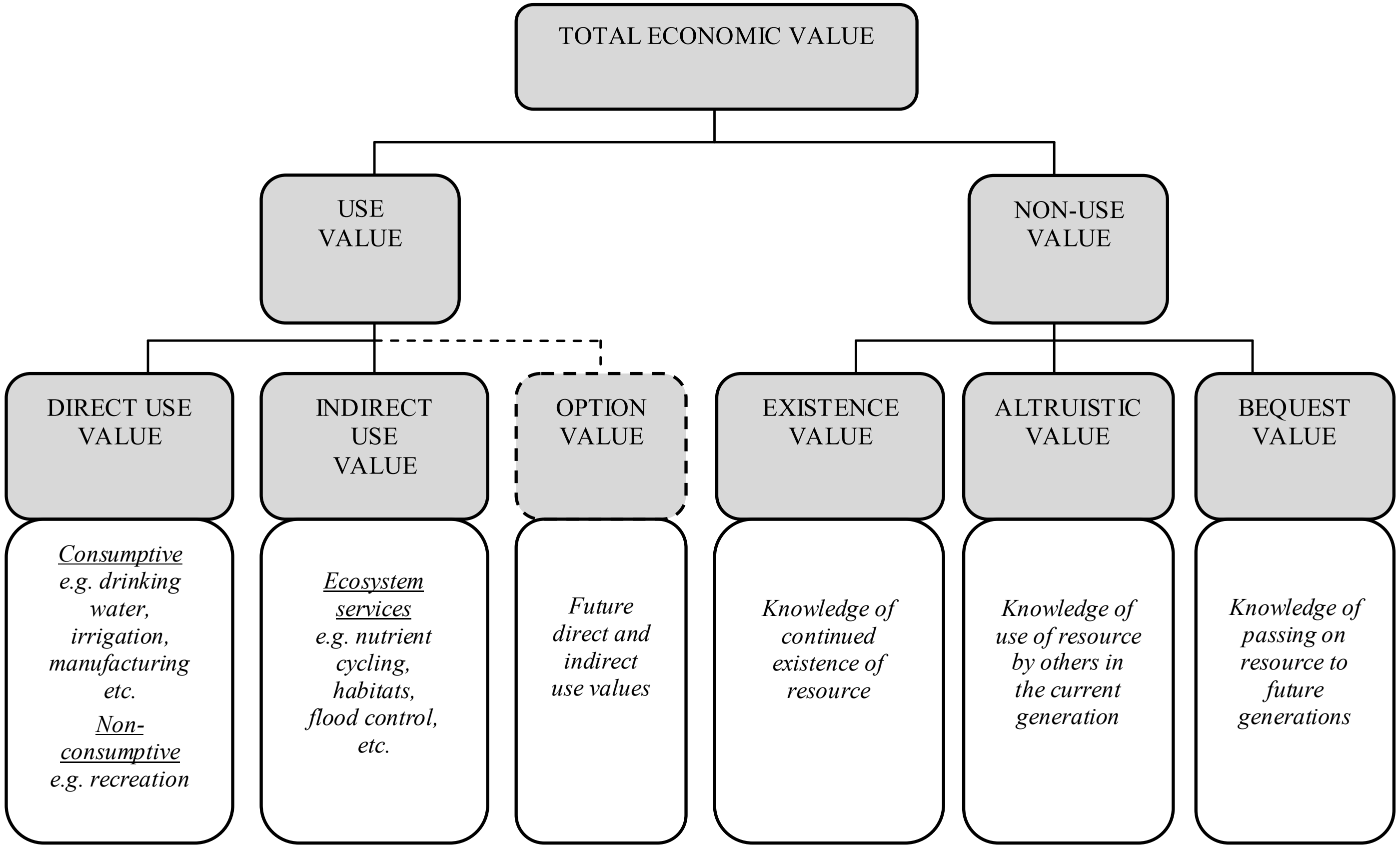
- **Direct use value:** Ecosystem services are used in either a consumptive manner, such as fishing for food or in a non-consumptive manner such as for recreation (e.g. bird-watching).
- **Indirect use value:** The value of ecosystem services provided such as nutrient cycling, habitat provision, climate regulation, etc.
- **Option value**: Not associated with current use of ecosystem services but the benefit of keeping open the option to do so in the future. A related concept is quasi-option value which arises through avoiding or delaying irreversible decisions, where technological and knowledge improvements can alter the optimal management of an ecosystem.

Non-use value is associated with benefits derived simply from the knowledge that ecosystems are maintained. In other words, non-use value is not associated with any use of an ecosystem. Non-use value can be split into three parts:

- Altruistic value: Derived from knowing that contemporaries can enjoy ecosystem services.
- Bequest value: Associated with the knowledge that ecosystems and their services will be passed on to future generations.
- Existence value: Derived simply from the satisfaction of knowing that ecosystems continue to exist, regardless of use made of it by oneself or others now or in the future.

Those who make direct and indirect use of goods and services, i.e. the users, are likely to hold both use and non-use values. Those who do not directly or indirectly use a good or service but still hold non-use values are called non-users. While users are relatively easy to identify, there is no theoretical definition of non-users. The definition is an empirical question which can be answered by primary research.

Figure 2: Total Economic Value



2 Economic Evaluation methods

Where there is a **market for the good or service** of interest, the **price, consumption and production data** can be used.

When **markets do not exist**, several types of valuation methods can potentially be used to identify non-market values (e.g. as described in eftec, 2006):

- **Production functions,** where the ecosystem service plays a role in producing a good or service with a market value, the value of a change in that service can be measured by estimating the resulting change in that market product. Examples are the contribution of pollination to certain crops, or of biodiversity to a local tourism industry. This analysis can be difficult as it requires reliable, and preferably quantified, knowledge of the relationship between the provision of the ecosystem service and the market product.
- **Revealed preference methods,** which use price and consumption information from markets that are affected by the good or service of interest. For example, hedonic property pricing method estimates the premium buyers pay for properties in environmentally high quality surroundings (this being the good of interest). Travel cost estimates the economic value of informal (free of direct charge) recreation by analysing the costs incurred by recreational visitors to travel to and from and at a recreational site.
- **Avoided costs**, where the improvement to the ecosystem service means society is relieved of costs it would have borne otherwise. For example, the reduction in predicted costs of flood defences, or in the need for water treatment investment to meet water quality standards, as a result of improved catchment management.
- **Stated preference methods** which use questionnaires to elicit individuals' WTP and/or WTA. These methods are potentially applicable to any resource and decision context and the only methods that can estimate non-use values. Application of these values involves applying value transfer (see below). These are complex, as to be done reliably values from existing studies will need to be adjusted to fit the ecosystem services change at the site being considered. This requires interdisciplinary work with input from economists, decision-makers and site managers, making adjustments where necessary and report these clearly (eftec, 2010). Value transfer guidelines detail criteria for matching existing valuation evidence to the appraisal case.

Using these methods for *new* primary economic valuation studies of non-market costs and benefits may only be a long term option for addressing gaps in the data. A more practical approach in terms of the analysis required during 2011 is to attempt use **value transfer** (eftec 2010). Value transfer is a process whereby information regarding economic value (use and non-use) in one (study) context is applied to a new (policy) context for which an estimate of economic value is required.

If value transfer is attempted then, in line with value transfer guidance, this will depend on the information available about the site (identified in Steps 1 – 3) and its match to the study site in terms of:

- The ecosystem services studied,
- The location / geography of the site,

- The change to the ecosystem services,
- The people affected, and
- The available alternatives (substitutes) for the ecosystem service.

The following table helps present the comparison of these points between the study being used and the policy site. For examples of its use see case studies in Annex B.

Characteristic	Study	Policy Site	Match*
The ecosystem services studied			
The location / geography of the site			
The change to the ecosystem services			
The people affected			
The available alternatives (substitutes) for the ecosystem service			
Conclusion for Value Transfer			

* Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

Input from site managers will help to identify this crucial information to the operation of value transfer, as per the information in Steps 1 - 4 of this tool. For example, in identifying the people affected in Step 4; the local/regional public (e.g. regulation of climate, lower public investment in flood control and/or flood damage), and/or local/regional private partners (e.g. water supply company, pharmaceutical or medicinal product derived via bioprospecting). This information from site managers must be considered alongside details of the study site to assess the 'match' according to these criteria. Based on this match, three outcomes are possible:

i. Where none or few of these criteria match, value transfer is unlikely to work.

ii. There is a good match between the study site and the policy site – the 'unit transfer' approach can be used. This is the simplest type of value transfer, refers to using an average value found in one context to another.
iii. Where most but not all of these criteria match, value transfer will need to adjust unit values, or use a WTP function. This process should be undertaken by those with a sound understanding of economic theory, in accordance with the available guidelines (eftec 2010). An example is elaborated in Box 3.

Most examples of value transfer are of the simpler type (ii). In general, the resource and policy application of value transfer is naturally defined by the coverage of existing studies. If value transfer is attempted, in order to estimate the economic value of a change in the provision of ecosystem services using value transfer, the economic analyst also needs:

- *A reliable estimate of the economic value* – ordinarily in terms of 'willingness to pay' in market data or estimated in relevant *existing* primary valuation studies;
- *A description of the change in the provision of the good under consideration* – this may be presented in qualitative and/or quantitative terms (from Steps 1-3);
- *Knowledge of how the economic value changes due to the change in provision of the good* – what is the relationship between the level of provision of the good and willingness to pay for marginal changes in the good (i.e. constant or non-constant)?; and
- *Knowledge of which factors influence the economic value* - particularly in terms of the population affected by the change, their use of the environmental resource, their socio-economic characteristics (e.g. income, age, gender, education and so on of the potential beneficiaries mentioned above) and substitute goods and services.

Box 3: Example of stated preference method using coefficients for WTP

In Flanders a **valuation function** for **different land use scenarios** has been developed by carrying out a **choice-experiment (CE)**. This is a sophisticated, state of the art questionnaire technique, in which respondents are asked to choose their preferred alternative out of two or more nature development scenarios, described in terms of their ecological quality and a full set of spatial characteristics to capture landscape preferences. The **six nature types** that have been used are: pioneer vegetation, mudflat and marsh, natural grassland, forest, open water reed and swamp, heath land and inland dunes.

The status quo is land used for agriculture without any natural or landscape value, without walking trails through the area and with a low number of species. The policy scenarios describe the transformation from this agricultural land use into a natural land use with specific attributes.

When making a choice, the respondent makes a trade-off between the value of the natural area and the additional tax, and in doing so he reveals his preferences and willingness to pay for natural landscapes. By varying the characteristics of the natural areas between the alternatives, the respondent reveals his preferences for these characteristics. The data were obtained from an internet survey, using the panel of a market research agency from which respondents were chosen at random in three different provinces of Flanders. 3.000 residents filled out the survey.

With statistical analysis this information can be expressed in a valuation function. The **valuation function** expressed in **yearly WTP** (willingness to pay) per household can be written as:

WTP = + 122 * pioneer vegetation + 93 * mudflat and marsh + 92 * natural grassland + 157 * forest + 133 * open water, reed and swamp + 133 * heath land and inland dunes + 0,05 * size in ha + 28 * species + 34 * availability of walking trails – 0,63 * distance in km + 8 * natural surroundings + 8 * residential surroundings – 15 * industrial surroundings – 0,36 * high number of species * age + 0,01 * monthly net income - 37 * % women + 108 *% membership.

The results show that people are willing to pay for additional natural landscape and that the amount depends on the characteristics mentioned above. The nature type is important. Forests are valued higher, pioneer vegetation, marshes and grasslands are valued lower than open water, swamps and heath land. The respondents are willing to pay more for easily accessible nature, but this is not a dominant attribute. People are also attaching a higher value to nature that has a rich biodiversity and is not surrounded by industry.

Source: Liekens I., Schaafsma M., Staes J., Brouwer R., De Nocker L., Meire P. (2010). Economische waardering van ecosysteemdiensten ('Economic valuation of ecosystem services, a guidance'). Client: Ministry of the Flemish Community. March 2010

Key assumptions used should be noted, so they can be considered under sensitivity analysis in Step 8. Where there is no firm quantitative estimate of ecosystem service changes, it may still be justifiable, under certain conditions, to use economic valuation methods. For example, even if the most we can say about the biodiversity service is that it will change from “severe decline” to approximately “stable”, valuing this change or transferring estimates (with appropriate caveats) from studies using similar characterisations may be better than omitting the impact from the analysis.

Of course this can yield only an approximate figure, which would have to be carefully reported with appropriate caveats. But the point is that we are not seeking “the right answer” but rather an improved level of evidence about economic value, sometime where the alternative is no evidence at all.

3 Economic values in decision-making

Although often considered just in the context of cost-benefit analysis[2] of policies, economic valuation of ecosystem services can serve multiple purposes, and is useful in many contexts. In this tool, monetary valuation is useful in expressing diverse outcomes in a common metric, but also for organising information about, communicating and discussing values. Thus, far from being limited to cost-benefit analysis economic valuation provides a methodological framework for identifying, measuring and valuing ecosystem benefits to humans, and this can be useful to help analysis by:

- Collating and processing large amounts of complex information about the impacts of management options;
- Expression of impacts in monetary units, commensurable with other economic effects;
- Identifying key knowledge gaps and guiding targeting of scarce research and data-collection resources;
- Incorporating information about baselines and time profiles of impacts, and
- Clear identification of which impacts are included and which are not in the estimates, and avoiding double-counting.

Thus using economic valuation in analysis can help to supporting debate and decision making, in particular, communicating with decision-makers and others who may be unaware of the range of ways in which environmental systems support and provide human values. Using economic valuation can also help communication by:

- Increasing awareness and understanding of the actual and potential service benefits to humans of Natura 2000 sites;
- Facilitating communication regarding these benefits with different stakeholders and the general public;
- Informing debate and decisions about financing options;
- Enhancing consistency across different decision processes.

But we must be clear too that using economic valuation is not easy and does not automatically solve problems. It is:

- Not a substitute for deliberation and decision making;

[2] Cost-benefit analysis (CBA) is a decision support method which compares, in monetary terms, as many benefits and costs of an option (project, policy or programme) as feasible, including impacts on environmental goods and services. It can, in principle, be applied both ex ante and ex post. Perhaps the most important advantage of CBA is that it is designed to target two of the most crucial appraisal questions: “Is a given objective worth achieving?” and if so, “What is the most efficient way of doing this?”. More detail on applying CBA the environmental issues can be found in eftec (2006).

- Not foolproof (if it is not used correctly, it can give misleading results);
- Based on methods that yield approximations, not exact figures;
- Dependent on understanding links from management changes to changes in natural processes and environments;
- Dependent on understanding links from natural processes to human welfare: valuation can incorporate uncertainty and risk, but does not remove it; and
- Restricted to values that derive from individual human preferences: it does not cover “intrinsic” values of nature, or “social values” unrelated to individual preferences and choices.

Furthermore, its use in this tool is limited to the specific analysis of changes in selected ecosystem services resulting from conservation measures taken at sites. Therefore the process described in this tool does not take into account all the broader socio-economic impacts on local economies and employment associated with designated and maintaining Natura 2000 sites. These broader impacts are already covered in the Tool developed by IEEP (IEEP 2009) and the impacts of increasing visitors to Natura 2000 sites is the subject of dedicated parallel analysis (BIOS in prep).

These points can make use of economic valuation contentious. However, provided they are kept in mind, valuation can be very useful, and this report is based on this understanding.

4 Economic Data Sources

Value transfer relies on interpretation of primary economic valuation studies. The project resources will not enable a comprehensive value transfer database to be established. However, in compiling the case studies we will utilize a significant proportion of the existing literature and the interpretation of these studies will provide a resource for future users of the tool. In future applications, users will need to supplement these data with studies undertaken since the tools publication and in areas not covered by the tool but of relevance to their case.

Some expected complications and variations in the data can be anticipated as a focus for sensitivity analysis. The following parameters (IEEP presentation, 2010) are identified as particularly relevant in value transfer for Natura 2000 sites:

- Wealthier individuals tend to have a higher willingness to pay (WTP) whether for recreation or to pay for species protection or access to sites.
- The value of water purification and provision depends inter alia on how many people benefit from these services in neighbouring cities or towns.
- The value of a protected area for flood protection depends on the level of risk, how the protected site can mitigate it, and what the economic and other assets at risk are.
- The value of carbon sequestration and storage on the other hand relates mainly to the physical processes of the site and the value of carbon

Several of these factors need to be interpreted in the light of specific information for each Natura 2000 site.

As is mentioned in the report 'Costs and Socio-Economic Benefits associated with the Natura 2000 Network' (IEEP, GHK & Ecologic, 2010), an approach which facilitates identification of the different stakeholders consists of evaluating the costs and benefits according to different land use types (e.g. agricultural, forests, marine). This allows to further narrow the analysis to certain ecosystem services provided by a land use type (e.g., flood protection from wetlands). In this way, the complexity of the tool and of the messages to be communicated are reduced. On the other hand, considerable attention should be given to the risk this approach brings providing an incomplete picture and biasing the comparison. However, such a complexity reducing approach allows to the study to efficiently identify the important ecosystem services from conservation measures at a site, which is in line with the specific communication goal of this study.

STEP 4 – identify the people affected

- *Identify relevant affected population*
- *For each impact in the area over which impacts occur (e.g. within site boundary, downstream river catchment, tourism locations),*

Based on Step 3, assess the number of people affected by the conservation measures. This is an important step because the number of people affected, and therefore the resulting values, can vary through several orders of magnitude. For different ecosystem services, the number of people that are relevant to the impacts can differ. For each ecosystem service change (recorded in Table 6) identify the number of people affected directly (e.g. population in the water catchment, farmers in the site), or indirectly (e.g. non-users in relation to loss of biodiversity).

The people affected may consist of **users** (local residents; visitors; people downstream consuming food, water, renewable energy, flood protection; the global population benefiting from carbon sequestration) and **non-users** (those holding non-use values, where that is likely to be a significant concern). For larger sites, populations may differ for different areas – for example some parts may be used for recreation and others not –. It may be useful in such cases to identify populations for sub-areas within the site.

If value transfer is used in Step 5, the key c**haracteristics** of the affected populations can be recorded under this step. Such characteristics might be the average income levels for affected populations, or distances from recreation sites. Often assumptions will be needed about these characteristics, such as that the income levels are the same as the national average.

As well as numbers of people, affected stakeholders can also be categorized such as:

- Businesses
- Purchasers
- People dependent on public utilities
- Customers
- Recreational users (walkers, bikers, fishing etc)
- Owners
- Government Agency
- Householders

- Local residents
- Interest groups.

The type and number of people affected can be recorded using Table 7, bearing in mind the considerations in Box 4.

Table 7. Template for presenting the scale or population affected

Change in Ecosystem Services	Affected area	Affected stakeholders	Quantification	Characteristics and assumptions
From Table 6			**NB: state units**	**e.g. average income levels**
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
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Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space

An important issue to note in this Step is that identifying the scale of impacts and the affected population has important links to calculation of monetary values in Step 5. The use of the ecosystem services framework is often limited by available scientific information to provide the data identified above. It is important that the best possible information is gathered from scientists and other stakeholders on these issues. Key assumptions should be noted for sensitivity analysis in Step 8.

Box 4: Considerations in analyzing the affected stakeholders

Define the affected population in terms of:

- Scale (marginal or non-marginal in comparison to the baseline).
- Who are the users or beneficiaries of ecosystem services?
- Who are likely to be the non-users with a positive value for the ecosystem services? Often not possible to know how large the non-user population is for a given good since this partly depends on the scale of the change in the provision of the good. However, assessment of the likelihood that they are significant is needed at this stage to progress with the rest of the analysis. Users may also have non-use values, in addition to their use values.
- The socio-economic characteristics of the user and likely non-user populations.

COMMENTS ON STEP 4

Insert text or type space

STEP 5 – valuation of ecosystem service changes

- *Select relevant economic value evidence*
- *Transfer values to changes in ecosystem services*

Step 5 contains the following sub-steps:

⇒ STEP 5 - 1: Identify market values for changes to ecosystem services

⇒ STEP 5 - 2: Identify non-market values for changes to ecosystem services

⇒ STEP 5 - 3: Collect evidence on value of changes to ecosystem services

In order to aid comparisons between the different impacts of conservation measures, monetary values should be placed on costs and benefits. Economic valuation of the changes to ecosystem services identified in Step 3 is based on the data that quantify changes. Valuation needs to place a monetary cost or benefit against a unit of that change. It then needs to aggregate those values for the potential measures being considered, and across the relevant scale of the change (e.g. area and/or population affected) (identified in Steps 3 and 4) and time. This aggregation takes place in Step 6.

Availability of monetary cost and benefit data is usually very different for market and non-market impacts (see 'Key Insights in Economic Valuation of Ecosystem Services' for a full explanation of these terms).

STEP 5 - 1: Identify market values for changes to ecosystem services

Provisioning services that produce resources that are sold in markets (e.g. fish production, crop yields), can be valued using market values (e.g. the typical cost per ton of these products. Market impacts can be considered in terms of the key activities that take place in Europe's rural environment that are dependent on ecosystem services, eg. :

- Agriculture
- Fisheries
- Waste water treatment and disposal
- Tourism and recreation

STEP 5 - 2: Identify non-market values for changes to ecosystem services

For services that do not produce market goods, other valuation approaches will be necessary. Non-market valuation approaches are described in the introduction to this part (Part II) of the tool. Applying these approaches is complex and requires either the input of an economist, or availability of existing published information in relation to the site. Once the different non-market valuation methods (applicable to each ecosystem service change) have been identified, it is necessary to select the relevant valuation evidence. There may be more than one relevant study or source of evidence, and it may be appropriate to use more than one to derive ranges for possible values.

STEP 5 - 3: Collect evidence on value of changes to ecosystem services

The information required in Table 8 allows an assessment of the range of values identified. Bearing in mind the issues described under Steps 5-1 and 5-2, the best available valuation evidence can be selected for use in Step 6. Where value transfer (see introduction to Part II) is carried out adjustments to the data can be analyzed and reported clearly using the Value Transfer Table shown in section 2 of the introduction to Part II.

Table 8. Template for presenting the economic value evidence for ecosystem service changes

Change in Ecosystem Services	**Description of impact (variables)**	Valuation method(s)	Unit Value(s)	Range(s)	Confidence	Notes
From Table 7	***From Table 6***					
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
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Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type	Insert text or type	Insert text or type

Change in Ecosystem Services	**Description of impact (variables)**	Valuation method(s)	Unit Value(s)	Range(s)	Confidence	Notes
				space	space	space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space

Once Table 8 is complete, it is necessary to reflect on the collective evidence to consider double counting risks, and interactions between different impacts, Any possible double counting, and other interactions between the changes in Table 8 should be recorded so they can be referred to when calculating costs in Step 6.

Example: if a stated preference survey result has been used to capture non-use values, this may also reflect market values, and if these are also measured separately they are at risk of being double-counted. It may be necessary to omit one or more service categories, if there is reason to believe that their value is captured through the valuation study(ies) used for another service.

Valuation is not always possible, for example because impacts cannot be quantified in Step 4, or because appropriate monetary values are not available. Therefore, important costs and benefits that cannot be given monetary values should be carried forward qualitatively into subsequent Steps (especially Step 7). The use of the ecosystem services concept to structure the analysis in this tool (e.g. to record the impacts of conservation measures in Table 6 in Step 3) helps to define which environmental impacts are not covered by monetary valuation, and to describe (qualitatively or quantitatively) the important ones for subsequent analysis.

COMMENTS ON STEP 5

Insert text or type space

STEP 6 – calculation of costs and benefits

- *Aggregate values of ES changes across relevant scale*
- *Highlight gaps in evidence*
- *Outputs: valuation results, indicative values*

Step 6 contains the following sub-steps:

⇒ STEP 6 - 1: Calculate value of changes to ecosystem services

⇒ STEP 6 - 2: Calculate the net value of changes to ecosystem services

The impacts identified in Step 3 need to be compared on a consistent basis to provide information to decision-makers. This step aggregates the values identified in Step 5, for the changes to ecosystem services (from Step 3), across the relevant people affected by the impacts identified (in Step 4).

STEP 6 - 1: Calculate value of changes to ecosystem services

When impacts have been valued in Step 5, monetary values for the change in services can be calculated. Important impacts that do not have monetary terms should be noted for Step 7, where they can be described in other units from Steps 3 and 4.

For changes to flows of ecosystem services over time, this produces a calculation to estimate annual costs (e.g. €/yr × impact/yr), over the appropriate aggregation scale (e.g. area of habitat or number of people affected). Aggregation has three dimensions:

i. Summing each impact across the relevant **number of people and/or scale**. Spatial measures (e.g. ha or km^2) will be used to express the value of impacts (i.e. € per ha or km^2). The people affected can be the number of businesses, households or individuals (from Table 7 in Step 4). When aggregating over populations, spatial variation in economic values (e.g. as a result of existence of distance-decay[3]) may need to be accounted for;

ii. Summing over the appraisal **time period.** The present value of costs should be calculated by applying discounting to make all costs and benefits comparable in present value terms. The time period used to consider the impacts on ecosystem services should be sufficient to capture significant impacts (see Section 3.4 in guidance) and should be at least 10 years, if possible 20 or 30 years. The examples in Annex B use a timescale of 20 years.

3 Distance – decay refers to the relationship between distance and economic values, in which the use value, and the user proportion within the population, declines with distance from the resource being valued. This is crucial for site-specific goods and services (Bateman et al. 2004).

iii. Summing the impacts of a measure **across the types of costs and benefits**. This can be done by summing impacts from different ecosystem service categories. The relevant units can be a measure of the environmental resource (e.g. like the number of fish);

Service flows, time horizons, and discount rates are explained in Box 5.

To ensure consistent comparisons, checks should be made that impacts are calculated in relation to the same type and extent of additional conservation measures, in terms of their requirements and their spatial extent, as identified in Step 2. All impacts also need to be assessed across the same time-frame (with values discounted as described in below).

Table 9 provides a template for this calculation for different services. Additional rows should be used for years in which the level of the service, the scale over which its impacts occur, and/or its unit value change. If necessary this can mean a row for each year over the time horizon. Different rows can also be used to account separately for impacts on different affected groups (of people). This can allow the distribution of impacts amongst different groups in society. Provided care is taken to avoid double-counting

The actual calculations requires a spreadsheet, since the values will differ from year to year due to the dynamics of the situation (see the case studies). Also the application of discounting will be facilitated with a spreadsheet.

Table 9. Template for calculating economic values for ecosystem service changes per year

Change in ecosystem service	Unit Value €/yr (a)	Scale/yr (b)	Annual value (a x b)	Time period
From Table 6	***From Table 8 – note unit should be the same as for change in ecosystem services***	***Area from Table 6, and/or People affected from Table 7***		***State years across which these impacts occur***
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space
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Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space	Insert text or type space

When analyzing changes to ecosystem services, it is likely that some changes will not be possible to value in monetary terms due to a lack of evidence, so this step needs to be treated with caution. Where data gaps and/or uncertainties are significant, aggregation of values can give a false impression of certainty and comprehensiveness. Therefore, it may be more appropriate simply to report individual present values for different ecosystem service changes, alongside qualitative assessments of other (non-monetized) changes (see Step 7 below).

STEP 6 - 2: Calculate the net value of changes to ecosystem services

Summing the ecosystem services impacts identified in Table 9 will provide results in terms of the total additional benefits (gross benefits). To translate these into additional **benefits net of costs (net benefits)**, relevant costs will need to be deducted. This is shown in Table 10. Costs for conservation measures will need to be calculated relative to the same baseline (Step 2) and assumptions (e.g. people affected) shown in Table 10.

The costs may be **straightforward** to assess, e.g. where they are known from existing interventions in habitat management. They also may be extremely **complex** , e.g. when the measure is still in its planning phase or when the time for management of conservation measures is not separately accounted.

Table 10 Template for calculating net value of ecosystem service changes

Ecosystem service	Discounted value of impacts across time horizon
From Table 4	
Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space
Insert text or type space	Insert text or type space
Total value of service changes	
Costs	the additional costs of the new management intervention or project, other than any ecosystem service costs accounted for above
Net present value	sum of benefits, minus costs

Based on the calculations, the impacts need to be summarised for decision-makers. To feed into the reporting in Step 9, it is important to note:

- Any significant gaps in evidence. Where impacts have not be given monetary values in Step 5, they should still be described in other terms as identified in Step 3. Even if they cannot be measured, gaps in the evidence on impacts should be included alongside the other results from the tools above when presented to decision makers.
- The level of confidence in the results.

- Key assumptions used, so they can be considered under sensitivity analysis in Step 8.

Box 5: Flows of Services, Time Horizons and Discounting.

Flows of Services: The habitats and ecosystems with Natura 2000 sites can be described as natural capital, giving rise to a flow of ecosystem services creating benefits for humans. Changes to ecosystem services as a result of new conservation measures can be thought of as changes to the flows of benefits from those services over time. These flows of benefits are things that accrue to people at particular points in time. This approach does not cover the intrinsic or moral value of Natura 2000 sites (but it does cover non-use values held by individuals) – but such considerations are outside the scope of standard economic analysis, and of this tool.

Time Horizons need to be specified for the analysis, and applied consistently to the analysis of different costs and benefits. For those using the tool, we suggest timescales for assessment of between 25 years and 100 years. Relevant considerations in the choice of time horizon are:

- The level of certainty about future changes to a site;
- Uncertainty over impacts on businesses (which are difficult to predict more that 10 years ahead);
- Longer time scales that capture a greater value from ecosystem services which can be sustained over time.

For new conservation measures, costs may be up-front, whereas ecosystem services benefits may not arise immediately (requiring an improvement in the state of the ecosystem) and then persist. Discounting at UK government rates of 3.5% (see HM Treasury 2003) means that a benefit of £1m in 100 years' time is worth just £50,000 in present values. This means that the error involved in truncating appraisal at 100 years will in most cases be acceptable, however this needs to be considered on a case-by-case basis.

Discounting aims to estimate the cost or benefit within each year, accounting for the profile of costs and benefits over the time horizon, and to apply discounting to make all costs and benefits comparable in present value terms (for example, reported in values for the year of analysis). The value of impacts should be converted to present value terms using EU guidance on discount rates; this is most easily done using a spreadsheet. Discounting practices are constantly under discussion (for example, in TEEB) and it is possible to justify different discount rates for different time periods (e.g. using lower rates for time periods further into the future). A net present value (NPV) for the overall option may be calculated. Here 'net' simply means benefits minus costs, and 'present' means that these have been discounted back to present value terms.

COMMENTS ON STEP 6

Insert text or type space

STEP 7 – account for non-monetized impacts

- *Capture key non-monetized impacts to present comprehensive analysis to decision-makers*

It is essential to provide a detailed assessment of the environmental effects that cannot be given a monetary value (non-monetized). As discussed under Step 6, there can be significant uncertainties and data gaps involved in ecosystem services analysis. Where data do not allow monetary valuation of impacts, it is still possible to produce analysis of these impacts, which can be a useful input to decision-making.

The analysis should provide detailed assessment of the effects that cannot be given a monetary value. This can be quantitative or qualitative depending on data and knowledge available. The key point is to ensure that all impacts are covered in the reporting stage, and in particular to ensure that the fact that no monetary value has been applied does not mean that the value is zero.

Such as for the monetized impacts described in step 6, the key non-monetized impacts should be based on the identification of the scale of ecosystem services (in Step 3) and considerations of the people affected (in Step 4). They can be recorded in tabular form (structured according to different ecosystem services) in line with tables in preceding Steps. This helps checking for gaps and double-counting in the coverage of impacts.

Quantification of non-monetized impacts is preferable. Quantification facilitates better understanding of the relative scale of different impacts, and allows theoretical comparisons of relative value to monetized impacts, which can be developed during sensitivity analysis (Step 8). A description of the key non-monetized impacts is an important input to reporting in Step 9.

COMMENTS ON STEP 7

Insert text or type space

Part III

INTERPRETATION AND REPORTING

Part III consists of Step 8 and 9:

- In step 8 a sensitivity analysis is carried out to see how the results could change if the data or assumptions used are changed
- In Step 9 guidance is provided for final reporting.

STEP 8 – sensitivity analysis

- *Consider how the results could change if the data or assumptions used changed*
- *The key data and assumptions to be tested should identified throughout the work*

Step 8 contains the following sub-steps:

⇒ STEP 8 - 1: Identify key issues for sensitivity analysis

⇒ STEP 8 - 2: Consider sensitivity of results to changes in data or assumptions

The purpose of sensitivity analysis is to ensure that key assumptions and limitations are reported. The parameters and assumptions to be tested should be identified throughout the Steps of the tool. The scope and level of effort of sensitivity analysis is case-specific. The basic tasks of sensitivity analysis in economic appraisal or other analyses[4] are:

i) Identify the key issues for sensitivity analysis;

ii) Consider how results can change if the data or assumptions used changed; and

iii) Report the conclusions of the sensitivity analysis to decision-makers.

STEP 8 - 1: Identify key issues for sensitivity analysis

The identification of assumptions and issues that require sensitivity analysis is an ongoing consideration throughout the preceding Steps. It need not be restricted to the key issues that have been identified in this tool:

- The assumptions about the future baseline (Step 1) against which impacts are assessed, and/or
- The uncertainty concerning estimates of changes to ecosystem services (e.g. timing, magnitude and significance) (step 3), and/or
- The scale of impacts such as the affected populations (Step 4), and/or
- The economic value of the impacts (Step 5), and/or
- Factors affecting value transfer or other economic valuation techniques used (Step 5), and/or
- The choice of discount rate (in Step 6), and/or
- The potential significance of evidence for non-monetized impacts (Step 7).

[4] Note that general principles for sensitivity testing, such as those detailed in *The Green Book* (HM Treasury, 2003) guide those presented in this step.

STEP 8 - 2: Consider sensitivity of results to changes in data or assumptions

Analysis should assess the effect that different assumptions about key parameters have on the unit and/or aggregate estimates of the economic value of the costs and benefits. Simply, low-high value ranges can be developed for different impacts. If probabilistic information is available, for example confidence intervals from scientific or economic analyses, this should be used. Failing that, assumptions will be required.

As well as reporting on the key sensitivities and ranges, often it can be useful to conduct **'switching analysis'**. This tests how high or low specific data (e.g. values or affected populations) would have to be in order to become more significant than other impacts, or in order to change sign for the whole 'bottom line'.

Sensitivity analysis can be applied to the **choice of discount rate**, but the reasons for possible use of different discount rates must be clearly stated. One such reason could be the very long term nature of changes to ecosystem services. Where the costs of a measure are up-front, the benefits occur much later. It can be useful to explore how low a discount rate needs to be in order for the measure to show a net benefit (positive net present value).

Impacts that cannot be expressed in monetary terms, analysed in Step 7, can also be subject to sensitivity analysis. For non-monetized impacts, sensitivity analysis can look at what the values of non-monetized impacts would have to be before they would impact on the 'bottom line' result. If the required values area not realistic, then the lack of monetary values for the issue in question is unlikely to be affecting the result on its own. This should not be the way of covering non-monetized impacts: they should still be written up separately (Step 7), and reported in Step 9.

The results of sensitivity analysis should be made clear during reporting (Step 9).

COMMENTS ON STEP 8

Insert text or type space

STEP 9 - reporting

- *Present results for decision-making*
- *Be clear on data gaps*
- *Ensure key assumptions and limitations are reported*

Transparent reporting is essential for informing decision-makers of the likely accuracy of the evidence provided. The calculation steps and the present value (the total value discounted over time) for each ecosystem service should be reported, as shown in the case studies in Annex B.

Net present values (the difference between discounted costs and discounted benefits) calculated from Table 10 may be presented for each conservation measure separately, Presenting ranges of results, and the number of significant figures used should be considered to reflect uncertainties in the calculations. Non-monetized changes should be fully reported.

Particular care should be taken to report uncertainties and caveats in some detail. Key points include:

- Assumptions and uncertainties about the impacts of management changes on ecosystem services: timing, magnitude and significance;
- Assumptions and uncertainties about the estimated number of people affected by different impacts;
- Assumptions and uncertainties about the transfer of economic values or functions;
- The potential significance of non-monetized impacts;
- Potential significance of key missing data, and
- Broad caveats associated with the resulting value estimates.

While reporting you should review the key issues from each of the preceding eight Steps. Providing a transparent account of the analysis demonstrates whether it has been undertaken in a thorough manner, and enables the results to be subjected to scrutiny and peer review (either formal or informal). Reporting should reference sources of data, justify assumptions and describe calculations of economic values.

Those conducting the analysis should communicate with decision-makers to ensure the results are presented as helpfully as possible. The analysis may not always produce 'clean' results demonstrating net benefits from conservation measures, for example because of lack of evidence or sensitivity of the results to the discount rate chosen. A higher discount rate may lead to short-term market benefits to current generations being assessed as greater than longer-term benefits from restoring ecosystems, despite the longer-term advantages of maintaining Natura 2000 sites to future generations.

COMMENTS ON STEP 9 Insert text or type space

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Annexes

Annex A: Template for economic valuation of conservation measures in protected areas

NATURA 2000 SITE	**Name & Country :** **Natura 2000 number :** **Biogeographical region :** **Surface (ha) :**	
Site description	**[insert text]**	**[insert picture from Google earth]**
Impression	**[insert representative picture]**	
Managing Authority	**[insert text]**	
Threats	**[insert text]**	
Conservation objectives	**[insert text]**	
Main conservation measures	**[insert text]**	
Selection of conservation measures and ecosystem services	**[insert text]**	
Contact person who participated in the case study	**[insert text]**	

Summary of economic valuation	Ecosystem service	Present value 2011 -2030 (€2010 prices)	Notes
	A. **[insert Ecosystem service]**	**[insert value]**	**[insert text + applicability marking:** green: high, orange: moderate, red: low confidence**]**
	B. **[insert Ecosystem service]**	**[insert value]**	**[insert text + applicability marking:** green: high, orange: moderate, red: low confidence**]**
	C. **[insert Ecosystem service]**	**[insert value]**	**[insert text + applicability marking:** green: high, orange: moderate, red: low confidence**]**
	D. **[insert Ecosystem service]**	**[insert value]**	**[insert text + applicability marking:** green: high, orange: moderate, red: low confidence**]**
	E. **[insert Ecosystem service]**	**[insert value]**	**[insert text + applicability marking:** green: high, orange: moderate, red: low confidence**]**
	… **[insert Ecosystem service]**	**[insert value]**	**[insert text + applicability marking:** green: high, orange: moderate, red: low confidence**]**
	X. **[insert Ecosystem service]**	**[insert value]**	**[insert text + applicability marking:** green: high, orange: moderate, red: low confidence**]**
	Net Value of conservation measures analysed	**[insert value]**	**[insert text + applicability marking:** green: high, orange: moderate, red: low confidence**]**
	Key non-monetized impacts	**[insert text]**	
	Sensitivity Analysis	**[insert text]**	
Summary	**[insert text]**		

CONSERVATION MEASURE 1	[insert Name of Conservation Measure]	
A. ECOSYSTEM TYPE	[insert text]	
B. DESCRIPTION OF CONSERVATION MEASURE(S)	[insert text + picture(s) if relevant]	
C. COSTS of CONSERVATION MEASURES	[insert value]	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	A. [insert Ecosystem service]	B. [insert Ecosystem service]
E. CHANGE in ES	[insert text]	[insert text]
F. AFFECTED AREA	[insert value]	[insert value]
G. AFFECTED PEOPLE	[insert value]	[insert value]
H. CHARACTERISTICS OF AFFECTED PEOPLE	[insert text, if relevant]	[insert text, if relevant]
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	[insert text]	[insert text]
J. MARKET or NON-MARKET VALUES	Market value/ Non Market Value	Market value/ Non Market Value
K. VALUATION METHOD	[insert text]	[insert text]

L. VALUATION	[insert value]	[insert value]
Present Value	[insert value]	
SOURCE	[insert references]	
M. CONFIDENCE	[insert text]	
N. KNOWLEDGE GAPS	[insert text, if relevant]	[insert text, if relevant]
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	[insert text, if relevant]	[insert text, if relevant]

Annex B. Ecosystem services affected by conservation measures.

Current state	Associated conservation measures	Affected ecosystem services (important change to be expected)	Impact // significance
Forests (Annex I HD: FORESTS)			
Locally absent due to deforestation in the past	Afforestation (of agricultural land, of mountain slopes)	• Cultural services	👍
		• Climate regulation	👍
		• Water regulation	👍
		• Water purification	👍
		• Air quality regulation	👍
		• Erosion control	👍
		• Avalanche control	👍
		• Food production	👎
Degraded due to presence of non native pine woods (planted in the past for economic reasons)	Deforestation of pine forests and replacing with deciduous forests	• Cultural services	👍
		• Pollination	👍
		• Maintaining genetic/species diversity	👍
		• Timber production	👎
		• Water regulation	👍
Degraded due to economic exploitation (eg no dead wood)	Application of sustainable forestry management measures	• Cultural services	👍
		• Timber production	👎

Current state	Associated conservation measures	Affected ecosystem services (important change to be expected)	Impact // significance
Degraded due to presence of invasive species	Invasive species control (eliminating invasive species, re-plantating with native species, demonstration projects, …)	• Maintaining genetic/species diversity	
		• Pollination	
		• Cultural services	
Degraded due to fragmentation (roads, croplands, urbanization, …)	Change of land use: realization of green corridors with patches of forest throughout agricultural and urbanized areas	• Maintaining genetic/species diversity	
		• Pollination	
		• Cultural services	
		• Food production	
		• Timber production	
		• Climate regulation	
		• Water regulation	
		• Water purification	
	Realisation of ecoducts	• Maintaining genetic/species diversity	
		• Cultural services	
Wetlands (Annex I HD: RAISED BOGS AND MIRES AND FENS, also humid grasslands, also freshwater habitats)			
Humid grasslands have been drained for intensive agriculture or transformed to cropland	Stop artificial drainage Increasing surface and/or groundwater levels Transform cropland to semi-natural grassland	• Cultural services	
		• Food production	
		• Water regulation	

Current state	Associated conservation measures	Affected ecosystem services (important change to be expected)	Impact // significance
		• Water purification	
		• Maintaining genetic/species diversity	
Dry grasslands have been irrigated for intensive agriculture or transformed to cropland	Stop irrigation Transform cropland to semi-natural grassland	• Cultural services	
		• Water regulation	
		• Food production	
		• Maintaining genetic/species diversity	
Degraded due to non sustainable agricultural practices	Agri-environment schemes (mowing, grazing, reduced application of fertilizers and pesticides)	• Cultural services	
		• Water regulation	
		• Food production	
		• Maintaining genetic/species diversity	
		• Water purification	
Wetlands (Annex I HD: RAISED BOGS AND MIRES AND FENS, also humid grasslands, also freshwater habitats)			
Natural flood prone areas are isolated from the river by dike systems and used for other land uses (agriculture, recreation, urbanisation, …)	Restore connection with the river (might be in a controlled way) in non-built areas and avoid building in flood prone areas	• Water regulation	
		• Storm damage control	
		• Food production	
		• Maintaining genetic/species diversity	
		• Water purification	

Current state	Associated conservation measures	Affected ecosystem services (important change to be expected)	Impact // significance
		• Cultural services	👍
Drainage of bogs and fens	Stop draining and restore original groundwater levels	• Climate regulation	👍
		• Maintaining genetic/species diversity	👍
		• Cultural services	👍
		• Water regulation	👍
Rivers and lakes (Annex I HD: FRESHWATER HABITATS			
Silting up along eroded river banks	Measures to halt erosion (fencing to prevent uncontrolled grazing, stabilizing structures, …)	• Erosion control	👍
		• Water regulation	👍
		• Maintaining genetic/species diversity	👍
Fish barriers in rivers	Fish passage installation	• Maintaining genetic/species diversity	👍
		• Food production	👍
		• Cultural services	👍
Rivers disconnected from winter valley	Improving and restoring natural relationships between river and adjacent valley	• Cultural services	👍
		• Water regulation	👍
		• Water purification	👍
		• Maintaining genetic/species diversity	👍

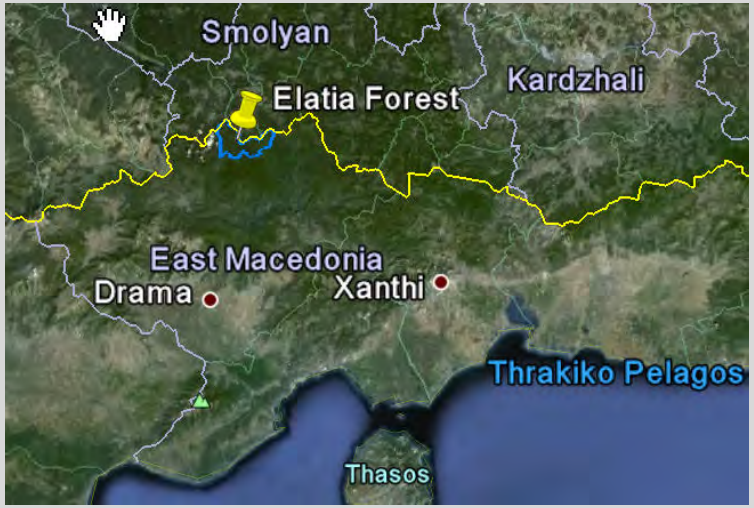
Current state	Associated conservation measures	Affected ecosystem services (important change to be expected)	Impact // significance
		• Storm damage control	👍
Spawning and nursery grounds physically degraded	In stream habitat improvement works to restore spawning and juvenile habitat	• Maintaining genetic/species diversity	👍
Water quality insufficient	Implementation of strict regulatory framework to prevent and solve emission of pollutants into the rivers Construction of water purification plants	• Water purification	👍
		• Maintaining genetic/species diversity	👍
		• Cultural services	👍
Degraded due to over-exploitation from netting and angling	Regulations to halt overexploitation eg. purchase or lease of fishing rights	• Maintaining genetic/species diversity	👍
		• Cultural services	👍 👎
		• Food production	👍 👎
Disturbed due to invasive species (fish, plants, …)	Invasive species control (eliminating invasive species, re-plantating with native species, demonstration projects, …)	• Maintaining genetic/species diversity	👍
		• Cultural services	👍
Coasts and estuaries (Annex I HD: COASTAL AND HALOPHYTIC HABITATS)			
Degradation of natural flood defense (eg. shell banks, shallow sand banks, non built beaches, broad dune areas – see below)	Preservation and restoration measures	• Cultural services	👍
		• Maintaining genetic/species diversity	👍
		• Storm damage control	👍
		• Food production	👍
		• Biochemicals and	👍

Current state	Associated conservation measures	Affected ecosystem services (important change to be expected)	Impact // significance
		pharmaceuticals production	
Dunes (Annex I HD: COASTAL SAND DUNES AND INLAND DUNES			
Degraded due to forestation (often with pine trees)	Deforestation and restoration of natural dune grasslands	• Maintaining genetic/species diversity	
		• Cultural services	
		• Air quality regulation	
		• Climate regulation	
		• Pollination	
		• Water regulation	
Degraded due to fragmentation	Connect dune areas wherever possible	• Cultural services	
		• Maintaining genetic/species diversity	
Degraded due to disturbed groundwater system	Regulate groundwater use	• Water regulation	
		• Maintaining genetic/species diversity	
		• Cultural services	
Heath and scrub (Annex I HD: TEMPERATE HEATH AND SCRUB, SCLEROPHYLLOUS SCRUB (MATORRAL)			
Abandoned heath and scrublands get overgrown with forest	Remove trees Install historical extensive grazing regimes	• Maintaining genetic/species diversity	
		• Cultural services	
		• Wild fire mitigation	

Current state	Associated conservation measures	Affected ecosystem services (important change to be expected)	Impact // significance
		• Air quality regulation	
Degraded due to fragmentation	Change of land use: realization of green corridors with patches of heath/scrub throughout agricultural and urbanized areas	• Maintaining genetic/species diversity	
		• Cultural services	
		• Food production	
	Realisation of ecoducts	• Maintaining genetic/species diversity	
		• Cultural services	
Rocks and caves (Annex I HD: ROCKY HABITATS AND CAVES			
Degraded due to disturbance (visitors)	See below 'Measures applicable to all ecosystem types'		
Measures applicable to all ecosystem types			
Degraded due to too small population of key species or disappearance of key species	Species recovery programmes Species re-introduction	• Cultural services	
		• Maintaining genetic/species diversity	
Degraded / disturbed due to tourism and recreation	Zonation measures, prohibiting access to sensitive areas, access infrastructure, awareness raising	• Cultural services	
		• Maintaining genetic/species diversity	
Threatened by climate change (extreme weather conditions eg. droughts)	Shift to more drought resistant species, measures to retain water, ….	• Cultural services	
		• Maintaining genetic/species diversity	
		• Climate regulation	

Current state	Associated conservation measures	Affected ecosystem services (important change to be expected)	Impact // significance
		• Water regulation	
		• Erosion control	
Threatened by changing land use (economic developments, urbanization, transport infrastructure) and/or energy developments (wind farms, hydropower stations)	Development, application and control of strict legislative framework Careful process to decide upon most suitable locations	• Cultural services	
		• Maintaining genetic/species diversity	
		• Climate regulation	
		• Water regulation	
		• Erosion control	
Decline in habitat surface due to changed land use in the recent past (economic developments, recreational resorts, urbanization, transport infrastructure)	Realization of additional habitat	• Cultural services	
		• Maintaining genetic/species diversity	

Annex B: Case studies

NATURA 2000 SITE	Name : **ELATIA FOREST** (Periochi Elatia – Pyramis Koutra) – **GREECE** Natura 2000 number : GR1140003 Biogeographical region : Mediteranean Surface : 7441,1 ha
Site description	The site is located in the north of Greece and is bordering Bulgaria. It is located in the Rhodope Mountains. The site is mainly covered by woodland (78% coniferous, 11% broad-leaved deciduous). Spruce forests (Acidophilous Forests Vaccinio-Piceetea, 9410) are the habitat type with the highest coverage (38%). About 5% of the site is covered with bogs, marshes and fens. Only about 2% of the site is grasslands. Important indicator species for the health of the ecosystem are Capercaillie (*Tetrao urogallus*) and Brown bear (*Ursus arctos*). In the south of the site there is a forest village with facilities for forest workers (bedrooms, restaurant, toilets etc) and managed by the local Forest Service of Drama. Additionally there are information signs on roads/places, information maps and leaflets, and self-guided paths. However due to the very remote location of the site visitor numbers are very low.  **Map** *(on Google Earth, from Natura 2000 Viewer)*

Impression	
Managing Authority	There are two stakeholders for management of the site: the Managing Authority of Rhodopi Mountain Range (Natura 2000 site and proposed National Park) and the local Forest Service of Drama. The first is responsible for biodiversity protection in the whole protected area of the Greek Rodopi and the second stakeholder is responsible for forest management.

Threats	Current threats: overexploitation and fragmentation due to forestry activities. Expected pressures: infrastructure development, uncontrolled tourism, wind farm development
Conservation objectives	A management plan is in place for the Rhodopi Mountain Range. No specific assessment of the conservation status of the protected habitats and species has been carried out yet. According to a recent research study (Grigoriadis et al. 2010) the dominant spruce habitat (nature 2000 code: 9410) is characterized as 9.1% favourable status, 66.7% unfavourable-inadequate status and 24.2% infavourable-bad status. The conservation objectives and subsequent actions in the site are part of the broader action plan for biodiversity protection for the whole Greek Rhodopi Mountain Range. The main conservation objectives are the restoration of the ecological values of the forests, grasslands and peat bogs.
Main conservation measures	• Sustainable forest management (SFM) • Grassland management (preserving high nature value grasslands against succession by forests) • Peat bog conservation/restoration
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • SFM as this is the main conservation measure (taking into account a 90% coverage of forests); SFM in this site involves managing the forests in line with Forest Stewardship Council (FSC) requirements for sustainable forestry; important changes to ecosystem services associated with this conservation measure are ***ecotourism/recreation**, **genetic/species diversity, timber production**, **climate regulation*** (carbon sequestration), ***food production*** and ***amenity/cultural value*** (of agricultural landscape preservation). • Grassland management; due to land abandonment some high nature value (HNV) grasslands are under pressure of succession by scrub and forests; therefore grazing by cows is supported; highly relevant ecosystem services associated with this conservation measure are ***food production*** and ***landscape amenity values*** • Peat bog conservation is an important part of the ***genetic/species diversity*** ecosystem service at the site, it will also act as a carbon store. However, its conservation is not judged to be resulting in significant change to other ecosystem services.
Contact person who participated in the case study	Dr. Nikolaos.S.Grigoriadis, Research Scientist, Forest Research Institute (FRI, www.fri.gr), National Agricultural Research Foundation (NAGREF); grig_nick@fri.gr. Technical support by several practitioners and specialists : Dr Panagiotis Platis (researcher at Forest Research Institute of Thessaloniki), Satvros Kehagioglou (forester at Forest Service Drama), Fanis Karabatzakis (consultant at Hunting Federation of Macedonia and Thrace)

Summary of economic valuation	Ecosystem service	Present value 2011 - 2030 (€2010 prices)	Notes
	I. Ecotourism and Recreation	0.446m	Low estimate based on travel costs
	II. Genetic/species diversity	-	Significant gap in benefits
	III. Fibre (Timber)	[- 1.03m]	Cost of reduced timber harvest
	IV. Carbon Sequestration	1.45m – 2.17m	Additional storage as a result of lower timber harvest, based on carbon valued at €17.2 – 39 (low) to €32-56 (high), per tonne for 2010 - 2030.
	V. Food	No change	May not change, as conservation measure is to redistribute grazing, not increase or decrease it.
	VI. Landscape and amenity	0.26m	Based on avoided loss of grassland to scrub for 10 years, thereby maintaining agricultural landscape.
	Costs	Unknown	Not expected to be significant
	Net Value of conservation measures analysed	**1.07 - 1.80**	**Partial valuation of ecosystem services. High uncertainty in several values used.**
	Key non-monetised impacts	Some important potential impacts are omitted from the valuation figures, e.g.: • Value of conserving genetic/species diversity, including of Greece's only upland peat bog. • Potential increased value to local economy from nature-based tourism as a result of improved condition of the site. • Long term value of avoiding future abandonment of traditional agricultural practices, which is likely without management measures. • Costs of management practices (other than reduced timber harvest) are not included, but they are expected to be modest (e.g. complying with FSC management standards can bring increased timber revenues; adjustments to grazing practices may bring some costs, e.g. fencing areas or subsidy payments).	

	Assessment of results and risk of double-counting	The result provides a valuation of some key ecosystem services of the sites, but there are significant gaps in terms of ecosystem service coverage and also cost information. The assessment covers the impacts of the conservation measures in different combinations according to the ecosystem services they produce (e.g. SFM results in carbon storage, but all the management measures contribute to genetic/species diversity). Therefore the risk of double counting is very low.
	Sensitivity Analysis	Using the travel cost method may significantly underestimate the value of recreation at Elatia. Doubling the transferred value for existing visitors increases the total value of recreation and ecotourism to €679,800. Alternative assumptions on the level of sequestration and value of carbon could change the overall value significantly (+/- 100% of net value). A sequestration level has been used from a research institute with good knowledge of the site, as this should reflect the best knowledge of site conditions, but it is high than some alternative levels. Alternative assumptions about the value of grassland (e.g. that higher % of site would be restored, or that per ha value is lower due to recent economic crisis) would not influence the conclusions significantly (+/- 10% of net value)
Summary	**The evaluation of conservation measures at Elatia Forest based on partial valuation of ecosystem services and partial calculation of costs suggest there are significant benefits that could result from implementing conservation measures. However, there is significant missing information on some aspects of visitor and non-use values, and some management costs. Key sensitivities in the analysis are the assumptions around carbon values. Other ecosystem service assumptions do not influence the scale of the result significantly.**	

CONSERVATION MEASURE 1	Introduction of sustainable forest and grassland management	
A. ECOSYSTEM TYPE	**Forests, grasslands, bogs**	
B. DESCRIPTION OF CONSERVATION MEASURE	A Special Management Plan has been prepared regarding site specific natural values e.g. threatened species. This plan was incorporated into the Forest Management Plan. Some additional measures are the introduction of bio-indicators in the forest management system concerning new aspects like dead wood etc., strengthening environmental attention for the forest as habitat and shelter for threatened species, and a better communication between foresters (Forest Service) and conservationists (Managing Authority) regarding forest measures and effective protection for important species.	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: • One-off costs (e.g. for infrastructural works): € not known • Ongoing cost (e.g. for maintenance works): € not known. • Expected life time: More than 20 years. Valuation based on 2012-2030. Total Additional Costs of conservation measures (One-off + ongoing): € not known, but other than reduction in timber revenues (see forests), not thought to be significant	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Ecotourism and Recreation**	**II. Genetic and species diversity**
E. CHANGE in ES	Improvement in condition of habitat and its attractiveness to visitors.	Improvement in condition of habitat and its preservation of biodiversity
F. AFFECTED AREA	7,041 ha Forest, 329 ha Grassland, 0.1 ha of peat bog.	
G. AFFECTED PEOPLE	Estimated 500 visitors per year. Average length of visit at least 2 days. Cultural festival held in the site is organized by “Sarakatsans” (herders from the past) and who are culturally connected with this landscape and the environment.	National and regional populations. 150 members of local nature NGO.
H. CHARACTERISTICS of	Access to the site is difficult due to its remoteness, so	Communities in remote rural area may have below average

affected people (e.g. income levels above or below average?).	visitors bear high travel and time cost to reach it. There is a cultural festival each year held in the site, but these visitors are not counted as site visitors.	incomes.
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Number of visitors, their value of each visit and their spending in local economy. Expert judgement that visitor numbers may double (to 1,000 visitors/yr) approximately.	Conservation status of site and protected species (e.g. Capercaillie, Brown Bear).
J. MARKET or NON-MARKET VALUES	Indirect market values of recreation benefits (travel cost method).	Valuation survey re: wetland Natura site (Birol et al, 2005) suggests that Greek population holds significant positive values (approx €15/respondent), but this cannot be transfer to Elatia.
K. VALUATION METHOD	Value transfer (see below) of indirect market values: Increase in value for current visitors and value for additional visitors.	
L. VALUATION	Increase in value for current 500 visitors per year of €12.5/day. Value for Additional 500 visitors per year of €19.2/day. Average length of visit 2 days (minimum). Annual value = €31,700	
Present Value (discount rate 3.5%)	Low Estimate: approximately €434,600 between 2012 and 2030.	
SOURCE	Value transfer from: Eleftheriadis, N (1996), see below.	
M. CONFIDENCE	Moderate - Low.	
N. KNOWLEDGE GAPS	Travel costs for visitors to Elatia	Evidence on non-use value for Greek forests.
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Study of visitor activity at Elatia.	Research into non-use values for protected areas/forests in Greece.

Assessment of Value Transfer: Study: Mount Olympos (MO) National Park (Eleftheriadis, N 1996). Policy Site: Elatia Forest Natura 2000 site.

Characteristic	Study (MO)	Policy Site (EL)	Match
The ecosystem services studied	Recreational value of forests in national parks and protected areas	Recreational value of forested landscape in protected area	Good.
The location / geography of the site	Mountainous area in Central Greece - accessible to large numbers of visitors	Mountainous area in Northern Greece, remote and abandoned, with low numbers of visitors	Poor, because of remoteness of EL in contrast to high visitor levels at MO
The change to the ecosystem services	Provision of access to the site	Enhancement of forest ecosystem	Poor, EL is an incremental change whereas MO values are for total value
The people affected	Unknown, but significant numbers of visitors, similar to MO.	500 visitors per year, estimated by expert judgement to increase to 1,000 wih favourable management. Average length of visit at least 2 days.	Satisfactory, although numbers very different, visitors travel costs are relevant factor
The available alternatives (substitutes) for the ecosystem service	Few, MO is unique site	Few in Greece, where site is only major national example of central European pine forest.	Satifactory, although for different reasons, both sites have unique selling points
Conclusion for Value Transfer	MO likely to significantly underestimate travel costs for small number of visitors to EL. MO value (€15, 1996 prices) inflated to give value to new visitors (€19.2, 2010 prices), and difference between MO value and non-protected area value (€2.5, (Kazana & Eleftheriadis, 1998)) = €12.5 1996 prices, inflated to €16.0, 2010 prices used for increase in value to existing visitors of improvements resulting from conservation measures.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

CONSERVATION MEASURE 2	Introduction of sustainable forest management (SFM)	
A. ECOSYSTEM TYPE	**Forests**	
B. DESCRIPTION OF CONSERVATION MEASURE	The principles of SFM are introduced, as well as the principles of the FSC certification scheme.	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: • One-off costs (e.g. for infrastructural works): € not known • Ongoing cost (e.g. for maintenance works): € not known. • Expected life time: More than 20 years. Valuation based on 2012-2030. Total Additional Costs of conservation measure (One-off + ongoing): € not known, but other than reduction in timber revenues, not thought to be significant.	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**III. Fibre**	**IV. Carbon**
E. CHANGE in ES	Current timber yield of 15,000 m^3 per year reduced by approx. 10% (-1,500 m^3). Timber species: Mainly Scots pine, spruce and less beech.	Increase in standing volume of timber by 1,500 m^3, and therefore of volume of stored carbon.
F. AFFECTED AREA	7,041 ha	7,041 ha
G. AFFECTED PEOPLE	Est. 150 foresters	Global Population.
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Local communities in of foresters in remote rural area may have below average incomes.	n/a
I. AFFECTED VARIABLES – units used to measure	Volume of timber m^3	Storage of greenhouse gases, 2.0 Tonnes of CO_2 eq per m^3 of timber (Stavros Kehagioglou, Forest Service of

change in ecosystem service		Drama, pers comm. August 2011)
J. MARKET or NON-MARKET VALUES	Market value	Non-market values.
K. VALUATION METHOD	Market price of forgone timber	Non-traded price of carbon
L. VALUATION	Timber valued at Est. €50 per m^3 Loss of 1,500 m^3 Implies lost revenue of €75,000 per year.	1,500 m^3 of timber, with 2 TCO_2 eq per m^3 = 3,000 TCO_2 eq. Carbon valued at €17.2 – 39 (low) to €32-56 (high) for 2010 – 2030.
Present Value	Mid: € - 1.03m	Low: €1.452m High: €2.175m
SOURCE	N.S. Grigoriadis pers comm., July 2011.	IEEP et.al. (in prep): DECC (2009), EC (2008), and Centre d'analyse stratégique (2009)
M. CONFIDENCE	Moderate, reduction in yield is an estimate. Analysis does not allow for possible increased timber values from certification/labeling as sustainably sourced timber.	Moderate. Rate of carbon sequestration is a European average.
N. KNOWLEDGE GAPS	Market for sustainably sourced timber – size and possible price premium.	Carbon cycle in forest management.
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Research sustainable timber market.	Research more detailed data relating to carbon storage in this forest type.

To convert to CO_2 equivalents the factor is 0.92 tonnes of CO_2 per m^3 of timber (European Commission 2001).

CONSERVATION MEASURE 3	Grassland management	
A. ECOSYSTEM TYPE	**Grassland**	
B. DESCRIPTION OF CONSERVATION MEASURE	The key conservation measures are grazing and mowing. In this way succession by forest is prevented.	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: • One-off costs (e.g. for infrastructural works): € not known • Ongoing cost (e.g. for maintenance works): € not known. • Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): € not known, but other than reduction in timber revenues, not thought to be significant.	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**V. Food provision**	**VI. Landscape and amenity**
E. CHANGE in ES	Maintain in grazing animals. Current stock of 500 animals.	
F. AFFECTED AREA	329 ha	
G. AFFECTED PEOPLE	5 Herdsmen. Other food provision: Est. 1,400 persons/year hunt in the woods, and they shoot wild boars (extracting about 2,800 Kg/yr of meat.).	Local, regional, national population
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities in remote rural area may have below average incomes.	Current budget crisis makes socio-economic parameters unpredictable.
I. AFFECTED VARIABLES –	Distribution of 500 grazing animals improved to avoid over-	Avoided loss of agricultural landscape, for a proportion of

units used to measure change in ecosystem service	grazing and under-grazing, therefore maintain grassland habitats. No change to provisioning service, but in the long term maintains traditional grazing practices, which otherwise are at risk of abandonement.	grassland that is currently undergrazed (assume half of site = 164.5 ha). This habitat would eventually revert to forest, but welfare losses assumed due to interim loss of landscape value for 10 years of scrub growth, and because traditional mixed landscape more highly valued than pure forest landscape.
J. MARKET or NON-MARKET VALUES	Market value	Non-market value.
K. VALUATION METHOD	Market price of meat	Value transfer of stated preference studies
L. VALUATION	No value as no change to production level (just redistribution of grazing)	Value of grassland €183/ha/yr (2009 prices) for 164.5 ha for 10 years.
Present Value		Mid: €271,000.
SOURCE		Ciaian & Paloma (2011)
M. CONFIDENCE		Low
N. KNOWLEDGE GAPS	Possibility to increase value of food by creating locally/ environmentally produced food labeling scheme.	Relative value of grassland compared to forest landscape and its value in maintaining mixed landscape.
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Assess if redistribution of grazing results in costs to graziers.	Research into non-use values for habitats.

Assessment of Value Transfer for grassland landscape: Study: EU Meta-analysis ←→ Policy Site: Elatia Forest Natura 2000 site.

Characteristic	Study Site (EU meta-analysis)	Policy Site (EL)	Match
The ecosystem services studied	Provision of grassland/ traditional agricultural landscapes	Provision of traditional grassland agricultural landscape	Good, similar agricultural landscapes.
The location / geography of the site	Agricultural areas of Greece.	Upland grasslands in otherwise forested landscape	Satisfactory, general similarity only.
The change to the ecosystem services	Maintenance of traditional grassland landscape	Conservation programme to prevent loss of grassland within forested landscape	Satisfactory, EL contains grassland within highly valued forest landscape.
The people affected	National population.	Local, regional and possibly national populations, depending on extent of non-use values.	Satisfactory, unclear if EL grassland is relevant to national population.
The available alternatives (substitutes) for the ecosystem service	Traditional agricultural areas with extensive substitutes on national scale.		Good
Conclusion for Value Transfer	EU values can be transferred, but with some uncertainty as they are relevant to more general agricultural landscapes.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

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NATURA 2000 SITE	Name : **HAAKSBERGERVEEN – THE NETHERLANDS** **Natura 2000 number : NL9801019** **Biogeographical region : Atlantic** **Surface : 592 ha**
Site description	The "Haaksbergerveen" forms the southern part of the habitat area "Buurserzand en Haaksbergerveen". The "Haaksbergerveen" is a relict of one of the raised bog areas on the border of the Netherlands and Germany. The reserve forms a transboundary reserve with the "Ammeloër Venn" in Germany [which is also a Natura 2000 area]. Main ecosystem types are wetlands, dominated by peat bogs (224ha), heath and scrub (112 ha) and forests and grasslands. After previous degradation, the reserve is now in a restoration phase. During the last few decades a network of dams was constructed in order to restore the necessary water tables to allow the fen-vegetation to recover.

Map *(on Google Earth, from Natura 2000 Viewer)*

Impression	
Managing Authority	Staatsbosbeheer is a governmental organization that manages the Haaksbergerveen site. They work intensively together with neighbours, local authorities and organisations in the region.

Threats	Current threats: • desiccation is the main threat • eutrophication • disturbance; tourists are encouraged to visit the recreational park nearby for recreational activities to limit the pressure on the park. Expected pressures:
Conservation objectives	Main objectives are: • Peat bog restoration • Keeping grasslands and heath in good ecological condition by means of extensive grazing (cattle, sheep) • Finding the balance between the recreational and ecological functions.
Main conservation measures	• Peat bog conservation/restoration. Many parts of the excavated peatbog are still in a building-up phase and need constant attention. In particular efforts to increase water retention are necessary (building dams) and to reduce external sources of eutrophication (buffer zone) • Visitor management • Extensive grazing
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • **Peat bog conservation/restoration**: half of the area will become peatbog; it is the main focus of the park management. Important ecosystem services associated with this conservation measure are climate change regulation (carbon sequestration), <u>water regulation</u> and <u>ecotourism/recreation</u> • **Visitor management:** to secure the restoration of the peatbogs, the management of the visitor flows and the area' access regulation is very important; the impact is assessed on the ecosystem service '<u>ecotourism/recreation</u>'.
Contact person who participated in the case study	• Roelof Heringa, Project manager & International affairs at Staatsbosbeheer (before District manager for, among others, the Haaksbergerveen area)

Summary of economic valuation	Ecosystem service	Present value 2011 -2030 (€2010 prices) Discount rate 3.5%	Notes
	A.Recreation	0.39m – 0.48m €	Rough estimations of the rise in visitor numbers, excluding non-use values.
	B.Water regulation	No information	
	C.Carbon Sequestration	No information	
	Costs	1.28 m €	Rough estimation of the costs of the past
	Net Value of conservation measures analysed	**-0,89 m – (-0,8m) €**	
	Key non-monetised impacts	**The non-use values are not monetized.**	
	Assessment of results and risk of double-counting	Recreation is the only ecosystem service for have sufficient information to valuate it. The valuation is based on Dutch values but the amount of visitors are estimations of the park management and not based on real numbers. As a result the confidence in the calculated values is moderate. We countered the problem of double-counting by not calculating the recreational value twice. The costs are partly an estimation of the park management and not entirely based on actual invoices.	
	Sensitivity Analysis	The range of the recreational value is not very big, so results are not very sensitive to changes in the estimation of visitors numbers. When the final version of this case study was already finalized, Roelof Heringa came up with a different estimation of visitors numbers. According to this latest estimation, the rise in visitor numbers was only 25% or 30,000 persons since the project of 2001-2003. This would change the net present value of the recreation benefits in 0.22 m €. The impact on the result would be minor as the net value stays negative. As both data were a guess and the benefits would not change much, we have used the first estimations.	
Summary	As most of the benefits could not be expressed in money terms, the net value resulted in a negative number. However, we estimate that if the ecological information would have been available, that this measure would have resulted in a positive net value, as literature reports that peat bog is very important in capturing CO2.		

CONSERVATION MEASURE 1	Peat bog conservation/restoration		
A. ECOSYSTEM TYPE	**Wetlands**		
B. DESCRIPTION OF CONSERVATION MEASURE	After 2000 a project was launched to stabilise the water levels in the different compartments in the peat bog area. The project started with a stakeholder-participation process in which the actual plan for the recreation was created by local stakeholders. Subsequently all measures were carried out in 2003 resulting in the removal of the sand roads, ditches, reconstruction of recreational routes for different types of users.		
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): • Construction of sand dykes: this was done in the past (approx. 1970-1995). Those figures are out of sight now. The sand dykes are constructed for the retention of the water. In that way the ideal circumstances are created for the peat bog to grow. Ongoing cost (e.g. for maintenance works): • Maintenance sand dykes: € 24,- / m'-> 1x /5 year maintenance for 1,000 m'. This results in 200 m' x € 24,- = 4,800 €/year • Removal of shrubs: 35.000 €/year Yearly maintenance cost: 39.800 € Total net present value: 0.58 million €		
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**A. Water regulation**	**B. Climate Change Regulation**	**C. Recreation**
E. CHANGE in ES	More stable discharge of water, decrease of flooding risk	Peat bog captures more CO2 than grassland	Changes in numbers of visitors
F. AFFECTED AREA	200 Ha of extra peat bog area	200 Ha	592 Ha (whole park)
G. AFFECTED PEOPLE	The local town, Haaksbergerveen	Global population	Tourists: visitor number is estimated at 80,000-100,000 per year (2007)

H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).			
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	m^3 water, flood risk	tCO_2 (tonnes of Carbon dioxide equivalent)	Number of visitors
J. MARKET or NON-MARKET VALUES	Market value	Market / Non-market value	Market value
K. VALUATION METHOD		Cost of abatement / Damage cost of carbon	Benefit transfer (original study: travel costs)
L. VALUATION	No quantitative information was found on the more stable discharge of water therefore this service is not been valuated	No information was available on the thickness of the peat bog. Therefore, it was not possible to valuate this service.	Since the beginning of the conservation measure in 2002 the park management estimates that visitor numbers have three folded. This means, a rise of about 54,000 – 67,000 persons at a value per visitor for the park of 0.49 EUR per visit (prices 2005 adapted to 2010)
Present Value			0.39 m€ - 0.48m €
SOURCE			- Values: Witteveen+Bos (2006), based on Van der Heide (2005) - Roelof Heringa, former park management
M. CONFIDENCE			Values are general values for The Netherlands, not specific for this site. The estimation of the rise in visitor numbers is a rough estimation made by the park management.
N. KNOWLEDGE GAPS	Ecological information on the discharge of water is missing.	Ecological information on the peat bog is lacking	

O. RECOMMENDATIONS FOR IMPROVING ACCURACY		Peat bog is said to capture a lot of carbon dioxide so efforts should be made to come up with the necessary ecological information to valuate this benefit in euros.	
P. REMARKS	• Water quality regulation is not submitted here because the peat bog is on a high location, above groundwater levels. So, no groundwater purification can take place. • Apparently, efforts have been done to estimate the thickness of the peat bog but it resulted to be very difficult and unsuccessful.		

CONSERVATION MEASURE 2	Visitor management planning (walking and horse trails)
A. ECOSYSTEM TYPE	**Wetlands**
B. DESCRIPTION OF CONSERVATION MEASURE	**Construction of trails for hikers, cyclists and bird watchers.**
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): • Construction trails: 400,000 € (part of the project 2001-2003) => prices of 2010: 435,735 € • Expected life time: 30 years • Ongoing cost (e.g. for maintenance works): • Maintenance plank path: 2,500 €/year • Maintenance trails(cycle routes, footpaths, bridlepaths): 4,200 €/year (material: 1,000 € + 3,200 € working hours) • Contribution to sheep flock: 11,000 €/year (real costs are much higher. Flock is mainly meant to prevent overgrowth on sand dykes, grazing of the bufferzone and wet heather areas) Total ongoing cost per year: 17,700 €/year Net present value of the total additional costs of conservation measure (One-off + ongoing): 435,735 + 260,364 = 696,099 € over a period of 20 years.
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	D. **Recreation**
E. CHANGE in ES	More visitors are expected because of the additional trails and it is expected that their valuation for the park will be higher.
F. AFFECTED AREA	592 Ha
G. AFFECTED PEOPLE	tourists

H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Number of visitors Value per visitor for the park, in € /person
J. MARKET or NON-MARKET VALUES	Market / Non-market value
K. VALUATION METHOD	Benefit transfer (original study: travel costs)
L. VALUATION	This is actually the same valuation as the recreation service under the first conservation measure. The rise in tourists was caused by the combination of the restoration of the peat bog and the construction of extra/better trails. The effect has to be divided over the two conservation measures. Calculating the benefits again here for 54.000-67.000 extra visitors would mean a double counting.
Present Value	Included in previous calculation of recreation
SOURCE	Witteveen+Bos, 'Kentallen Waardering Natuur, Water, Bodem en Landschap: Hulpmiddel bij MKBA´s', 2006 Roelof Heringa, Project manager & International affairs at Staatsbosbeheer
M. CONFIDENCE	
N. KNOWLEDGE GAPS	
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	
P. REMARKS	A Dutch study made a total estimation of all the ecosystem services of peat bog together. They came up with an average of 1.127 EUR per Ha. This would bring the global benefits for the Haaksbergerveen site at 620.000 EUR per year. On a 20-year term at a discount rate of 3,5% this is 9.1m €.

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NATURA 2000 SITE	Name1 : **HUMBER ESTUARY – UK** Natura 2000 number : UK90006111 (SPA), UK0030170 (SAC) Biogeographical region : Atlantic Surface : +/- 37000 ha
Site description	The Humber is the second largest coastal plain estuary in the UK, and the largest coastal plain estuary on the east coast of Britain. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. The range of salinity, substrate and exposure to wave action influences the estuarine habitats and the range of species that utilise them; these include a number of Annex 1 breeding birds, winter and passage waterfowl, river and sea lamprey, grey seals, vascular plants and invertebrates. Habitats within the Humber Estuary include Atlantic salt meadows and a range of sand dune types in the outer estuary, together with sandbanks which are slightly covered by sea water all the time, extensive intertidal mudflats, Salicornia and other annuals colonising mud and sand, and coastal lagoons. As salinity declines upstream, reedbeds and brackish saltmarsh communities fringe the estuary. The Humber Estuary has an average of 40,000 ship movements per year and its ports and wharves handle 14% of the UK's international trade, it is the country's largest port complex. Industrial interest alongside the estuary includes chemical works, oil refinery complexes and power stations.

(on Google Earth, from Natura 2000 Viewer)

Impression	
Managing Authority	Natural England - the state institute for nature protection. The site is a very large estuary system, 81km from one end to the other. There is no single organisation responsible for "managing" it as a whole. Natural England's role is that of statutory adviser on nature conservation on this site. As such, it advises other competent authorities (e.g. planning authorities) in carrying out their duties to ensure they meet the requirements of the Directive. Under the EMS Management Scheme for the site, the competent and relevant authorities do collaborate to identify management measures beyond their immediate responsibility.
Threats	Current threats: Intensive infrastructure development inc ports; port related industrial development; heavy and chemical industries; recreation and tourism; wind farm development; fishing; agriculture; wildfowling. Expected pressures: sea level rise
Conservation objectives	The Estuary has a set of Conservation Objectives produced by Natural England which detail the features of nature conservation interest, attributes and targets for the favourable condition of those interests. Natural England carries out regular condition assessment exercises to measure the current state of the interest features against the Conservation Objectives. The conservation objectives for the site relate maintaining the condition of the key coastal habitats present such as inter-tidal

	marshes and coastal dunes, and maintaining the ability of the site to support internationally important numbers of birds. The birds primarily use the site's inter-tidal habitat for feeding, but also rely on other habitats and land outside the site (e.g. for roosting during high tides). Therefore the conservation objectives in relation to birds relate not only to the maintaining inter-tidal habitats, but also maintaining sufficient roosting areas elsewhere in or adjacent to the site, and ensuring they are not subject to disturbance by commercial or recreational activities. The Humber Estuary is a UK European Marine Site (EMS) and thus has a Management Scheme established with the overall aim of "ensuring the Humber Estuary EMS and its associated features are maintained in 'favourable condition' for future generations to appreciate". The size of the site is extremely large, and so is not subject to a single site management plan, and much of the estuary is largely unmanaged. Management plans that are important to achieving these objective include: • The estuary's formal Flood Risk Management Strategy implemented through a shoreline management plan, that addresses the issues and implications of flood protection around the estuary for the next 50 years. These include habitat loss to 'coastal squeeze' which is addressed through habitat recreation through management realignment projects. • Environmental management is in place for some discrete areas, eg nature reserves and managed realignment sites within the site boundary. Some of the subtidal habitat is subject to dredging (a form of management) for commercial purposes.
Main conservation measures	• Managed realigments (amongst the largest in Europe) - Managed realigment is the moving back of hard flood defence banks so that previously terrestrial areas can be allowed to revert to intertidal. • Alteration of infrastructure development to minimize impacts on the sites features
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • Managed realigment as this is the main conservation measure; important ecosystem services associated with this conservation measure are food production, climate change regulation and water regulation. • Alteration of infrastructure development protects the site against deterioration and therefore preserves the current value of all the ecosystem services from the site. This benefit is measured as the Total Economic Value (TEV) of the site.
Contact person who participated in the case study	Tim Page, Conservation Adviser (Humber Estuary), Natural England, Northern North Sea Team, Marine Function. Natural England, 25 Queen Street, Leeds, LS1 2UN

Summary of economic valuation	Ecosystem service	Present value 2010 -2030 (€2010 prices)		Notes
		Low	**High**	
	I. Food production	4.30 m	40.16 m	Based on role of intertidal habitat as nursery area for commercial fish species.
	II. Climate regulation	1.02 m	2.31 m	Climate regulation: increased carbon sequestration in inter-tidal habitat compared to agricultural land management.
	III. Water regulation	39.57 m	39.57 m	Following realignment, the costs of maintaining the flood defence banks are lower, as they are less susceptible to erosion by wave action (due to buffering effect of increased intertidal habitat area).
	IV. All services	[0.59 m]	[1.19 m]	Covers all services, including non-use values of genetic/species diversity, amenity and cultural value, and risk it double-counts with services I – III. ***Therefore is not used to calculate net value***.
	Costs	7.79 m	7.79 m	Costs of engineering works plus opportunity costs of lost agricultural land
	Net value of conservation measures analysed	**37.10 – 74.25 m**		**Confidence in the lower estimate is higher.**
	Key non-monetised impacts	**Non-use values. Those for local population may be captured in valuation of all ecosystem services, but non-use values to national population are not covered.**		
	Assessment of results and risk of double-counting	Managed realignment is undertaken on part of the flood embankments at the site, but contributes to maintaining the whole site's condition. Several ecosystem services will be affected by this measure. It is only feasible to value three specifically. Changes to the value of biodiversity maintenance, cultural and spiritual services, and recreation opportunities are valued through transfer of a total economic value function ("all services"), but this has greater uncertainty. Larger values are identified through analysis of specific ecosystem services: - Food production: increased productivity is valued by transferring results from study establishing production function from saltmarsh habitat on the east coast of Scottish. The habitat involved is within a similar ecosystem (estuary system on the North Sea coast), and therefore judged to be similar		

		enough to support this transfer. Higher values can be identified, but the transfer of these is subject to greater uncertainty as the highest productivity will only occur under specific conditions. - Climate regulation: Values per tonne of carbon are taken from current research on ecosystem services from Natura 2000 sites (led by IEEP). - Water Regulation: This value attributes reduction in flood embankment maintenance costs to an area of saltmarsh buffering it from wave erosion. This function is actually dependent on the width of the saltmarsh, and the value used is for the broadest width of salthmarsh studied (and therefore the lowest per ha value). The TEV figure for the site is much smaller than the values for these services and also possibly double-counts them. Therefore it is not used to calculate the net value of the conservation measures.
	Sensitivity Analysis	The conclusions are very sensitive to assumptions about reductions in flood defence costs (water regulation) and the role of the intertidal habitat in fisheries productivity. The fisheries productivity high value is 10 times the low value, reflecting this sensitivity. There is only one value for flood defence benefits. If this value was reduced by 10 times, the measures would still produce net benefits, if it was halved, the net benefit would be > €15m (i.e. more than double the costs).
Summary	**The analysis of conservation measures captures the main ecosystem services, and suggests a strong net benefit from them. However, the net value is very sensitive to assumptions about reductions in flood defence costs and the role of the intertidal habitat in fisheries productivity. Modelling of these services for this site, rather than transfer of assumptions would significantly improve confidence.**	

CONSERVATION MEASURE 1	Managed realignment		
A. ECOSYSTEM TYPE	**Wetlands**		
B. DESCRIPTION OF CONSERVATION MEASURES	Managed realignment is undertaken on part of the flood embankments at the site, but contributes to maintaining the whole site's condition.		
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): engineering works: estimated €6.14 million, opportunity costs of agricultural land = approx €6,221/ha for 265 ha = €1.65m Ongoing cost (e.g. for maintenance works): possibly substantial cost savings each year; see Water Regulation ecosystem service (III below). Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): €7.79m		
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Food production**	**II. Climate Change Regulation**	**III. Water regulation**
E. CHANGE in ES	Fisheries productivity increased through larger habitat and nursery ground for fish	Increase or decrease in greenhouse gas sequestration/emissions depending on land type	Flood embankments less susceptible to erosion by wave action (due to buffering effect of increased intertidal habitat area).
F. AFFECTED AREA	265 ha	265 ha	265 ha of flood accommodation space, but contributes with a number of other flood control areas in providing lower pressure on embankments and flood protection to area surrounding floodplain
G. AFFECTED PEOPLE	Local and sub-regional fishers	Global population	Population at risk of flooding around estuary or reliant on infrastructure at risk

H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities with a higher dependence on fisheries = have incomes below national average.	n/a	Average income higher than average for the Government Office Region (Yorkshire and The Humber).
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Fisheries landings Stevenson identified catch of 54,426 tonnes in relation to 6040.9 hectares of saltmarsh, (average of 9 tonnes /ha/yr). Fonseca: 0.28 – 6.78 kg of bass ha saltmarsh surviving to age where they are minimum landing size within local fisheries	tCO_2 (tonnes of Carbon dioxide equivalent) Carbon savings (tCO_2, per year): Low: 2,506 High: 3,287	Length of flood embankment with lower erosion pressure.
J. MARKET or NON-MARKET VALUES	Market value of landings (Fonseca: minimum of €4.10 – & average of €6.38 /kg)	Market /Non-market value	Market value – costs of maintaining embankment
K. VALUATION METHOD	Transfer of production function (see table below)	Cost of abatement / Damage cost of carbon	Avoided sea wall maintenance costs
L. VALUATION	Stevenson: Low: €1,105 to Mid: €10,324 (high = € 21,134) ha/year = Total: €293,000 - €2,736,000 /year Fonseca: Low: €1.28 to Mid: €11.97 /ha/yr = Total: €86,813 – €808,628 /year	Carbon valued at €17.2 – 39 (low) to €32-56 (high) for 2010 – 2030. Total: €60,636- €119,143 per year Minus one-off carbon cost of €70,176-€193,722 due to emissions from construction activity.	€10,170/ha/year Total: €2,696,000/year
Present Value (3.5% discount rate)	Stevenson: Low: €4.30 m – Mid: €40.16 m (Fonseca: Low: €1.5 m - €13.5 m)	Low: € 1.019m High: € 2.312m	€39.57 m
SOURCE	Stevenson, J. (2001). Fonseca L. (2009)	DECC (2009), EC (2008), and Centre d'analyse stratégique (2009)	King, Susana E. & Lester, John N, 1995.
M. CONFIDENCE	Moderate, reflected by large range, but this is based low-mid values from source	Moderate. Valuation data is established but confidence in sequestration estimates	

	studies (high values cannot be applied to the site with confidence). The values from the Fonseca study look at productivity for just one fish species, so it is expected that they would be lower than those from Stevenson, which cover total fisheries productivity.	is moderate.	
N. KNOWLEDGE GAPS	Knowledge of production function: importance of habitat to fisheries productivity not known accurately.	Knowledge of bio-chemical functions supporting sequestration in inter-tidal zone.	Specific contribution of this particular flood controlled area often difficult to estimate (as flood prevention of densely populated areas is often realized by a combination of several flood controlled areas)
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Improved understanding of role of intertidal habitat in lifecycles of commercial fish species.	Modelling of siltation rates at the site (since carbon storage is partly dependent on deposits in silt).	Modelling of flood defence embankments maintenance costs and reduced flood risk, as a result of realignment.

Note: A recent study deals with a number of managed realignment case studies in England (Luisetti et.al. 2011). It covers all services including cultural, existence and genetic/species diversity values. The change in ecosystem services results from the avoiding the degradation of the site's conservation features by flood defences or other infrastructure development. This conservation measure contributes to the condition of the entire site (37,000 ha), but the impacts of development are restricted to much smaller areas. This valuation is based on preventing damage to an assumed area of 50 – 100 ha of saltmarsh. By means of value transfer from a stated preference survey the TEV was calculated (for the Humber case : €779.4/year = €38,970 - €77,940 /year, or a net present value of €0.59 - 1.19 m/yr). The confidence is moderate. The values are a good basis for value transfer, but the effects of development on the site are uncertain. An important knowledge gap is the specific nature of potential infrastructure development proposals (see 'Value Transfer for TEV' table below).

Assessment of Value Transfer for Food Production: Studies: Stevenson (2001) (s) and Fonseca (2009) (F). Policy Site: Humber Estuary Natura 2000 site.

Characteristic	Study (S, F)	Policy Site (H)	Match
The ecosystem services studied	S: Fisheries productivity from saltmarsh F: Fisheries productivity from saltmarsh for one fish species (bass)	Fisheries productivity from saltmarsh	Good
The location / geography of the site	S: Scottish saltmarsh, north/central North Sea F: Saltmarsh in Blackwater estuary, Essex, Southern North Sea.	Saltmarsh on Central area of North Sea coast	Satisfactory, in similar areas of North Sea. The exact position of the sites on their respective coastlines and therefore their fisheries productivity
The change to the ecosystem services	Increase in fish productivity due to nursery area function of the saltmarsh	Increase in fish productivity due to nursery area function of the saltmarsh	Good
The people affected	Fishing industry	Fishing industry	Good
The available alternatives (substitutes) for the ecosystem service	Other areas of saltmarsh around North Sea coastlines, which are reducing due to development and sea level rise	Other areas of saltmarsh around North Sea coastlines, which are reducing due to development and sea level rise	Good
Conclusion for Value Transfer	Basis for value transfer is good. The high figures in the S and F studies may be due to characteristics specific to those sites, and so valuation at H is based on the lower and mid range values.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

Assessment of Value Transfer for TEV: Study: Managed realignment case studies in England (Luisetti et.al. 2011) (L). Policy Site: Humber Estuary Natura 2000 site.

Characteristic	Study (L)	Policy Site (H)	Match
The ecosystem services studied	Mainly recreation and amenity, but reflects value of all services	All services	Good
The location / geography of the site	Intertidal saltmarshes along the east coast of England	Saltmarsh on central area of east coast of England	Good
The change to the ecosystem services	New habitat creation	Prevention of damage or destruction of saltmarsh	Satisfactory, value of destruction analogous to value of creation, but if habitat only damaged, value will be only a proportion of creation value
The people affected	Local population	Local population	Good
The available alternatives (substitutes) for the ecosystem service	Other areas of saltmarsh along coastlines	Other areas of saltmarsh along coastlines	Good
Conclusion for Value Transfer	Basis for value transfer is good. The figures in L are for complete loss of the habitat, so could overestimate the value of damage that partly reduces the value of H. As a result the figures are only applied to a small part (50 – 100 ha) of the site – as an estimate of the area that could either be lost (or equivalent to a large area that is damaged and loses part of its value) due to infrastructure development.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

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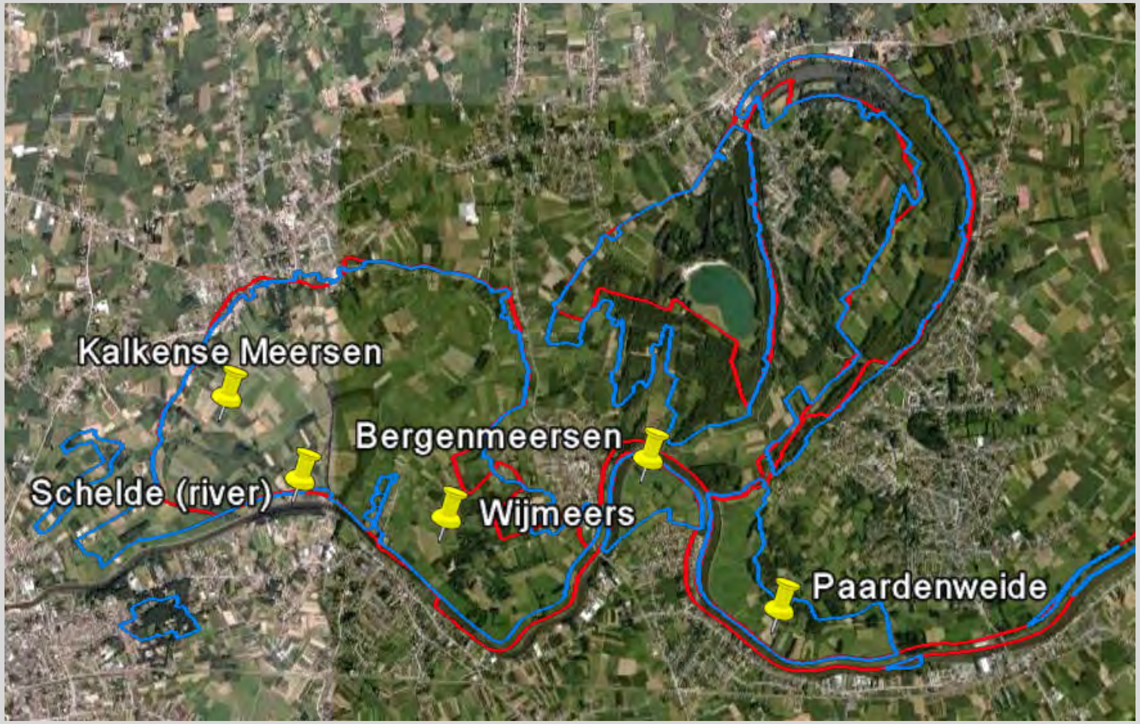
NATURA 2000 SITE	Name : **KALKENSE MEERSEN - BELGIUM** **Natura 2000 number : BE2300006 (SCI), BE2301235 (SPA)** **Biogeographical region : Atlantic** **Surface : +/- 1000 ha**
Site description	The cluster 'Kalkense Meersen' is part of the bigger SCI 'Estuary from Schelde and Durme rivers from the Dutch border until Ghent' (8957 ha) and the SPA 'Durme river and middle part of Scheldt river' (4190 ha) which both consist of a whole chain of smaller clusters along these rivers. In these clusters wetlands and estuarine habitats (tide dependant) are created within the framework of the Sigma Plan, a plan aimed at increasing safety levels (against flooding of the Schelde) as well as increasing nature (quantity and quality). The cluster Kalkense Meersen is one of the most strategic areas of the Schelde basin to buffer extreme highwater levels in a controlled way. Main habitat types are grasslands, marshes, intertidal mudflats, river dunes and forests.



Cluster Kalkense Meersen – SCI (blue), SPA (red) *(on Google Earth, from Natura 2000 Viewer)*

Impression	
Managing Authority	Cooperation between Flemish Department of Inland Waterways (construction of infrastructure necessary to realize floodplain restoration), Flemish Agency for Nature and Forestry and Natuurpunt (Natuurpunt is the largest Belgian NGO working on the protection of nature); Natuurpunt will implement some of the conservation measures
Threats	Current threats: intensive agriculture, too low groundwater levels, fragmentation of habitats, urbanization, pollution

	Expected pressures: once the floodplain restoration measures are realized, no new pressures are expected
Conservation objectives	The conservation objectives are aimed at restoring the original river landscape by means of wetlands restoration and restoration of estuarine habitats. Estuarine habitats in this area belong to the very rare types of freshwater tidal marshes with willow forest, reed and the rare Caltha palustris var. Araneosa. These habitats will become a vital part of the riverine ecosystem (purification, oxygenation, foraging). Behind de dykes, the objective is to restore diverse habitats that once were an integral part of the floodplain: grasslands, reedlands and alderforest. The scope of this habitat restoration is large (to Flemish standards) and aims to create enough habitat to restore populations of species as Corncrake (Crex crex) and Great Bittern (Botauris stellaris) (among others).
Main conservation measures	The main conservation measures are all measures related to the restoration of the original floodplain along the Schelde river. Important measures are the infrastructural works eg. overflow dikes, sluices, new ring dikes, removal of existing dikes, etc… Other measures are increasing the groundwater levels, restoring marshlands, avoiding external pollution, extensive grassland management, deforestation of poplar plantations and visitor management measures.
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • **Floodplain restoration**, as this is the key measure here; related ecosystem services are water regulation and genetic/species diversity. • Transformation from intensive grassland management to **extensive grassland management**; associated ecosystem services which are substantially affected are food production, genetic/species diversity and landscape amenity values. • **Water purification** (deviation of polluted water to a water treatment station instead of allowing entrance into the hydrological system of the Cluster Kalkense Meersen); selected related ecosystem services are genetic/species diversity and landscape amenity values.
Contact person who participated in the case study	Mr Dominiek Decleyre (dominiek.decleyre@lne.vlaanderen.be), Flemish Agency for Nature and Forestry

Summary of economic valuation	Ecosystem service	Present value 2011 -2030 (€2010 prices)	Notes
	I. **Water regulation (via CFA)** *from CRT and depoldering*	Min 9.1m max 23.51 m	Avoided damage costs through lower flood risk Based on 2 damage cost functions. Difficult to estimate the number of affected households.
	II. **Genetic/species diversity** *(via CRT and* **depoldering)**	5.5 m	Gain in non-use value through tidal ecotype (Control Reduced Tide) Based on a CVM study for the nearby Dender river.
	III. **Food production** *from wetlands*	-6.22 m	Decreased productivity of cattle (from 5 to 2 cows per ha) Based on the change in net value added for Wijmeers.
	IV. **Landscape/Amenity** *from wetlands*	2.13 m	Gain in landscape value through more biodiversity (especially flora) Based on the 'Natuurwaardeverkenner', a Flemish tool for valuation of ecosystem services .
	V. **Genetic/species diversity** *from clean water*	5.5 m	Gain in non-use value for biodiversity through non polluted Kalkense Vaart canal. Based on a CVM study for the nearby Dender river.
	VI. **Landscape & Amenity** *from clean water*	0.94 m	Gain in amenity value for cleaner water in the Kalkense Vaart. Based on a CVM study for the nearby Dender river.
	VII. **Costs**	11.98 m	
	Net Value of conservation measures analysed	**Min: 5 m€** **Max: 19,4 m€**	
	Key non-monetised impacts	Non-use values for local population and conservationists are captured for all ecosystem services, but not all national population is covered[1]. All changes in ecosystem services could be assessed with appropriate CVM data.	

[1] Only the conservationists in Flanders are taken into account, which represent 3,3% of the Flemish households. We assume that the site is in particular of great value for conservationists and that they show a real willingness to pay.

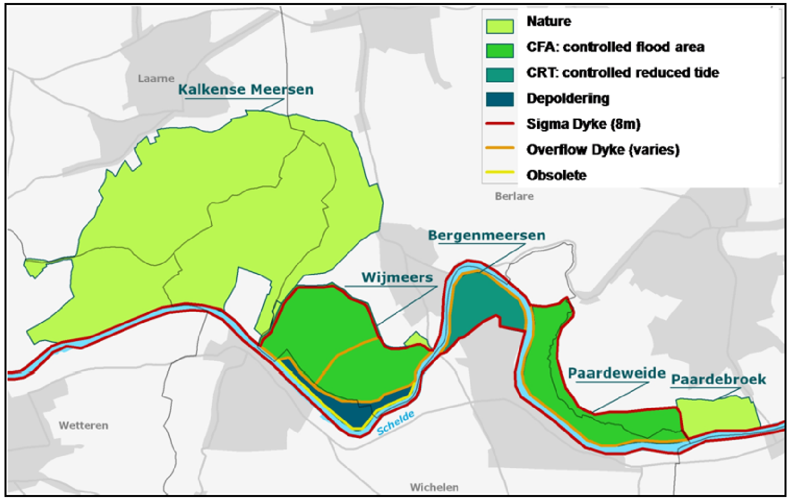
Assessment of results and risk of double-counting	The result provides a valuation of the key ecosystem services of the site, with decent valuation of costs and benefits. There is no risk of double counting as each conservation measure corresponds with a different area of the site (grasslands/wetlands, estuarine nature & inland waterways (Kalkense Vaart)). The following ecosystem services are analysed: - Food production: decreased productivity of cattle - Genetic species/diversity & Landscape and amenity value : valuation by transferring results from a study establishing non-use value from the nearby Dender river. The habitat involved is a similar ecosystem (river system in the centre of Flanders), and therefore judged to be similar enough to support this transfer. + Valuation based on the 'Natuurwaardeverkenner', a Flemish tool for valuation of ecosystem services - Water Regulation: avoided costs through a reduction in flood risks. This function is actually dependent on the number of affected households, which is hard to estimate. A rather conservative approached is applied: • only the surrounded households were taken into account. • the damage cost functions are based on the lowest level of flood (0.5m), and therefore the lowest damage values per household; A change in a regional water system affects in principle the entire water system[2]. The change in benefit must therefore be assigned to the entire area along the Schelde river which is vulnerable for floodings (several cities and municipalities).
Sensitivity Analysis	As well for the ecosystem service 'water regulation' (a)as for the ecosystem service 'genetic/species diversity' (b) a sensitivity analysis is carried out on two conservation measures: a) Floodplain Restoration • Assigning an aggregated safety benefit of 360.000 euro per ha[3] influences the conclusions significantly (4 to 66 times the net value). • The infrastructure of the controlled reduced tides, for example sluices, has a much higher lifetime than 20 years. Broadening the discounting period from 20 to 100 years does also significantly affect the result (1.5 to 2.4 times the net vale).

[2] The Kalkense meersen are a part of the Sigmaplan cluster, which consists of about 1800 ha of flood area along the Scheldt catchment.

[3] Based on avoided construction costs for raising the dikes + avoided risk related to increased security for the entire region of the Sigmaplan (Scheldt catchment). (THV Sigma Schelde; 2010)

	• In both cases the minimum value changes from negative to positive. b) Water purification • The results from De Nocker et al (2005) are relatively high compared with other Belgian studies examining the willingness to pay (WTP) for clean water. o Based on a written survey during the Scaldit project the WTP for achieving "good status" in Flanders is estimated to averagely 19 to 30 € per household per year (Brouwer et al,2007). Given a total length of 1400km of waterways in Flanders, these values correspond to 1.3 to 2.1 eurocent per km per household. o On the basis of a Walloon study, the overall benefit of achieving good status for all Walloon water surface is estimated at 20 to 35 € per household per year. With 451 km of waterways, the per km WTP ranges between 4.4 and 7.8 eurocent (average: 6.1 eurocent). Alternative assumptions on the non-use value of good water quality (6.1 cent per km instead of 1.5-2€/km) change the overall value significantly from 6.289 m € to 0.04 m € (15 times less)
Summary	**The key ecosystem services that are relevant for the site are captured, and decently monetized. The study covers the main ecosystem services of the Kalkense Meersen. The 3 conservation measures result in a benefit ranging from 4.97 m € to 19.39 m € The ecosystem services 'water regulation' and 'food provisioning' are the largest contributors to the overall value. The former is based on rough estimations of affected households, without taking into account the broader region of the Schelde catchment or flood prone area. As a result the water regulation value is very sensitive to assumptions about changes in the number of damaged houses, flood frequency and depth of the flood. An aggregated safety benefit per ha is used as an upper limit in the sensitivity analysis, which lifts up the total net value of the 3 studied conservation measures with a factor 9, to more than 68.65 m €.**

<table>
<tr><th>CONSERVATION MEASURE 1</th><th>Floodplain Restoration</th></tr>
<tr><td>A. ECOSYSTEM TYPE</td><td>Wetlands + Grassland</td></tr>
<tr><td>B. DESCRIPTION OF CONSERVATION MEASURE(S)</td><td>The measure is to create more water storage capacity, thus prevent flooding. With this measure a historical ecosystem service will be restored. A distinction can be made between a restoration as wetlands (non-tidal bound) and as estuarine nature (tidal).



Estuarine nature exists within the study area of both Controlled Reduced Tide (CRT) and Depoldering. A CRT is a variant of a wetland (Controlled Flood Area, CFA), with the differences that a CRT is subject to daily tides. In an area with CRT water enters also under 'normal' conditions, causing a muted tidal flooding in the area. For the construction of Controlled Reduced Tides, the dikes along the Scheldt have to be converted into overflow dikes (see picture below, on the left and in the middle). In addition, new ring dikes need to be constructed. There are also constructions required to drain the collected water at high tide back at the moment of low tide .</td></tr>
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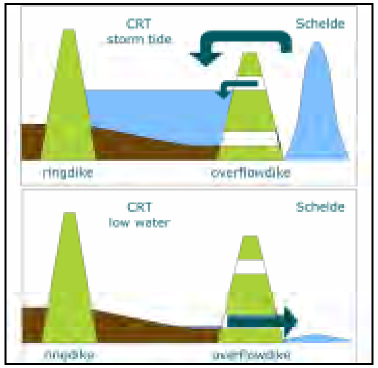
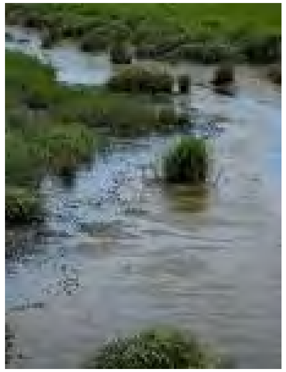




A Controlled Reduced Tide is characterized by mudflats and marshes. Mudflats dry up during low tide and are completely under water during high tide. They have a high biodiversity and are an important food source for birds (see picture above, on the right). Salt marshes are vegetated areas which are only inundated at very high water lever. Therefore they constitute a suitable breeding area for birds (Floor, J., 2009).

CFA normal tide

CRT low tide

CFA, one in 50 years

CRT high tide

CFA, one in 100 years

CRT storm tide, CFA function

A flood plain can also be restored as a **depoldered area**. In the case of depoldering, the entire dike will be removed, provoking a highly dynamic tidal mudflat/tidal marsh. There is a faster sedimentation than CRT. The fauna is characterized by reed (Phragmites), willow tidal forest ("temporate mangrove") and diatoms.

For the Kalkense Meersen the following division is made in floodplain restoration areas:

- Controlled Reduced Tide (CRT) & depoldering: 67.6 ha
- Controlled Flood Area (CFA): 214.6 ha

The floodplain restoration measures which are realized in the Cluster Kalkense Meersen serve not only a safety

	goal. Some of the measures even only serve ecological goals! A major component of the CRT and depoldering projects is to increase biodiversity. Therefore the costs of Controlled Reduced Tide (CRT) & depoldering will be compared with the benefits of the ecosystem service 'genetic/species diversity' . As the main goal of the Controlled Flood Area (CFA) project is safety, the costs of CFA will be compared with the benefits of the ecosystem service 'water regulation'.	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): (1) • CRT & Depoldering: 6.8 m € (100.000 € per ha) • CFA: 7.3 m € (34.000 € per ha). Ongoing cost (e.g. for maintenance works): • CRT & Depoldering: 0.136 m € (2% of construction costs of dykes and sluices) • CFA: no extra maintenance costs (replacement of existing dyke, maintenance costs remain the same). (2) Cost per year 0.136 m € Expected total additional costs (20 years , 3.5% discount rate): 3.89 m € Total Additional Costs of conservation measure (One-off + ongoing; 20 years, 3.5% discount rate): **18 m €**	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Water regulation (via CFA)**	**II. Genetic/species diversity (via CRT and depoldering)**
E. CHANGE in ES	Buffer to prevent inundations in surrounded towns (the positive effect of the change in storage capacity on the annual probability of flood/inundation in the area).	Creation of mudflat, marsh, gullies with specific: – Fauna: extra spawning area, fish migration (lateral) through sluices – Flora: purple loosestrife (L. salicaria) / marsh marigold (C. palustris) / reed / willow forest)
F. AFFECTED AREA	214.6 ha	67.6 ha
G. AFFECTED PEOPLE	20.000 households (4)	Conservationists: 88.000 households *(members of Natuurpunt[4]).*

[4] Natuurpunt is the largest Belgian NGO working on the protection of nature. With over 88,000 members in 2010 it represented 3.3% of Flemish households.

H. CHARACTERISTICS OF AFFECTED PEOPLE	/	/
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Yearly benefits: • Flood risk without floodplain restoration: from 1/70 year • Flood risk with floodplain restoration: 1/2000 year (if the whole SIGMA plan is executed). 1/350 year if only partly executed (Kruibeke/Bazel/ Rupelmonde area) (5) • Damage per flood per household: (6) Minimum: 2800 € (based on a % of average housing prices) [5] Maximum: 6000 € (average of flash flood)[6] • Whole area: Minimum: 640.000 €/yr (1/350yr flood risk & 2800€/household) Maximum: 1.654.286 € €/yr (1/2000yr flood risk & 6000€/household)	Yearly benefits for non-use value: Additional willingness to pay for transition from moderate to good biodiversity quality (3): • 2 € /household/km/year (based on a CVM study for the Dender river) • For the Scheldt adjacent on CRT/depoldering area (2.2km): 387,200 €
J. MARKET or NON-MARKET VALUES	Market value	Non Market Value
K. VALUATION METHOD	• Quantification: Flood risk = probability of flooding (per year) * number of affected households	CVM . increase in value for nature conservationists.

[5] Formula: Cost of damage (in %) =2d² + 2d (with d = the water depth, assumed to be 0,5m –the minimum depth for flash floods caused by rivers/sea). The outcome is the relative damage in percentage of the housing value. The average listing price in 2010 for a house in the region of Berlare & Laarne was € 186.141 (http://www.immovast.be/statsbelgium.php).

[6] Formula: Cost of damage (in €) = 2103,80 d + 4741,16 (with d = the water depth, assumed to be 0,5m –the minimum depth for flash floods caused by rivers/sea) . In prices of 2007. Deflator to 2007 → 2010: 1,039.

	• Monetization: Damage function: costs per household in case of flood	
L. VALUATION	Net benefits: 640.000 – 1.654.286 €/yr	Net benefits: 387,200 €/yr
Present Value	**Minimum: net costs : 1.379 m €** **Maximum: net benefits: 13.037 m €**	
SOURCE	(1) De Nocker et al, 2004; (2) De Nocker et al, 2005; (3) Liekens et al; 2009; (4) Decleyre, D, project manager. ; 2011; (5) THV Sigma Schelde, 2010 & Lammers, et al, 2000 (6) Hecq et al, 2008	
M. CONFIDENCE	**Costs:** Moderate: based on estimates in cost benefit analysis of the SIGMAplan[7]. This means that the whole Scheldt area is included; no specified costs prognosis was available for Kalkense Meersen. **Benefits:** - number of households: (-) based on expert judgment (4) - damage value: (+) 2 damage functions + check with use of "safety benefit per ha" value	The same as A. A CVM study is executed in the neighborhood (Dender River). Ok for extrapolation to this case.
N. KNOWLEDGE GAPS	/ The studied area is already subject of several studies	Number of affected people and their willingness to pay for this specific project
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	/	/

[7] The Sigmaplan protects everyone who lives and works in the Scheldt basin . Aside from protection against floods, the Sigma plan should also protect the economic impact of the river, without excluding a healthy ecosystem for the Scheldt. The Kalkense Meersen are a small part of the Sigma area.

Assessment of Value Transfer for Genetic/species diversity: Studies: Liekens et al (2009) (L) Policy Site: Kalkense Meersen Natura 2000 site (KM)

Characteristic	Study (L)	Policy Site (KM)	Match
The ecosystem services studied	Genetic/species diversity	Genetic/species diversity	Good
The location / geography of the site	Dender River	Scheldt River	Good (Dender is a tributary of the Scheldt)
The change to the ecosystem services	Additional willingness to pay for transition from moderate to good biodiversity quality	Creating a unique biodiversity by CRT (mudflat, marsh, gullies)	Satisfactory
The people affected	Households in the project area	Conservationists in Flanders	Satisfactory (KM is an area of supralocal importance. A conservative approach is applied by taking into account only the conservationist part of the population)
The available alternatives (substitutes) for the ecosystem service	Other rivers in Flanders	Rare fauna & flora, eg. retrievable in the Scheldt estuary (e.g. Land van Saeftinghe), some 70km away.	Satisfactory/poor, but if anything means valuation is an underestimate of the policy site value.
Conclusion for Value Transfer	Basis for value transfer is good, although the uniqueness of estuarine nature is not captured, which means a slight underestimating of the valuation.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

CONSERVATION MEASURE 2	From intensive to extensive grassland management
A. ECOSYSTEM TYPE	**Wetlands + Grassland**
B. DESCRIPTION OF CONSERVATION MEASURE(S)	The moist meadows and grazing pastures in the area are historically very rich in species with many flowers and herbs. By reseeding and fertilization a great area has become poorer in biodiversity. The measure "From intensive to extensive grassland management (pasture)" intensively managed agricultural land reduces gradually in size. The Kalkense Meersen gradually evolve into a shared nature function by extensive pasture & hay meadows.   The following grassland management will be installed: Pure hayland management: • mowing twice a year on well defined dates • fertilization and pesticide use are prohibited Pasture : • grazing with a fixed number of animals within specified periods (decrease from 5 to 2 cattle per ha) • fertilization and pesticide use are prohibited
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): Land acquisition costs are excluded, as those costs only generate an income transfer which does not involve changes in general welfare for society. Ongoing cost (e.g. for maintenance works): 45.745 € /yr (350 €/ha/yr compensation to the farmers x 130.7ha) (1) Expected life time: benefits calculated for 20 year period, which will require multiple renewals of 5-year agri-environment agreements, introducing a risk that cost will change.

	Cost per year: 0.046 m € Total Additional Costs of conservation measure (One-off + ongoing for 5 years): **0.229 m €**		
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**III. Food production**		**V. Landscape/Amenity**
E. CHANGE in ES	Decrease in agricultural output through extensive grassland management and change from arable land to wetland.		Increase of landscape and amenity value due to higher number of species and higher area for recreation.
F. AFFECTED AREA	130.7 ha. (arable/grassland → wetland)		130.7 ha. (arable/grassland → wetland)
G. AFFECTED PEOPLE	Local farmers;		Conservationists: 88.000 households (members of Natuurpunt)
H. CHARACTERISTICS OF AFFECTED PEOPLE	Income of farmers lower than average income		//
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	<u>Yearly costs:</u> The costs are expressed as change in net value added (NVA). *The social costs include:* *a) The loss of net production value of . the land;* *b) Ground based value (manure disposal)* *See table below for overview* • Chosen value: 3348 €/ha/yr[8](2) • Whole area: 438.000 €		<u>Yearly benefits for landscape and amenity</u> <u>value:</u> Willingness to pay for a change from intensive grassland to extensive managed grassland: € 1.7 per household (4) • Total: € 148.875
J. MARKET or NON-MARKET VALUES	Market value		Non market value
K. VALUATION METHOD	Production function		CVM , increase in value for residents
L. VALUATION	**Net costs: 0.333 m €/yr (first 5 first years), 0.287 m €/yr (for period afterwards)**[9]		

[8] Actualised value of 3030 €/ha/yr. From 2004 to 2010: x 1.105 (3030 €/ha/yr x1.105 = 3348 €/ha/yr)
[9] First 5 first years: 342,555 € = 45,745 € + 438,000 € - 127,000 € - 13,400 € & Period afterwards: 296,810 €= 438,000 € - 127,000 € - 13,400

Present Value	**Net costs: 4.3 m €**		
SOURCE	(1) D. Decleyre, project manager, 2011 (2) De Nocker et al, 2005; (3) http://www.kalkensemeersen.be/wandelen.htm (4) VITO, UA and LNE, 2011.		
M. CONFIDENCE	**Costs:** high : data from project manager **Benefits**: • Food: high: location specific data for case Wijmeers is available • Landscape and amenity: high (recent tool for valuation of ecosystems in Flanders)		
N. KNOWLEDGE GAPS	//	Number of affected people and their willingness to pay	Number of affected people and their willingness to pay
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	//	CVM study in the (near) area	CVM study in the (near) area

Table: Social costs for agricultural change (applicability marking: green: high, orange: moderate, red: low applicability) From 5 cattle per ha to 2 cattle per ha.

Category	Valuation (per ha/ per year)	Source
NVA for the Wijmeers area	€ 3,030	De Nocker et al, 2005;
Mean NVA for Controlled Reduced Tide (CRT); Controlled Flood Area (CFA) & Depoldering in the area of the Sigmaplan[10].	€ 3,430	De Nocker et al, 2004;
Eviction indemnity; stimulus for owners to sell their property (20% of the land value).	€ 2,400	Waterwegen en Zeekanaal, sd;
Production value (dairy) For the Netherlands	€ 5,600	Willems, et al; 2005;
The average NVA of grassland (if agricultural production is no longer possible) For the Netherlands	€ 1,300	Reinhard et al; 2007;
NVA for the loss of agricultural land (throughout Flanders and all types of agriculture)	€ 7,560	De Nocker et al, 2005;

[10] The Sigmaplan protects everyone who lives and works in the Scheldt basin . Aside from protection against floods, the Sigma plan must also protect the economic impact of the river, without excluding a healthy ecosystem for the Scheldt. The Kalkense Meersen are a small part of the Sigma area.

Assessment of Value Transfer for Landscape/Amenity : Studies: VITO, UA and LNE, 2011.(V); Policy Site: Kalkense Meersen Natura 2000 site (KM)

Characteristic	Study (V)	Policy Site (KM)	Match
The ecosystem services studied	Landscape & Amenity	Landscape & Amenity	Good
The location / geography of the site	Ecotype Grasslands	Wetlands along an inland river	Good
The change to the ecosystem services	Additional willingness to pay for transition from intensive grassland to extensive natural reserve	Increase of landscape value due to higher number variation in fauna and flora	Good
The people affected	Residents	Conservationists	Good
The available alternatives (substitutes) for the ecosystem service	Other extensive grasslands in Flanders	Other wetlands along rivers in Flanders (quite abundant)	Good
Conclusion for Value Transfer	Basis for value transfer is good, willingness to pay is derived from a recent and large-scale CVM study in Flanders		

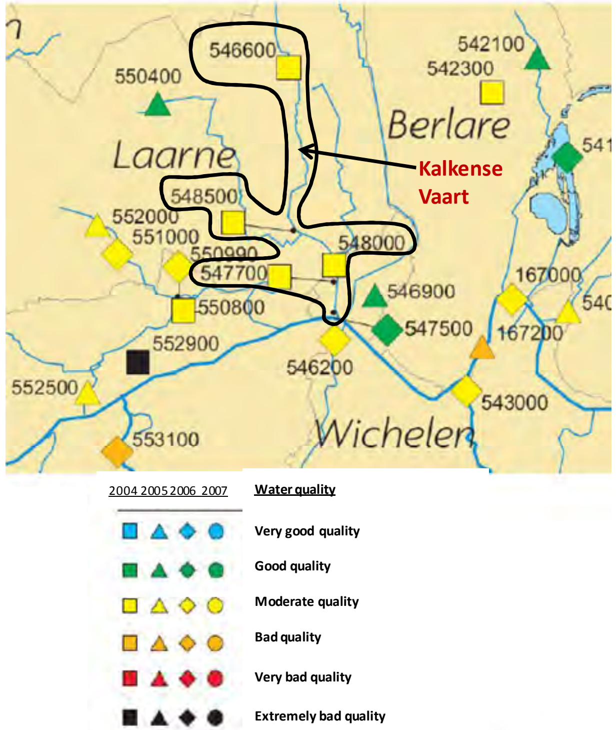
Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

<table>
<tr><th>CONSERVATION MEASURE 3</th><th>Water purification</th></tr>
<tr><td>A. ECOSYSTEM TYPE</td><td>Wetlands + Grassland</td></tr>
<tr><td>B. DESCRIPTION OF CONSERVATION MEASURE(S)</td><td>

By digging a small connecting canal pollution from overflows is avoided in the Kalkense Vaart. By disconnecting the discharge of rainwater from the sewer system, overflows are reduced (so the rain water is processed separately).

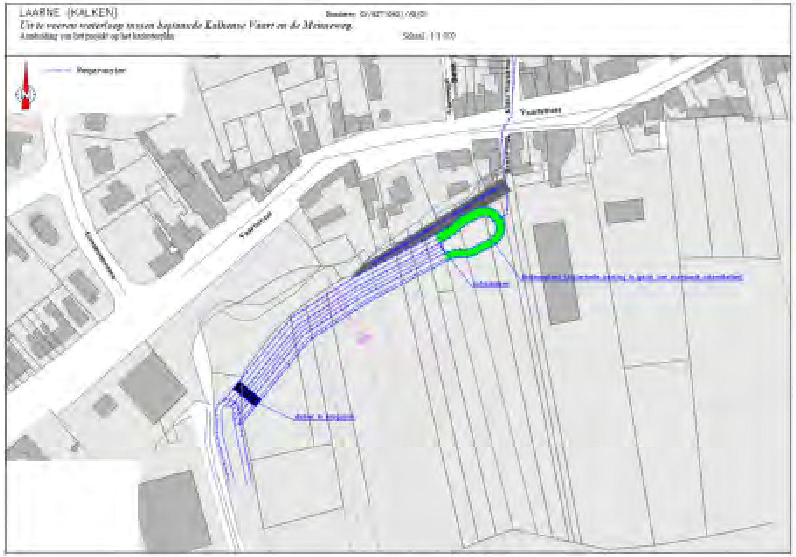
Length of the canal: 200m

Figure: current water quality in the Kalkense Vaart



Width of the canal: 10 m

Figure: scheme of the planned connecting canal (in blue)



</td></tr>
<tr><td>C. COSTS of CONSERVATION</td><td>Additional cost as a result of taking the conservation measure:</td></tr>
</table>

MEASURES	One-off costs: digging the canal (earthmoving, expropriations, felling of some trees and concrete work): + / - 100,000 € (1) Ongoing cost: • vegetation maintenance: 2.24€/m x 2*200m = 896 €/year [11] • dredging the canal (dredging of 50cm of sludge): 21 €/m³ x 10x200m = 42.000€/15 years = 2800 € /year[12] (2) Cost per year: 3.696 €; actualized value (20 years, 3.5% discount rate): 0.106 m € Total Additional Costs of conservation measure (One-off + ongoing, 20 years, 3.5% discount rate):**0.206 m €**	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**VI. Genetic/species diversity**	**VII. Landscape & Amenity Value**
E. CHANGE in ES	Less eutrophic water, with more species.	Improvement in perceived value.
F. AFFECTED AREA	Kalkense Vaart (water and banks) and the Scheldt (marginal effect)	Kalkense Vaart (water and banks) and the Scheldt (marginal effect)
G. AFFECTED PEOPLE	Conservationists: 88.000 households (members of Natuurpunt*)*	Number of adjacent households: 20.000 (1)
H. CHARACTERISTICS OF AFFECTED PEOPLE	/	/
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	<u>Yearly benefits:</u> Additional willingness to pay for transition from moderate to good <u>biodiversity</u> quality for the Kalkense Vaart (2.2km) (3) • 2 € /household/km/year (based on a CVM study for the Dender river) • Whole area: : 387,200 €	<u>Yearly benefits:</u> Additional willingness to pay for transition from moderate to good <u>water</u> quality for the Kalkense Vaart (2.2km) (3): • 1.5 € household/year/km (based on a CVM study for the Dender river) • Whole area: 66,000 €

[11] Cutting brushwood: every 3 years; removing of wood: every 5 years; mowing & scratching reed beds: every 3 years; removing of exotics: year several times every year(dependent on degree of contamination with exotics).

[12] Based on medium costs of *dredging* (small project with high costs per m³) & lowest cost of *transportation, dewatering & sludge processing* (non contaminated sludge as only rainwater will flow in the canal).

J. MARKET or NON-MARKET VALUES	Non Market value		Non Market value
K. VALUATION METHOD	CVM , increase in value for nature conservationists		CVM, increase in value for adjacent residents
L. VALUATION	Net benefits: 387,200 €/yr		Net benefits: 66,000 €/yr
Present Value	**Net benefits: 6.289 m €**		
SOURCE	(1) D. Decleyre, project manager; 2011 (2) Ruijgrok. et al; 2011 (3) Liekens et al; 2009		
M. CONFIDENCE	**Costs:** good: expert judgment + planned budget for the canal. **Benefits**: moderate: difficult to estimate the number of affected people (which part has really a willingness to pay?) + data is based on a study of the Dender River (15km away from Kalkense Meersen in bird's eye view).		
N. KNOWLEDGE GAPS	Number of affected people and their willingness to pay		Number of affected people and their willingness to pay
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	/ a CVM study is executed in the neighborhood (Dender River). Ok for extrapolation to this case.		/ a CVM study is executed in the neighborhood (Dender River). Ok for extrapolation to this case.

Assessment of Value Transfer for Genetic/species diversity: Studies: Liekens et al; 2009 (L); Policy Site: Kalkense Meersen Natura 2000 site (KM)

Characteristic	Study (DN)	Policy Site (KM)	Match
The ecosystem services studied	Non-use value	Genetic/species diversity	Good
The location / geography of the site	Dender river catchment	Kalkense Vaart	Good (Dender is a medium-sized nearby river, Kalkense Vaart is a small canal of 2.2km length)
The change to the ecosystem services	Additional willingness to pay for transition from moderate to good biodiversity quality	idem	Good
The people affected	Households in the project area	Conservationist in East-Flanders	Satisfactory (KM is an area of supralocal importance. A conservative approach is applied by taking into account a % of the population)
The available alternatives (substitutes) for the ecosystem service	Other waterways rich on biodiversity in the neighbourhood	idem	Good
Conclusion for Value Transfer	Basis for value transfer is good, a CVM study is executed in the neighborhood (Dender River). Ok for extrapolation to this case.		

Assessment of Value Transfer for Landscape Amenity Value: Studies: Liekens et al; 2009 (L); Policy Site: Kalkense Meersen Natura 2000 site (KM)

Characteristic	Study (DN)	Policy Site (KM)	Match
The ecosystem services studied	Non-use value	Amenity value	Good
The location / geography of the site	Dender river catchment	Kalkense Vaart	Good (Dender is a medium-sized nearby river, Kalkense Vaart is a small canal of 2.2km length)
The change to the ecosystem services	Additional willingness to pay for transition from moderate to good water quality	idem	Good
The people affected	Households in the project area	Conservationist in East-Flanders	Satisfactory (KM is an area of supralocal importance. A conservative approach is applied by taking into account a % of the population)
The available alternatives (substitutes) for the ecosystem service	Other waterways with good water quality in the neighborhood	idem	Good
Conclusion for Value Transfer	Basis for value transfer is good, a CVM study is executed in the neighborhood (Dender River). Ok for extrapolation to this case.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

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NATURA 2000 SITE

Name : KRKONOSE MOUNTAINS – CZECH REPUBLIC

Natura 2000 number : CZ0521009(SPA), CZ0524044 (SCI)

Biogeographical region : Continental

Surface : 40939 ha (SPA), 54973 ha (SCI)

Site description

Krkonose Mountains National Park (including both the SPA and SCI which show an important overlap) is located in the north of the country on the border with Poland. The park is mainly covered with forests (broad-leaved deciduous woodland 22%, coniferous woodland up to 15% and artificial forest monoculture up to 34%), grasslands (Humid grassland, Mesophile grassland 10%, and alpine/sub-alpine grassland 4%) and some heath and scrub (3%). Bogs, marshes and fens cover 1% of the area. The area is populated with ca 82.000 people.

Krkonose Mountains National Park has been assessed as one of the most visited National Parks in the world when standardized per unit of area. The annual visiting rate is ca 8 million people/year. Consequently the pressure of tourism and recreation is quite heavy.

Map

(on Google Earth, from Natura 2000 Viewer)

Impression

Managing Authority

The Krkonoše Mountains National Park Administration (www.krnap.cz)

Threats	Current threats: tourism (incl. winter and summer activities), skiing activities (incl. new downhill tracks, lifts, snow making and night lightning), house-building Expected pressures: wind farm development, additional tourism infrastructure
Conservation objectives	Since 2010 new site management plan is in place. As the conservation status of considerable parts of the forests, grasslands and wetlands is unfavourable conservation measures are focused on these habitats. According to the management plan the main conservation objectives are conservation of species and genetic diversity of trees in forests and support of natural processes in the forests, conservation of natural state and hydrological regime of wetlands and peatbogs, conservation and restoration of natural state of tundra ecosystems and conservation of geobiodiversity of the *Pinus mugo* bush, conservation of ecological and landscape functions of meadows, conservation or enhancement of populations of endangered species of plants and animals and conservation of the remarkable shapes of relief and other phenomenons of abiotic nature.
Main conservation measures	• Sustainable forest management • Grassland management • Visitor management • Hunting and fishing restrictions
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • **The total set of conservation measures (SFM, grassland management and visitor management measures)** is taken as the first 'conservation measure' affecting mainly the ecosystem services ecotourism/recreation, and genetic/species diversity. As in this case these ecosystem services are affected by the whole set of measures the combination of all measures is considered. • **SFM** (taking into account a more than 60% coverage by forests, half of this being plantations); important changes to ecosystem services associated with this conservation measure are erosion control and climate regulation (carbon sequestration). • **Grassland management**; due to land abandonment some HNV grasslands are under pressure of succession by scrub and forests; highly relevant ecosystem services associated with this conservation measure are food and fuel (biomass) production and landscape amenity values.
Contact person who participated in the case study	Mr. Stanislav Březina, PhD, sbrezina@krnap.cz the Krkonoše Mountains National Park Administration (www.krnap.cz) .

Summary of economic valuation	Ecosystem service	Present value 2010 - 2030 (€2010 prices, 3.5% discount rate)		Notes
		Low	**High**	
	I. Recreation and ecotourism	11.72m	23.45m	Increase in utility of recreational visits from improved condition of habitats
	II. Genetic/species diversity	-	-	May be partly reflected in grassland cultural values
	III. Food	14.12m	14.12m	Based on good knowledge of farming systems, but unclear if include effects of market price support through EU subsidies.
	IV. Amenity and cultural value	0.26m	0.62m	Value of conservation of traditional grassland for landscape and biodiversity
	V. Erosion control			Significant reduction in risk of soil erosion across 10,000 ha forest
	VI. Fibre (Timber)			Slight reduction in harvest
	VII. Carbon	3.91m	5.61m	Increase in forested area and therefore increase in stored carbon, but exact impacts uncertain.
	Costs	18.02m	18.02m	Agri-environment payments for 1,000 ha of grassland
	Net value of conservation measures analysed	**€12.0 – 25.8 m**		**Costs and benefits partially known, and uncertainty over carbon values, so a very approximate value.**
	Key non-monetised impacts	Some important potential impacts are omitted from the valuation figures, e.g.: • Value of non-commercial (e.g. subsistence) uses of grazing animals (goats and cows for milk-supply), horses for owner's recreation. • Role of site in regulating managing soil erosion. • Loss of revenue from reduced timber harvest • Increased carbon storage from sustainable forest management		
	Assessment of results and risk of double-counting	There is a risk of double counting between the recreation and amenity/cultural values, in that the latter may include values related to recreational use. However, the amenity/cultural values are based on average		

		landscape figures, so would be expected to be an underestimate of the value of the site.
	Sensitivity Analysis	The two highest value services values are considered reasonably robust. There is a good knowledge of the farming systems that produce food, and the recreation and ecotourism value is based on a reasonable comparator site. The omission of timber values is not thought be significant as the changes to timber extraction as a result of conservation measures are not very large. The carbon value is highly uncertain as the extent of additional carbon storage as a result of tree planting is difficult to estimate. The values do not reflect the full value of the site as genetic/species diversity is unvalued, but are still equivalent to €287 – 507 /ha, or €14 - 25/ha/yr. The costs of management measures for such an extensive site would not expected to be greater than these values, meaning that there would be net benefits from undertaking them.
Summary	**The evaluation of conservation measures in the Krokonese Mountains captures the values of the main ecosystem services from the site. It suggests these are significant benefits that could result from implementing conservation measures. Key sensitivities in the analysis are the assumptions around carbon values. Other ecosystem service assumptions do not influence the scale of the result significantly.**	

CONSERVATION MEASURE 1	Habitat management measures to deliver favourable conservation status.	
A. ECOSYSTEM TYPE	**Forest, Grassland, Heath and Scrub**	
B. DESCRIPTION CONSERVATION MEASURE	The combined set of conservation measures includes SFM, extensive grassland management and visitor management.	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): € not known Ongoing cost (e.g. for maintenance works): € not known. Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): € not known, but requires development and implementation of visitor management plan.	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Recreation and ecotourism**	**II. Genetic and species diversity**
E. CHANGE in ES	Improvement in condition of habitat and its attractiveness to visitors.	Maintain and enhance existence, landscape and amenity value for the species and habitats at the site.
F. AFFECTED AREA	54,980 ha	
G. AFFECTED PEOPLE	Tourism and recreation businesses in local population. Estimated 5.4 million visits / year.	Local population: estimated 82,000 local inhabitants, estimated 5.4 million tourists / year Regional, national populations.
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities in this rural area have incomes below the national average.	

I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Number of visitors.	Condition of site, as this relates to its total economic value of site.
J. MARKET or NON-MARKET VALUES	Market and non-market values	n/a, but may be partly covered in visitor values under recreation and ecotourism
K. VALUATION METHOD	Stated preference, based on contingent travel-cost analysis.	
L. VALUATION	Change in consumer surplus /person/trip = €0.148 - 0.295 (2010). For 5.4 millon visitors = €0.797m - €1.594m per year	See Value transfer 2 under conservation measure 2.
Present Value (3.5% discount rate)	Low: €11.723 - High: €23.447m	
SOURCE	Value transfer from Melichar & Scasny (undated)	
M. CONFIDENCE	Moderate. Some uncertainty over application of value transfer due to ecosystem services changes between study site and this site.	
N. KNOWLEDGE GAPS	Welfare change from marginal improvement in habitat condition.	Czech population's values for biodiversity conservation
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Understand role of habitat condition in attracting visitors to the site.	Research non-use values for biodiversity in Czech Republic.

Assessment of Value Transfer: Study: Jizerské Hory Mts. Policy Site: Krkonese Mountains Natura 2000 site.

Characteristic	Study (JH)	Policy Site (KR)	Match
The ecosystem services studied	Recreational value of forested landscape, affected by severe air pollution damage	Recreational value of forested landscape, affected by low-level damage from air pollution and other factors (e.g. soil erosion)	Satisfactory. Damage in KR is about 10% of the damage at JH
The location / geography of the site	Mountainous area in Northern Czech Republic	Mountainous area in Northern Czech Republic	Good, sites have similar composition of habitats (except KR also has subalpine zone)
The change to the ecosystem services	Conservation programme to prevent damage	Conservation programme to prevent damage, but threat of damage less severe	Satisfactory. Damage in KR less severe than JH.
The people affected	Unknown, but significant numbers of visitors, JH are considered by public to be more serene and peaceful than KR	Level of recreation higher at KR: 5.4 million visitors/yr. Some visit only for downhill skiing	Satisfactory, both notable visitor destinations, but some differences in visitor motivations
The available alternatives (substitutes) for the ecosystem service	The areas are both significant upland forest areas ona national scale, and in fact substitutes for each other - 24% of JH study respondents named KR as a substitue site (most frequent response)		Good
Conclusion for Value Transfer	JH values likely to reflect greater degree of avoided damage than relevant to KR. KR damage is estimated at 10% of that at JH. Also JH may provide greater ultility due to more peaceful image, it is etimated that this could halve values at KR compared to JH. Therefore, 5-10% of values from JH applied to KR.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

CONSERVATION MEASURE 2	Grassland management
A. ECOSYSTEM TYPE	**Dry Grassland**
B. DESCRIPTION OF CONSERVATION MEASURE	Farmers within the SPA and SCI Krkonoše sites are participating in different types of agro - environmental schemes with financial support from the European Agricultural Fund for Rural Development (EAFRD). This project started last year and about 80 farmers have been successfully involved. Cooperation between farmers and the State is based on voluntary agreements for 5 years. Farmers have to adapt their management to support the nature protection on farmland. They are subject to regular controls and they obtain extra finances when they comply with the rules. All schemes are focused on maintenance (or improvement) of habitats or species condition. Each of the schemes has strictly determined rules of management. Farmers on area of Krkonoše mostly use one of the following schemes or a combination of several of them: • Agro-environmental scheme focused on sustainable management of "rich-species meadows" • Agro-environmental scheme focused on protection of Corncrake ("Corncrake-friendly" management) • Agro-environmental scheme focused on protection of wetlands (habitat 7140) Another possibility used by farmers, owners of small piece lands (e.g. meadows around house) is "Sustainable management of mountain rich-species meadows". In general, mowing and grazing are used in order to keep the meadows in a desirable condition.
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure (through introduction of grazing regime to maintain grassland against habitat succession (1,000 ha), Restriction of spread of invasive species (3,000 ha), Restriction of house-building (especially for holiday houses)): One-off costs (e.g. for infrastructural works): € not known Ongoing cost (e.g. for maintenance works): approximately € 700/ha/yr, for 1,000 ha = €700,000/yr Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): € 10.3 million+.

D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	III. Food	IV. Fuel	V. Landscape, amenity and cultural values
E. CHANGE in ES	Maintain productivity from extensive agricultural use of grassland	Provide biomass for energy generation.	Maintain traditional grassland agricultural practices that would otherwise be lost
F. AFFECTED AREA	Existing 2,000 ha of pasture, plus 1,000 ha of new pasture.	1,000 ha	1,400 ha; for restoration (1,000 ha) and avoided loss of traditional grassland agricultural landscape. Avoided loss for estimated 20% of grassland (400 ha) that would be abandoned.
G. AFFECTED PEOPLE	Herdsmen. Currently about 30 full-time farmers (each with 70 to 300 ha of grassland) .and 200 hobby farmers (each manage > 0.5 ha grassland part-time) in the site.	Local population. Fuel wood harvesters/users	Local, regional, national population
H. CHARACTERISTICS of affected people	Communities in this rural area have below average incomes.		
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Number of grazed animals is maintained or increases.	Volume of fuel.	The value to regional population of the grassland, which would eventually revert to forest, but welfare losses assumed due to interim loss of landscape value for 10 years of scrub growth, and because traditional mixed landscape more highly valued than pure forest landscape
J. MARKET or NON-MARKET VALUES	Market value	Market value	Non-market value
K. VALUATION METHOD	Market price value of other production: 20 kg of meat/sheep @ approx €4/kg for 5,000 sheep; plus 250 kg of meat/cow @	Market price	Value transfer of stated preference studies

	approx €3 /kg, for 1,000 cows; plus 150 horses, rented for riding for minimum of 50hrs/yr @ €10/hour = €1.225m /yr (€612.5/ha for existing pastures).		
L. VALUATION	Conservation measure estimate to avoid abandonement of estimated 20% of existing pasture over next 20 years = €160,000/yr plus productivity from new pasture = €800,000/yr. TOTAL = €960,000/yr	unknown	Value Transfer 1: €12.44/ha/yr Applied to 1,400 ha of grassland = €17,420/yr. OR Value Transfer 2: €30/ha/yr. Applied to 1,400 ha of grassland = €42,000/yr.
Present Value	€14.121m	-	€256,000 OR €619,000
SOURCE	Calculated productivity		Ciaian & Paloma (2011) Krumalova (2002)
M. CONFIDENCE	Moderate		Moderate – Low
N. KNOWLEDGE GAPS	Likely rate of abandonment on existing pastures and productivity from new pastures. Possible value of site-branded produce. Value of non-commercial (e.g. subsistence) uses of grazing animals (goats and cows for milk-supply), horses for owner's recreation. Unclear if food prices include effects of EU price support subsidy payments,	Uncertain potential of biofuel	Marginal value of preserving grassland against development and re-wilding.
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Assess potential for biodiversity-businesses	Research potential markets and supply	Strengthen evidence base through primary research into values and distribution (E.g. extent of distance-decay for non-use values).

Assessment of Value Transfer for grassland landscape 1: Study: Krumlova (2002) on Czech Agriculture. Policy Site: Krokonese Mountains Natura 2000 site.

Characteristic	Study Site (CZ)	Policy Site (KR)	Match
The ecosystem services studied	Provision of landscape and biodiversity conservation through traditional grassland agriculture	Provision of traditional grassland agricultural landscape	Good, similar agricultural landscapes.
The location / geography of the site	Agricultural areas of the Czech Republic.	Upland agricultural ares in otherwise forested landscape	Satisfactory, general similarity only.
The change to the ecosystem services	Maintenance/enhancement of grassland/ traditional agricultural landscape	Conservation programme to prevent damage to grassland agricultural landscape	Good, KR is specific example of change covered by CZ study.
The people affected	National population.	Local, regional and possibly national populations, depending on extent of non-use values.	Satisfactory, unclear to what extent KR is relevant to national population.
The available alternatives (substitutes) for the ecosystem service	Traditional agricultural areas with extensive substitutes on national scale. However, both study sites allow for this.		Good
Conclusion for Value Transfer	CZ values can be transferred, but they capture both landscape and biodiversity values from traditional management of agricultural grasslands. Marginal value of maintaining grasslands (CZK 142/working person/yr, 2002) is inflated to 2010 prices, aggregated to all working population and divided by Czech agricultural area to give €17.24/ha/yr.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

Assessment of Value Transfer for grassland landscape 2. Study: EU Meta-analysis. Policy Site: Krokonese Mountains Natura 2000 site.

Characteristic	Study Site (EU meta-analysis)	Policy Site (KR)	Match
The ecosystem services studied	Provision of grassland/ traditional agricultural landscapes	Provision of traditional grassland agricultural landscape	Good, similar agricultural landscapes.
The location / geography of the site	Agricultural areas of the Czech Republic.	Upland agricultural ares in otherwise forested landscape	Satisfactory, general similarity only.
The change to the ecosystem services	Maintenance/enhancement of grassland/ traditional agricultural landscape	Conservation programme to prevent damage to grassland agricultural landscape	Good, KR is specific example of change covered by EU study.
The people affected	National population.	Local, regional and possibly national populations, depending on extent of non-use values.	Satisfactory, unclear if KR is relevant to national population.
The available alternatives (substitutes) for the ecosystem service	Traditional agricultural areas with extensive substitutes on national scale. However, both study sites allow for this.		Good
Conclusion for Value Transfer	EU values can be transferred, but with some uncertainty as they are relevant to more general agricultural landscapes. Value of maintaining pasture = difference between values of grassland (€107) and arable (€77) landscapes in the Czech Republic = €30/ha/yr.		

CONSERVATION MEASURE 3	Sustianable Forest Management	
A. ECOSYSTEM TYPE	**Forest**	
B. DESCRIPTION OF CONSERVATION MEASURE	Removal of non native woods, leaving parts of the forests 'unmanaged', etc..	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measures (Planting saplings adapted to stony soils and with sufficient root development to stabilise soils. 600 wooden barriers to slow water runoff from wet types of forests): One-off costs (e.g. for infrastructural works): € not known Ongoing cost (e.g. for maintenance works): € not known. Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): Opportunity costs of potential revenues from woodland.	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**VI. Erosion Control**	**VII. Carbon**
E. CHANGE in ES	Reduction in runoff of soil particles	Increases carbon storage from planting of 10,000 ha.
	Around 1,500,000 saplings have been planted in the NP since 2003. A considerable proportion of them (more them 50%) have been in areas vulnerable to erosion by runoff, but the precise number is not known.	
F. AFFECTED AREA	Appropriate management has reduced significant threat of erosion across approx 10,000 ha of forests in 2003 to a minimal risk. Wooden barriers to slow runoff planned for 6,800 ha forest	
G. AFFECTED PEOPLE	Direct users of the site (visitors, foresters), and indirect users (e.g. who could be impacted by eroded soil lower in water catchment).	Global population
H. CHARACTERISTICS of affected people	Communities in this rural area have below average incomes.	n/a

I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Loss of topsoil, siltation of runoff and of water supplies	Storage of carbon dioxide eq emissions. The trees planted will increase the forested area (34,400 ha) by approximately 2% (an increase of 688ha). This will increase carbon storage. The forest is estimated to store 280 tC/ha (IEEP et al in prep) once the trees are mature. So the increase in carbon storage is estimate to be 192,640 tC) in 2030.
J. MARKET or NON-MARKET VALUES		Non-traded value of carbon.
K. VALUATION METHOD		Non-traded price of carbon
L. VALUATION		Carbon valued at €39 to €56 per tonne in 2030 (IEEP et al in prep).
Present Value		€3.91 – 5.61m
SOURCE		IEEP et.al. (in prep): DECC (2009), EC (2008), and Centre d'analyse stratégique (2009)
M. CONFIDENCE		Low – need to understand extent of forestry establishment.
N. KNOWLEDGE GAPS	Role of forests in catchment water supplies	Change to stored carbon and timber extraction as a result of conservation measures
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Better general understanding of this ecosystem service	Model change to carbon storage in forests as a result of conservation measures.

References:

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Melichar J. & Scasny M (undated) Introduction to Non-Market Valuation Methods and Critical Review of Their Application in the Czech Republic.

Krumalova V (2002) Evaluation of chosen benefits on environment and landscape coming from Czech agriculture. Agric. Economics, 48 (1): 13-17.

NATURA 2000 SITE

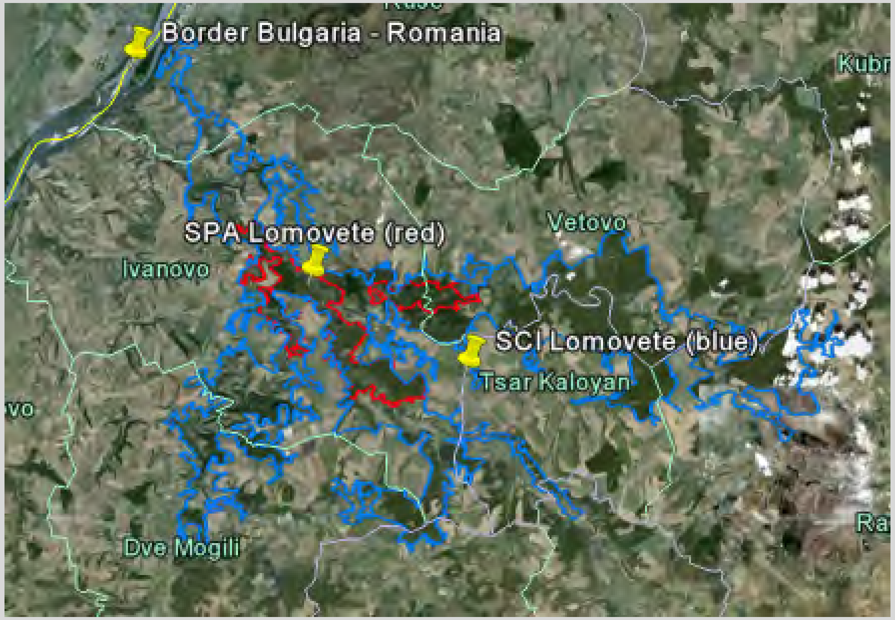
Name : LOMOVETE – BULGARIA

Natura 2000 number : BG000608 (SCI) and BG002025 (SPA)

Biogeographical region : Continental

Surface : +/- 32500 ha

Lomovete includes a complex of canyons of Rusenski Lom river and its 3 tributaries. It is part of the Rusenski Lom Nature Park. About 35% of the SCI is covered with broad leaved deciduous woodland, 10% with artificial forest monoculture, and 11% with dry grasslands and steppes. In Lomovete 13 habitat types have been identified. Most of them are semi-natural grasslands and natural forests. Some of the habitats having higher share are: Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites), Sub-Pannonic steppic grasslands, Pannonic loess steppic grasslands, Euro-Siberian steppic woods with Quercus spp, Pannonian-Balkanic turkey oak –sessile oak forests. Bird species count to almost 150 species.Almost 50% of the lands in Lomovete are state property, 33% private property. Buffer zones around Lomovete comprises private arable lands, most of which are intensively managed. There is one visitor centre a a number of marked eco-trails.



(on Google Earth, from Natura 2000 Viewer)

Managing Authority	Rusenski Lom Nature Park Directorate
Threats	Current threats: intensive farming practices close to settlements and in buffer zones; this leads to overgrazing, overuse of meadows, conversion of grasslands to arable lands, eutrophication (pesticides and fertilizers use); poaching; land abandonment, resulting in degradation of grasslands,

	most of which are High Nature Value farmlands, due to overgrowth with shrubs/ trees; tourism, resulting in disturbance of wild animals (birds) during breeding and nesting; uncontrolled bee-keeping (new roads created by bee-keepers) Expected pressures: similar
Conservation objectives	The management plan of Rusenski Lom Nature Park stipulates restrictions for tourism development. A specific management plan for the Natura 2000 site is not yet in place. In 2008, the WWF Danube Carpathian prepared a management plan for Lomovete. However, this document is not official. Now, the Rusenski Lom Nature Park Directorate is developing one under the Romania-Bulgaria CBC Programme 2007-2013. The main conservation objectives laid down in the management plan of Rusenski Lom Nature Park include: • Protection of the biological and landscape diversity • Protection of the cultural and historical sights • Improvement of the policy on the management and specialized protection (guarding) of the nature park • Reaching a balance between protection and use of natural resources • Accumulation of income for municipalities resulting from opportunities and advantages provided by the natural area The secondary targets relate to: • Improvement of the communication policy of the Directorate • Development of RD activities; monitoring of certain elements of the nature complex relevant to the main conservation targets • Ecological awareness raising among youngsters and work with local stakeholders on building nature-protection attitude • Ensure opportunities for sustainable tourism development The regimes and restrictions stipulated into Rusenski Lom Nature Park relate to the relevant articles of the Protected Areas Act[1] • Art. 30: (1) Within the natural park there can be settlements, settlement formations and resorts, and it is possible to perform economic activities that do not pollute the environment & (2) Protected areas of other categories, falling within the boundaries of nature parks preserve their regimes, defined by the Ordinance of their designation. • Art 31: On the territories of nature parks it is forbidden to: 1. clear cut into high forests with the exception of poplar, and in coppice forests – on a surface not exceeding 3 ha 2. introduce non-native animal and plant species 3. graze goats, except in areas defined for the purpose

[1] Please note that the numbering of articles is according to the valid ones at the moment of developing the management plan – 2006:

	4. collection of fossils and minerals, destruction of rock formations 5. pollution of water and land with domestic, industrial and other wastes; 6. camping and camp fires 7. open mining 8. extraction and primary processing (enrichment) of metallic minerals by applying chemical and chemical-bacteriological methods and cyanide 9. activities and con 10. structions not allowed by the designation order of the park, the management plan and development and technical plans and projects 11. collection of rare, endemic, relict and protected species, except for scientific purposes 12. other activities defined by the order for the designation of the protected area and with the management plan
Main conservation measures	• Floodplain restoration • Agri-environmental schemes • Sustainable Forestry Management • Hunting restrictions • Visitor management
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • **Visitor management measures**; there are 2 important historical sites within the sites' protected habitats; these are a cultural attraction to tourists, but the unmanaged visitor patterns lead to two problems: 1°/disturbance by large groups of visitors during the breeding season, and 2°/ litter around the sites; measures are the establishment of eco-trails, zoning i.e. controlled access to some areas in April-July (e.g. rock climbing areas, bat colonies in caves); in particular cycling, rock climbing, and big groups need adequate control; ecotourism and recreation is a highly relevant ecosystem service related to this measure; also the ecosystem service genetic/species diversity is selected as avoiding disturbance by means of adequate visitor management contributes to the preservation of this ecosystem service • Sustainable Forestry Management • Wetland restoration
Contact person who participated	Maya Todorova, Sustainable Finance Coordinator, WWF Danube-Carpathian Programme (http://wwf.bg) ; mtodorova@wwfdcp.bg (with the support of Tzonka Hristova, Rusenski Lom Nature Park Directorate)

in the case study			
Summary of economic valuation	**Ecosystem service**	**Present value 2012 - 2030 (€2010 prices)**	**Notes**
	I. Ecotourism and Recreation	-	Site has significant visitor activity, but nature-based tourism potential is under-exploited.
	II. Genetic/species diversity	-	Unable to connect impacts of management measures to valuation evidence.
	III. Fiber (timber)	0	Conservation measures to deliver Forest Stewardship Council (FSC) certification will not require a change in logging volumes. Certification may increase the value of the timber produced.
	IV. Carbon	0	
	V. Water regulation	-	Contribution of site to reducing downstream flood risks is not quantified.
	VI. Water purification	0.895m	Uncertainty over the transfer of average EU water treatment costs
	VII. Grassland landscape/amenity	0.026m	Based on the avoided loss of grassland to scrub for 10 years, thereby maintaining agricultural landscape
	VIII. Costs	2.038m	Visitor Management: €0.119m; Agri-environment costs: €1.916m; Forestry certification: €2,500 + training and equipment costs
	Net value of conservation measures analysed	**- 1.117m**	**Highly uncertain as values only capture part of the impacts of conservation measures**
	Key non-monetised impacts	**Some important potential impacts are omitted from the valuation figures, e.g.:** • **Value of site from conserving genetic/species diversity, and for local ecotourism and recreation.** • **Training and equipment costs for implementing FSC certified forest management.**	
	Assessment of results and risk of double-counting	The results have major gaps and therefore no conclusions can be made about the net value of the conservation measures. There is no risk of double counting between the values for grassland landscape/amenity and water purification. The amenity/cultural values are based on average landscape figures, so would be expected to be an underestimate of the value of the site.	

CONSERVATION MEASURE 1	Visitor management measures
A. ECOSYSTEM TYPE	**Whole site**
B. CONSERVATION MEASURE(S)	Habitat management measures to deliver favourable conversation status. Visitor management to address negative impacts of disturbance and litter. There are 2 significant historical sites within the sites' protected habitats. These are a cultural attraction to tourists, but unmanaged visitor patterns lead to two problems: • disturbance by large groups of visitors during the breeding season • litter around the sites. Visitor management by establishing eco-trails, and controlling access to some areas in April-July (e.g. rock climbing areas, bat colonies in caves). In particular controls are needed of cycling, rock climbing, and big groups. Currently 4,000 visitors/yr use accommodation on the territory of Rusenski Lom Nature Park (which at 3,408 ha, is part of the Natura 2000 site). The average price per night in the area is approximately 12 euro per person. The 2 historical sites are visited by organised groups and individuals. There are around 5,000 visitors per year on average for each of the 2 historical sites. They pay an entrance ticket of €2/person (1€ for students and retirees). According to the management plan of Rusenski Lom Nature Park the following regimes related to tourism should be respected: • Walking on marked routes to historical sites should be in groups not exceeding 20 people, with a guide • Walking on eco-trails should be in groups of max. 8 people • Visits inside the historical sites should be organized in groups of max. 5 people It is forbidden to: • Rest /lie on wet meadows; • Create loud noise and listen to loud music • Collect flowers Approach birds nests
C. COSTS of	Additional cost for the development and maintenance of 4 eco-trails of total length 40 km, located close to 4 settlements. The cost of

CONSERVATION MEASURES	management and monitoring are also calculated. One-off costs (e.g. for infrastructural works): Technical equipment to maintain the trails: 3 bush cutters, €360; 3 mowing machines, €480; design of information boards, €800 = €1,640. Ongoing cost (e.g. for maintenance works): Annual costs: 3 people working part-time directly related to maintenance, €2,100; Management (biologist), €2,970; Monitoring (biologist), €2,162; Consumables, €850. Production (€630) and putting up (€960) information boards (assumed to be replaced every 2 years) = €795/yr. Total = €8,027/yr. Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): €119,700.	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Recreation and ecotourism**	**II. Genetic/species diversity**
E. CHANGE in ES	Use and option values of visitors.	Maintain and enhance existence, landscape and amenity value for the species and habitats at the site. With better management, the numbers of tourists could increase, but the visitor flow needs better management. More zoning and an increase in signposted trails.
F. AFFECTED AREA	32,489 ha, Approx 15% of site is forest = 4,873 ha	
G. AFFECTED PEOPLE	There are 8 tourism companies operating in the area. They range from large ex-state national bodies to small local businesses. Four of them are believed to be interested in promoting an eco-tourism offering based on the site's environmental and cultural features. There are 2 Tourism information centres in the area, and another that is due to be established.	Local population: 35,000 inhabitants in 3 municipalities in which site is located. Regional, national populations
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Bulgarian income per capita is well below European Average. Communities in this rural area have below average incomes.	Local community in this rural area has below average incomes.
I. AFFECTED VARIABLES –	Number of visitors. Value per visit and spending in local economy	Condition of site, as this relates to its total economic value of

units used to measure change in ecosystem service	per visit.	site.
J. MARKET or NON-MARKET VALUES	Market and non-market values	Non-market value
K. VALUATION METHOD	Results from forest meta-analysis:	Results from forest meta-analysis
L. VALUATION	Marginal value of EU forest recreation = €1.33/ha/yr (implying site value of > €6,000 per year). But value of conservation measures are some increment of this value, based on increase in condition of the site.	Marginal 'passive value of temperate mixed EU forest' = €119/ha/yr (implying site value of > €950,000 per year). But value of conservation measures are some increment of this value, based on increase in condition of the site.
	NOTE: for both these services we could estimate a marginal value IF we can say what % damage to visitor attractiveness/site's non-use value is avoided by introducing conservation measures. A proxy for this % could be % below favourable condition: i.e. if favourable condition = 100, how would you score site currently? What would you expect score to be in 2030 without management measures?	
Present Value	-	-
SOURCE	Chiabai et. al (2007)	Chiabai et. al (2007)
M. CONFIDENCE		
N. KNOWLEDGE GAPS		
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Evidence to link valuation studies to change in condition of Natura 2000 sites	

CONSERVATION MEASURE 2	Sustainable forest management measures	
A. ECOSYSTEM TYPE	**Forest**	
B. DESCRIPTION CONSERVATION MEASURE(S)	Introduction of sustainable forest management – to achieve FSC certification standard.. Long-term targets for the management of forests include: • coniferous stands - replacement of black and white pine with native tree species; • deciduous high forest - conservation and restoration; • forests for reconstruction - restoring native forrest; • coppice forests – conversion to seed forests in order to increase their life cycle; • scrubby woods (acacia) - replacement with native tree species; • poplar - replacement with native tree species.	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs: Preparation for certification including training, forest research and development of additional management procedures; € not known; Implementation of the certification process, including initial and on-going audit; estimated € 0.5/ha for large forests = €2,437 Ongoing cost (e.g. for maintenance works): € not known, payment schemes still being developed by Government. Forest is 90% in public ownership, and managed by state authorities. Likely to require additional funding for adaptation measures including training, purchase of special equipment. Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): €2,500 + training and equipment costs.	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**III. Fibre. At present high quality timber is processed, lower quality timber is used as fuel.**	**IV. Carbon**
E. CHANGE in ES	No reduction in timber yield expected as a result of management measures. Potential price premium as a result of FSC	No expected change in volume of standing timber and therefore

	certification.	little change to carbon storage.
F. AFFECTED AREA	Approx 15% of 32,489 ha site is forest = 4,873 ha	
G. AFFECTED PEOPLE	Local foresters	Global population
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities in this rural area have below average incomes.	n/a
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Volume of timber, value of timber: in 2010 production was 4,007 m^3, giving income of €10,400	Carbon dioxide eq emissions.
J. MARKET or NON-MARKET VALUES	Market value	Non-traded value of carbon.
K. VALUATION METHOD	Market price of timber.	Social damage function
L. VALUATION	Potential premium on timber as a result of MSC certification uncertain, but current demand for certified Timber in Bulgaria exceeds supply, so some premium is expected.	-
Present Value	n/a	
SOURCE	Regional Forestry Directorate of Ruse (via WWF, pers comm, September 2011).	
M. CONFIDENCE	-	-
N. KNOWLEDGE GAPS	Market for sustainably sourced timber – the scale of continuing demand and likely price premium for timber.	
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Research into market for sustainably sourced timber.	

CONSERVATION MEASURE 3	Floodplain restoration		
A. ECOSYSTEM TYPE	**Grassland**		
B. DESCRIPTION OF CONSERVATION MEASURE	According to the management plan of Rusenski Lom Nature park, the next regimes of farm activities[2] on grasslands should be respected (: • Mowing of meadows should be done after June 15; • Mowing must be implemented from the middle to the periphery of the meadow in order to protect bird species; • Restoration measures of converted meadows should include re-seeding, dragging and regulated mowing considering the grow phase of grasses. For re-seeding purposes, it is necessary to use 10 kg/ 0,1 ha grass seeds from local grass species or clover; • Maintenance of grasslands by removal of shrubs and stones • For the restoration of native meadow species along the river, it is necessary to remove all ruderal phytocenoses • Prohibition of using pesticides and fertilizers • Prohibition of converting grasslands into arable lands • The rate of grazing should be maintained at 1 ha per cattle animal and 0,2 ha per small farm animal		
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): €485 per ha for clearing and re-seeding of 396ha = € 192,300; Costs of floodplain restoration of €3,470 per ha for 270 ha = € 937,000. Total one-off costs = 1,129,300. Ongoing cost (e.g. for maintenance works): Costs of mowing estimated at € 6,800 per year; € opportunity cost of arable use of floodplain land, assumed to be reflected in agri-environment payments of 135/ha = €53,460/yr. Total PV = €786,390. Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): €1.916m		
D. AFFECTED ECOSYSTEM	**V. Water Regulation**	**VI. Water purification**	**VII. Landscape and Amenity**

[2] which are the same as the restrictions imposed by the Order for the designation of Lomovete PA.

SERVICE(S) (ES)			
E. CHANGE in ES	Reduction in downstream flood risk	Maintenance of floodplain grasslands (avoiding conversion to arable land) retaining function to absorb nutrients and particulates from flood waters	Maintain traditional grassland agricultural practices that would otherwise be lost
F. AFFECTED AREA	In 3,408 ha nature park, Approx 18% is farmland (600 ha), of which 45% is meadows = 270 ha		270 ha meadows, plus 126 ha dry grassland = 396 ha
G. AFFECTED PEOPLE	Downstream floodplain inhabitants	Downstream water users	Local, regional, national population
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities in this rural area may have below average incomes.		
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Flood damage in downstream areas. There have been serious flood events in the area in the last 10 years, resulting in very significant damages and loss of life. The response to the flooding has been to dredge rivers to remove silt, suggesting that siltation as a result of soil erosion from surrounding land is a contributing factor to the flooding.	Water quality downstream. The water company drawing water from the area supplies approx 250,000 people with water, making charges of approx €0.88m per yr.	The value to regional population of the dry grassland, which would eventually revert to forest, but welfare losses assumed due to interim loss of landscape value for 10 years of scrub growth, and because traditional mixed landscape more highly valued than pure forest landscape. Value of loss of meadows to arable is permanent.
J. MARKET or NON-MARKET VALUES	Market value of avoided damage to property	Market value, based on average EU costs of water treatment to remove N.	Non-market value
K. VALUATION METHOD	n/a	Transfer of valuation study from other Danube tributaries (Morava)	Value transfer of stated preference studies
L. VALUATION		€225.4/ha, for 270 ha = €60,850/yr	Value Transfer 1: €5.05/ha/yr. For 126 ha of dry grassland = €636/yr (2010-2020).

			AND Value Transfer 2: €5.05/ha/yr Applied to 270 ha of meadows = €1,360/yr (2010-2030).
Present Value		€895,000	€5,470 for dry grassland, plus €20,040 = €25,510
SOURCE		Seffer (2000) (Morava paper)	Ciaian & Paloma (2011) Krumalova (2002)
M. CONFIDENCE		Low	Moderate – Low
N. KNOWLEDGE GAPS		Average EU N treatment costs may not apply to Bulgaria	Marginal value of preserving grassland against development and re-wilding.
O. RECOMMENDATIONS FOR IMPROVING ACCURACY		Anaysis of nutrients in Lomovete catchment	Strengthen evidence base through primary research into values and distribution (E.g. extent of distance-decay for non-use values).

Assessment of Value Transfer for Water Purification: Study: Morava River (Austrian/Slovak border). Policy Site: Lomovete Natura 2000 site, Bulgaria.

Characteristic	Study (MO)	Policy Site (LO)	Match
The ecosystem services studied	Nutrient retention along Danube tributary	Nutrient retention along Danube tributary	Satisfactory. Retention at LO may be lower due to lower nutrient loadings (details unknown)
The location / geography of the site	Floodplain grasslands along Morava river and floodplain on Slovak/ Austria Border	Floodplain grasslands along rivers and floodplain in Bulgaria	Good.
The change to the ecosystem services	Increased nutrient retention through conversion of floodplain arable land to permanent grassland		Good
The people affected	Downstream water consumers (saved water treatment costs)		Satisfactory. Large populations in downstream towns and on Danube. However, role of sites in overall nutrient loads unclear
The available alternatives (substitutes) for the ecosystem service	Few alternatives, necessitating water treatment	Few alternatives, necessitating water treatment	Poor. Relative costs of water treatment may vary.
Conclusion for Value Transfer	The values for nutrients absorption per ha from MO (€225.4/ha) can be applied to LO, but will low levels of confidence due to uncertainties over water treatment costs. Two other studies are not as closely comparable to Lomovete, but still provide useful context: comparator Gren (REF): Annual value of the existing Danube floodplains € /ha. Denhart (undated): €500 – 1600 per ha per year for removal of 200kg N/yr on River Elbe, Germany.		

Assessment of Value Transfer for Grassland Landscape/Ameity Value: Study: EU meta-analysis. Policy Site: Lomovete Natura 2000 site, Bulgaria.

Characteristic	Study Site (EU meta-analysis)	Policy Site (LO)	Match
The ecosystem services studied	Provision of grassland/ traditional agricultural landscapes	Provision of traditional grassland agricultural landscape within areas protected for biodiversity and landscape	Good, similar agricultural landscapes. LO may have higher value as Natura 2000 site
The location / geography of the site	Agricultural areas of the Bulgaria.	River valley agricultural areas	Satisfactory, general similarity only.
The change to the ecosystem services	Maintenance/enhancement of grassland/ traditional agricultural landscape	Conservation programme to prevent damage to grassland agricultural landscape	Good, LO is specific example of change covered by EU study.
The people affected	National population.	Local, regional and possibly national populations, depending on extent of non-use values.	Satisfactory, unclear if LO is relevant to national population.
The available alternatives (substitutes) for the ecosystem service	Traditional agricultural areas with extensive substitutes on national scale.		Good
Conclusion for Value Transfer	EU values can be transferred, but with some uncertainty as they are relevant to more general agricultural landscapes. Value of maintaining pasture = difference between values of grassland (€17) and arable (€12) landscapes in the Bulgaria, inflated to 2010 prices = €5.05/ha/yr.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

References:

Dehnhardt A (undated) Elbe river, The replacement value of flood plains as nutrient sinks: a case study of the river Elbe. Institute for Ecological Economy Research (IÖW). Potsdamer Str. 105, 10785 Berlin, Germany

NATURA 2000 SITE	Name : **MUNTANYA DE MONTSERRAT – SPAIN** **Natura 2000 number : ES5110012** **Biogeographical region : Mediteranean** **Surface : 7270,4 ha**

Site description

The full name of the site is Montserrat – Roques Blanques – Riu Llobregat. Montserrat Mountain stands out as a clearly distinct geographical, individualized and homogenous unit. Its geographical elements give it its unique appearance of a very rugged rocky massif, in which erosion has created numerous buttresses, cliffs and crests, which is a climber's paradise. Vegetation is apparently sparse, but there are many species, some of them endemic, well adapted to the rocky environment and lithosols. In valleys holm oak and aleppo pine abounds. Amongst the most representative fauna of the Park are the Southeastern Spanish Ibex (goat) and wild boar, in rocks and the holm oak forests respectively, and birds of prey, such as the Bonelli's eagle or the Peregrine falcon which are located in the less accessible areas of the cliffs.

Due to its attractiveness for hiking, climbing etc. and the vicinity of a densely populated area (Barcelona) there is an increasing number of visitors in the Natural Park of Montserrat Mountain. Figures are really high (3.000.000 visitors per year), taking into account the small area of this site. Consequently, there is an increasing impact of mass recreation further enhanced by the development of large infrastructures in the visitor centre (restaurants, shops) and surrounding areas (roads and large parking areas).

Map *(on Google Earth, from Natura 2000 Viewer)*

Impression

Managing Authority

The Board of Muntanya de Montserrat is the lead agency and manager of the Natural Park. It is a part of the Autonomus Government of Catalonia, under the direction of the Head of Natural Parks Office. The municipalities, the Abbey of Montserrat and other small owners are also involved.

Threats	Current threats: Recreation overexploitation because of the proximity of Barcelona. For the environment the biggest threat are the climbers and hikers who enter the nesting areas; other threats are land abandonment resulting in forest expansion. Another major threat are forest fires as they result in erosion (with high risks on landslides). Expected pressures: Tourism is expected to increase even more.
Conservation objectives	One of the Board's objectives is conserving and restoring the park, to protect its unique relief and preserve the natural (geological, vegetation, fauna and landscape) to preserve the functional ecosystems of the area and to safeguard the historical , archaeological, artistic and monumental values.
Main conservation measures	• Visitor management. After Natura 2000 designation and thanks to an agreement with the Catalan federation of mountaineering, there are specific regulations of some activities, as climbing and mountain-bike. • Hunting is forbidden but there is a joint program with hunters for controlling the population of wild boar and wild goat • Wildfire prevention • Preserving high nature grasslands against succession; it is part of a broader program on Sustainable Agriculture; a project for the creation of an 'Agricultural Park' in the surrounding area of the site is ongoing
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • **Visitor management**, as it comprises the whole park and the different ecosystem types. The most important ecosystem service is ecotourism and recreation. In a second stage the visitor management planning is intended to influence the genetic/species diversity but this service is not selected here. • **Wildfire prevention**, as in case of a wild fire it would change the park quite severe as almost 25% of the park is forest and without the forest the typical landscape would disappear. The selected ecosystem services are timber production, climate change regulation, water regulation, air quality regulation, erosion control, food production and landscape amenity. • **Preserving high nature grasslands against succession**. Here climate change regulation, air quality regulation and timber production are chosen as relevant ecosystem services.
Contact person who participated in the case study	Dr. Xavier Ariño (xavier.arino@uab.cat), Universitat Autònoma de Barcelona (www.uab.cat)

Summary of economic valuation	Ecosystem service	Present value 2011 - 2030 (€2010 prices) discount rate 3.5%	Notes
	A. Ecotourism and Recreation	No change	
	B. Fibre (Timber)	Free	
	C. Carbon Sequestration	9.2 – 20.1m€	Net effect from the increase in forest because of wildfire prevention and decrease in forest because of grassland. Assuming for the wild fire prevention that conservation completely prevents loss of forest landscape, and avoiding loss of 50% of carbon stored in forest and a decrease in carbon sequestration because of the grassland conservation instead of letting it grow into forest.
	D. Water regulation	No information	
	E. Air quality	Not relevant	
	F. Food	1.06m € - 1.4m €	Only part of the food benefits without accounting for subsidies.
	G. Amenity and cultural value	33.68m €	Own calculations of travel costs and rough estimations of change in visitor numbers. Not including non-use value. The value to the local population is included only if they are users of the park.
	H. Erosion control	22 – 29.4m€	Based on avoided costs.
	Costs	21.75m €	**Quite detailed costs, 20.2 million € is from visitor management planning (mostly maintenance, including wages). The rest are mainly wages for park staff.**
	Net Value of conservation measures analysed	**44.1 – 62.8 m€**	Most of the major values have been quantified with some reliability
	Key non-monetised impacts	**The non-use values are not included. The timber is not sold so the net increase in forest is not monetized.**	

	Assessment of results and risk of double-counting	The key ecosystem services that are relevant for the site are captured. The landscape amenity value is the largest contributor to the overall value but is based on rough estimations of visitor reduction numbers. The value the landscape has for the locals is not included in this value neither is the non-use value. So the benefit of this ecosystem service will be even higher in reality. The risk of double counting is low because no ecosystem services are relevant to different measures, except from carbon sequestration. For carbon sequestration however, the net effect is calculated. The milk price, which is of minor importance in the net value, is not adjusted for possible subsidies given to the farmers because of a lack of data.
	Sensitivity Analysis	Using the travel cost may significantly underestimate the value of the landscape of the park. As this is the most important ecosystem service a more accurate estimation will make the total net value of this package of conservation measures even higher. As well for food, for erosion control as for carbon sequestration a sensitivity analysis is done by taking into account a range of values. The result of this sensitivity analysis is shown as well in the range of the total net value of the conservation measures. The sensitivity analysis of the food does not significantly affect the result. The range of the carbon sequestration has a greater impact on the result. The range of the erosion control measure is much smaller than the range for carbon sequestration and therefore the variation only affects the result moderately. When the highest values are used for all the services the net value of the conservation measures rise by 42%. More than half of this rise is from carbon sequestration and for about 40% by erosion control benefits variation.

CONSERVATION MEASURE 1	Visitor management planning (i.e. restrictions on the areas that can be visited and the number of hunters/hunted animals)
A. ECOSYSTEM TYPE	**Forest, rocks and caves**
B. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: • One-off costs (e.g. for infrastructural works): 2.5 million € • Ongoing cost (e.g. for maintenance works): 1.2 million € • Expected life time: not known, we presume 20 years Present value of total additional cost over a 20 year period: 2.5 + 17.7 million € = 20.2 million €
C. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Ecotourism and recreation**
D. CHANGE in ES	No changes in visitor numbers is expected. Hunting will be restricted to 4 days instead of 12 to 15 days but not less hunters or hunted animals are expected.
E. AFFECTED AREA	2030 Ha of restricted area and 25 Ha of regulated area
F. AFFECTED PEOPLE	Hunters
G. CHARACTERISTICS of affected people	
H. AFFECTED VARIABLES – units used to measure change in ecosystem service	
I. MARKET or NON-MARKET VALUES	
J. VALUATION METHOD	

K. VALUATION	
Present Value	none
SOURCE	Dr. Xavier Ariño, Universitat Autònoma de Barcelona Park Management
L. CONFIDENCE	The yearly maintenance cost are very high in comparison with the other costs. The risk of some things being double counted is real.
M. KNOWLEDGE GAPS	We don't know for sure if people will or will not change their behavior because of the restrictions.
N. RECOMMENDATIONS FOR IMPROVING ACCURACY	

CONSERVATION MEASURE 2	Wildfire prevention			
A. ECOSYSTEM TYPE	**Forest**			
B. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs: none Ongoing cost (e.g. for maintenance works): • 2 people 50% of their time all year: 48,000 EUR * 50% = 24,000 EUR • 4 persons 2 months a year: o monthly cost per person: 24,000 EUR / 12 = 2,000 EUR o 4 persons 2 months a year: 2,000 * 4* 2 = 16,000 EUR • 1 farmer and his team 1 day a week: 32,000 EUR/year • Cost of cows: 7 EUR/Ha * 900 Ha = 6,300 EUR / year (Exclusive cost of buying cows) Total Cost per year: 24,000 + 16,000 EUR + 32,000 + 6,300 EUR= 78,300 EUR Present value over 20 years: 1.15 million €			
C. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**II.Timber production**	**III. Climate Change Regulation**	**IV. Water regulation**	**V. Air quality regulation**
D. CHANGE in ES	Decrease in timber production by removing forest lanes near pathways[1] On the other hand an increase because of lower possibility of a wildfire.	Decrease in greenhouse gas sequestration/emission because of grass instead of forest, but increase of storage because of preventing the wild fire in the forest.	The forest decreases the risk of flooding of the river.	Decrease in NOx and PM capturing because of grass instead of forest, but increase of the capturing of NOx and PM because of preventing the wild fire in the forest.
E. AFFECTED AREA		Decrease: 14 ha	The roads in the park	

[1] mostly pines and holm oakes

		Increase: 1744 Ha Net increase: 1730 ha		
F. AFFECTED PEOPLE	Locals who receive the timber for free.	Global population	Visitors. Local residents	Not relevant as there is no major source of air pollution nearby and these effects are limited in distance.
G. CHARACTERISTICS of affected people (e.g. income levels above or below average?).		n/a		
H. AFFECTED VARIABLES – units used to measure change in ecosystem service	Amount of timber, measured in m^3	tCO_2 (tonnes of Carbon dioxide equivalent). Assume 50% of the forest's carbon store would be lost to fires without conservation measures.	Amount of money spent on cleaning up after floods, measured in EUR.	Tonnes of Nox, tonnes of PM
I. MARKET or NON-MARKET VALUES	free	Market / Non-market value	Market value	
J. VALUATION METHOD		Transfer of carbon storage values	Damage costs	
K. VALUATION	It is not expected that less timber would be given to the locals.	1730 ha forest with 280tC per ha = 484,400 tC. Assume avoided loss 50% = 242,200 tC reduced emissions. Carbon valued at 63.12 € (low) to 117.44 € (high) per tC.	It is not possible to estimate the increase in costs if a wildfire would happen.	
Present Value		15 m € - 28,4 m €		
SOURCE	Dr. Xavier Ariño, Universitat	IEEP, 'Estimating the overall	Dr. Xavier Ariño, Universitat	-

	Autònoma de Barcelona	economic value of the benefits provided by the Natura2000 network', 2010	Autònoma de Barcelona	
				-
L. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**VI. Food production**	**VII. Landscape amenity**	**VIII. Erosion control**	-
M. CHANGE in ES	Increase in profits through milk and meat of the cows (45-60 cows)	Avoided decline in visitors' numbers because of the destruction of the typical landscape in case of a fire.	Reduction in runoff of soil particles and in falling rocks	
N. AFFECTED AREA	900 ha forest	1730 ha forest	The rocky area of the park	
O. AFFECTED PEOPLE	The farmer who sells the meat and the milk	The amount of visitors is estimated by the park management at 2.5m per year (mostly climbers, also hikers and hunters). The valuation of local residents will also be affected.	tourists	
P. CHARACTERISTICS of affected people (e.g. income levels above or below average?).		- 47% of visitors are from the Catalonia Region, 8% from Spain and 45% foreigners. - 90% of visitors stay only 1 day These characteristics are based on a study for the whole region, so not only for tourism in the Muntanya de Montserrat park.		

Q. AFFECTED VARIABLES – units used to measure change in ecosystem service	Value of meat and milk, measured in EUR per liter milk or EUR per kg meat	Avoided decline in number of visitors. The park management expects 20% less visitors in case of a fire, i.e. 500,000 visitors less. When the landscape loses its typical aspects then the valuation of the visitors that keep visiting the park and of the locals will also decline.	Avoided costs for erosion control because of wildfire prevention	
R. MARKET or NON-MARKET VALUES	Market value	Market value	Market value	
S. VALUATION METHOD	Selling price	Travel cost	Prevention costs to avoid landslides and rock falls through installing anchors, geogrids and steel wires to protect roads, buildings and other infrastructure)	
T. VALUATION	**Milk:** 5000L/cow/year 0.32€/L 1,600 EUR/cow Total: Between 72,000 EUR (45 cows) and 96,000 EUR (60 cows) yearly **Meat :** It is not known how much meat is sold every year so no calculation can	The value per person per visit is estimated at 4.58 € (see remarks). The park management expects 20% less visitors in case of a fire: 2.5m *0.2 *4.58 € per person per visit = 2.29m € less value yearly in case of wildfire There is no data on the drop in valuation of the remaining visitors and the locals.	1.5-2 million €/year	

	be made.			
Present Value	1.06 million-1.4 million €	33.68 million €	22 – 29.4 million €	
SOURCE	Dr. Xavier Ariño, Universitat Autònoma de Barcelona	- Visitor estimations: Dr. Xavier Ariño - Google Maps, petrol prices August 2011	- Dr. Xavier Ariño, Universitat Autònoma de Barcelona	
U. CONFIDENCE	Moderate. It's a rough estimation of the hectares. Moderate confidence in carbon sequestration values and uncertainty about the degree of carbon loss in case of fire.			
V. KNOWLEDGE GAPS	A lot of information is lacking about the valuation, especially the valuation of the visitors and locals for the typical landscape and the damage cost of flooding. Also specific information on carbon storage in these kind of forests and carbon loss in case of fire are needed.			
W. RECOMMENDATIONS FOR IMPROVING ACCURACY	As landscape amenity is the most important ecosystem service it is important to have a clear view on the amount of visitors in the park every year. Today these are just estimations. A survey among the park visitors, in which valuation is also a topic, would help to make a more accurate calculation of the conservation measures benefits.			
X. Remarks	o The cows that are used in the park graze the undergrowth of the forest and in that way they prevent wild fire but they also prevent the forest from expanding. The farmer is breeding the cows, so there is no cost for buying them. The farmer is also responsible for the selling of the meat and milk. o The short term ranges for carbon sequestration were chosen because the forest exists already today and the loss of benefits are calculated in case of a fire today. The benefit is a one time fire event that burns the complete forest down and so releases half of all the carbon captured. This loss of benefit is a one time event for a full grown forest and is therefore not discounted over a 20 year period. o Most of the visitors come from Barcelona by car, which is approximately 57 km from the main entrance of the park in Montserrat. We estimated the petrol costs at 6,87 € one-way for a standard petrol car (petrol at 1,34 €/L). This means a total travel cost of 13,74 € per car. We assumed that the average car has 3 persons in it.			

CONSERVATION MEASURE 3	Preserving high nature grasslands against succession		
A. ECOSYSTEM TYPE	**Grassland**		
B. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): none Ongoing cost (e.g. for maintenance works): • 2 people 50% of their time all year: 48,000 EUR * 50% = 24,000 EUR • 3,000 EUR per year for a biologist (general supervision) Total cost per year: 27,000 EUR Total present value over 20 years: 0.4 m €		
C. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**IX. Climate Change Regulation**	**X. Air quality regulation**	**XI. Timber production**
D. CHANGE in ES	Decrease in greenhouse gas sequestration/emissions depending on land type	Increase or decrease in NOx and PM capturing because of grass instead of forest	Decrease in timber production (mostly pines and holm oakes)
E. AFFECTED AREA	550 ha would otherwise be forest	550 ha	550 ha
F. AFFECTED PEOPLE	Global population	Not relevant as there is no major source of air pollution nearby and these effects are limited in distance.	Locals who receive the timber for free.
G. CHARACTERISTICS of affected people	n/a		
H. AFFECTED VARIABLES – units used to measure change in ecosystem	tCO_2 (tonnes of Carbon dioxide equivalent) Carbon savings for forest: 280 tC/Ha Carbon saving for grassland: 139 tC/Ha	Tonnes of Nox, tonnes of PM	Ha of grassland and the amount of timber in m^3 per Ha

service	Difference: 141 tC/Ha less capturing*		
I. MARKET or NON-MARKET VALUES	Market / Non-market value		Non-market
J. VALUATION METHOD	Cost of abatement / Damage cost of carbon		There is no reduction in this service expected.
K. VALUATION	550ha of grassland capturing 141 tC/ha less than forest = 77,550 tC less. Value of 143.13 € (low) to 205.52 (high) per tC in 2030		
Present Value	Low: -5.8m€ High: -8.3m€		
SOURCE	Dr. Xavier Ariño, Universitat Autònoma de Barcelona IEEP		
L. CONFIDENCE	The estimation of the hectares is rough.		
M. KNOWLEDGE GAPS			
N. RECOMMENDATIONS FOR IMPROVING ACCURACY			
O. REMARKS	*We assume that the forest would be fully grown after 20 years and so that in 2030 for the first time this difference in tC capturing would appear. Because of that we will use the value per tC for 2030 (the same as for 2020 but discounted back from 2030 to 2010 at 3,5% discount rate).		

References:

http://www20.gencat.cat/portal/site/patronatmontserrat

IEEP, ‘Estimating the overall economic value of the benefits provided by the Natura2000 network’, 2010

NATURA 2000 SITE	Name : **NAARDERMEER – THE NETHERLANDS** **Natura 2000 number : NL2000012 (SPA), NL3000061 (SCI)** **Biogeographical region : Atlantic** **Surface : 635 ha (SPA), 1152 ha (SCI)**

Site description

Naardermeer is a marshland region in the centre of The Netherlands. The region derives its greatest value from the fact that various rare breeding birds and migrating birds can be found there as well as the rich variety of types of vegetation which are characteristic of a marshland area that is fed with seepage water. Naardermeer is part of the Vechtplassen region, which consists of various lakes and marshes for which it functions as a core zone.

Naardermeer was purchased by Vereniging Natuurmonumenten in 1906. It is the oldest protected nature area in The Netherlands. The area is situated in the province of Noord-Holland, south east of Amsterdam. The marshland region lies between the Gooise hills in the east and the river Vecht in the west. Contrary to the other lakes in the 'Vechtplassen' region created by peat cutting, Naardermeer is a natural lake, which resulted from an influx from the river Vecht. The original marshland covers an area of +/- 650ha. An area of 400 hectares is situated outside this central marshland area and, after being used as agricultural land for a long time, in 1997 it was designated as a buffer and nature development area.

The main habitats in Naardermeer are grasslands, wetlands, lakes (oligo-mesotrophic waters, as well as lakes eutrophic by nature) and bog forests (birch woods with bog moss).

Naardermeer is equiped with a well developed visitor access infrastructure (visitor centres, information panels, leaflets, boattrips, restaurant, acces path and toilets for disabled, hikes, ..).

Map: *(on Google Earth, from Natura 2000 Viewer)*

Impression	
Managing	Natuurmonumenten (Dutch Society for Preservation of Nature) (www.natuurmonumenten.nl). Natuurmonumenten is the largest nature

Authority	conservation NGO in The Netherlands.
Threats	Current threats: • budget restrictions of new Dutch government might cause serious delays in realizing ecological connections with broader network • eutrophication of the lake due to non sustainable agricultural practices in adjacent agricultural area • changing land use (economic developments, urbanization, transport infrastructure) and/or energy developments (wind farms, hydropower stations)
Conservation objectives **Main conservation measures** **Selection of conservation measures and ecosystem services**	A new site management plan for the period 2012 – 2030 is in preparation. Main conservation objectives focus on improving the condition of the wetlands and haylands and on the water quality and quantity (water level). • Extensive grassland management (intensive mowing, grazing by sheep and Galloways) • Water regime management (artificial water level control) • Building ecological connections with neighbouring nature areas • Purification of inlet water • Selling the meat of the Galloway Cows as labeled “Wildernisvlees” (marketing measure) • Invasive species control (eg. Prunus serotina in the forest, Aronia melanocarpa, fish species, …) The following measures and ecosystem services were selected: • **Extensive grassland management by sheep**, as this one of the main conservation measures affecting the wetlands and haylands over 80% of the site; related ecosystem services which are selected here are <u>genetic/species diversity</u>, <u>ecotourism and recreation</u> and the <u>supporting services wool and meat</u>; biomass production (from reed, hay, water vegetation) is still in a test phase (transport seems to be too costly) and was therefor not selected as an additional ecosystem service. • **Extensive grassland management by Galloways.** Although the management method (grazing by Galloway cattle) does not change, an increase in the revenues of selling the meat was realized by means of smart marketing (<u>labeled “wilderness meat”)</u>; the affected ecosystem service is ‘<u>food production</u>’. • **Retention of nutrients from the lake**; this measure contributes to the ecosystem services ‘<u>water purification’</u> and ‘<u>genetic/species diversity</u>’. An interesting issue in this case is the involvement of delinquents in the reed management process by a local reed enterprise. On the basis

	of an agreement between the City of Amsterdam and the entrepreneur drug addicts are obliged to perform certain tasks (eg. clearing of timber, tying and transporting bunches of reed, removing of leaf litter, etc; building of "rietschelft"[1] , keeping ditches open, …) and in this way are kept away from the street. Also task prisoners deliver labour. One can say that this 'alternative' type of conservation measure affects 'human health' in a positive way. Due to the fact that only very limited data were available for the economic valuation this conservation measure was not further elaborated.
Contact person who participated in the case study	Gradus Lemmen, Site manager; g.lemmen@natuurmonumenten.nl ; see also www.natuurmonumenten.nl/naardermeer

[1] old storage of reed in the shape of a house, without cover sail

Summary of economic valuation	Ecosystem service	Present value 2011-2030 (€2010 prices)		Notes For all cases: discount rate 3,5%
		Min	**Max**	
	I. Genetic/Species diversity *from sheep grazing*	0.08 m	0.12 m	Increase of biodiversity by grazing by sheep instead of mechanical mowing + avoided costs of mechanical mowing Based on Dutch CVM study for ecotype lakes and marshes
	II. Tourism/recreation	0.02 m	0.02 m	Recreational value of more biodiversity and presence of sheep Based on Dutch CVM study for ecotype lakes and marshes
	III. Wool and food	0.015 m	0.015 m	Meat/wool associated with sheep Based on benefits of meat and wool
	IV. Water purification	0.004 m	0.02 m	Keeping the lakes low on nutrients Based on the highest charge on sewage & the costs of water purification for the Netherlands. The P-charge of the water purification by the wind mill could not be traced.
	V. Genetic/ Species diversity *from water purification*	0.51 m	1.02 m	Specific fauna and flora due to low nutrients in lakes Based on Dutch CVM study for ecotype lakes and marshes
	VI. Food	0.17 m	0.2 m	Increased yield of meat through better marketing
	Costs	0.88 m	0.88 m	
	Net Benefits of conservation measures analysed	**Min: -0.08 m**	**Max: +0.52 m**	**Partial valuation of ecosystem services. Uncertainty in several values.**

Key non-monetised impacts	Non-use values are expressed in € per ha, which makes it impossible to capture valuation of local population/tourists. Double checking with existing CVM studies (based on household data) is an option. Some important impacts are omitted from the valuation figures, e.g.: • value of the change from mechanical mowing to grazing by sheep • value of the change from good water quality to optimal water quality (minimal P-charge)
Assessment of results and risk of double-counting	The result provides a valuation of one key ecosystem service of the site (purification of inlet water) and two smaller ecosystem services(grazing the dykes by sheep and labeling the Galloway meat). There is no risk of double counting as each conservation measure corresponds with a different area of the site (lakes, grasslands/wetlands, dykes).
Sensitivity Analysis	The valuation of Genetic/ Species **diversity** and Tourism/recreation has greater uncertainty, due to missing values for changes (see above). As well for water purification as for genetic species/diversity a sensitivity analysis is done by taking into account two conservation measures: a) Retention of nutrients from the lake • Assigning the same benefit of the chemical water treatment plant to the wind mill purification would not influence the conclusions significantly (1 - 10% of net value). • Alternative assumptions on the range of change in non-use value of water purification change the overall value significantly. A broadening of the range with 10% (10-50% change), changes the results with 75 to 134%. This small broadening of the range even affects the total net value for the 3 ecosystem services substantially, although without change in +/- sign[2]. b) Extensive grassland management by sheep • Broadening the range of change of the non-use value does not significantly affect the result. The effect is marginal (3 to 5%).

[2] When lowering the change in biodiversity from 20 to 10%, the total net value of all conservation measures lowers from -0,079 to -0,335 m € (-23,5%). Using 50 instead of 40% change, has even a greater effect: total net benefits rise from 0,518 to 0,774 m € (+67%) .

	Conclusion: the range of the ecosystem Genetic species/diversity of the water purification measure has a greater impact on the total result of all 3 conservation measures, with a change of 23 to 67% .
Summary	**A main conclusion is that the analyzed ecosystem services could all be monetized, except for the P-charge associated with the windmill water purification. On the other hand, the study does not cover the main ecosystem services of Naardermeer. The site is divided into 3 ecotypes: lakes, wetlands/grasslands and forests. For the lakes (32% of total area), the main ecosystem service is analyzed. For wetlands and grasslands (40% of the Naardermeer reserve) only small (marginal) ecosystem service were taken into account. No ecosystem services of forests are examined, IThe 3 conservation measures result in a range from a small net costs (0.079 m €) to a more substantial net benefit (0.518 m €). The Genetic species/diversity value is the largest contributor to the overall value but is based on rough estimations of the change in biodiversity. As a result the net value is very sensitive to assumptions about changes in non-use value, especially for the conservation measure “retention of nutrients from the lake“.**

CONSERVATION MEASURE 1	Extensive grassland management by sheep		
A. ECOSYSTEM TYPE	**Grasslands + rivers and lakes**		
B. DESCRIPTION OF CONSERVATION MEASURE(S)	Grazing of the dikes (9ha) by sheep instead of mechanical mowing 		
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): // Ongoing cost (e.g. for maintenance works): sheep on dikes: 2000 € /year (222.22 €/ha) (1) Total costs per year: 2000 €		
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Genetic/Species diversity**	**II. Tourism/recreation**	**III. Wool and food (meat)**
E. CHANGE in ES	Prevention of succession on dykes and several advantages for nature instead of mowing by machines. [3]	More value for visitors	Meat and wool production
F. AFFECTED AREA	9 ha	9 ha	9 ha
G. AFFECTED PEOPLE	Residents/visitors	Yearly 16.000 visitors for walking, estimate of 2.5 % extra visitors due to conservation measure (1)	Reed cutter (in charge of sheep herd), conservator
H. CHARACTERISTICS	//	///	///

[3] Mowers ground invertebrates, small mammals and amphibians lurking in the vegetation. Grazing sheep give small animals enough time to escape. The sheep graze irregularly and thus bring more structure to the vegetation (with more Genetic Species/diversity as a result). A second advantage of sheep instead of machines are the avoided emissions and fuel consumption.

I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Yearly Avoided Costs by not mowing mechanically: Mechanical mowing: • Per ha: 586 € [4](2) - 850 € (3)[5] • Whole area: 5275 € - 7650 € Yearly benefits from non-use value: • 527 €/ha (N2K type: lakes and marshes.) (3) • Estimated change in biodiversity: 10-20% (1) • Whole area: 474 € - 949 €	Yearly benefits from tourism and recreation: • 6.220 €/ha (N2K type: lakes and marshes.)(3) • Part associated with extra visitors (2.5%): 155.5€/ha • Whole area: 1400 €[6]	Yearly benefits form meat: (4); (5) • Number of slaughtered sheep per year: 10 • Kg/sheep: +/- 80 kg (ewe) • Gain per kg/sheep: 1 € + 21€ ewe prime • Total: 1010 € Yearly benefits from wool: (4) • Number of sheep: 40 • Kg wool/sheep: 3 kg (average including lambs) • Gain per kg wool: 0.30 € • Total: 36 €
J. MARKET or NON-MARKET VALUES	Non - Market value	Non - Market value	Market value
K. VALUATION METHOD	CVM, increase in value for nature conservationists.	CVM , increase in value for visitors	Market prices
L. VALUATION	Net Benefits: 5749 €/yr - 8599 €/yr	Net Benefits: 1400 €/yr	Net Benefits: 1046 €/yr
Present Value	**Minimum net benefits: 0.088 m €** (present value of 6195 €) **Maximum net benefits: 0.129 m €** (present value of 9045 €)		
SOURCE	(1) G. Lemmen, conservator, 2011; (2) Comm. Verheijen, 2009 (3) Kuik, et al; 2006; (4) Rhöse, E., 2010 (5) de Bont et al; 2008		

[4] Mowing, picking up the grass clippings and removing for compost; 4 tonnes / ha; ecotype: wetlands around lakes

[5] Machinal mowing, picking up the grass clippings and removing for compost; manual work excluded. Ecotype: slopes and dykes

[6] 2,5% x 6220 €/ha x 9 ha= 1400 €/yr

M. CONFIDENCE	<u>Avoided costs:</u> Good; prices from conservator + 2 sources for mechanical mowing prices. <u>Non-use value:</u> Moderate/Low: no data available of non-use value for change from mechanical mowing to grazing by sheeps[7] (sensitivity analysis is needed) + data is based on a national study .	<u>Recreational value:</u> Quantity Moderate/low: difficult to estimate the qty of extra visitors as the conservation measure only affect a marginal part of the natural reserves (the dykes, 0.76% of total area) <u>Recreational value:</u> Price Moderate: data is based on a national study .	<u>Food & material benefits:</u> quantity & prices Ok, prices for 2010. Data from National Working Group Professional Sheep farmers (LWPS)
N. KNOWLEDGE GAPS	• the % change in biodiversity • the non-use value expressed as a change	Amount of extra visitors due to conservation measure	/
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	CVM study for the Naardermeer (or near area) and/or an ecological study of the fauna and flora of the dykes with and without grazing by sheep.	CVM study for the Naardermeer (or near area)	/

[7] Only data available on the aggregate value for the habitat, of which expert judgment is applied. Although, judgment is very difficult: what is the mowing frequency compared to the grazing pressure of the sheep, how can the increase in ground invertebrates, small mammals and amphibians be estimated, …

Assessment of Value Transfer for Genetic/species diversity: Studies: Kuik, et al; 2006; (K) Policy Site: Naardermeer Natura 2000 site (NM)

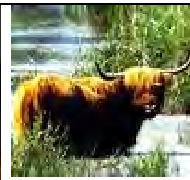
Characteristic	Study (K)	Policy Site (NM)	Match
The ecosystem services studied	Non-use value of Natura 2000 areas	Genetic/species diversity of dykes	Good
The location / geography of the site	Lakes and Marshes in the Netherlands[8]	Naardermeer Lake	Good
The change to the ecosystem services	WTP for non-use value in the ecotype "lakes and marshes"	Additional WTP for non-use value of more biodiversity through sheep grazing.	Poor (K doesn't measure additional WTP due to a conservation measure. As a result we had to estimate the %change in biodiversity)
The people affected	Not specified (aggregate value of 9 Dutch studies)	Residents/visitors	Satisfactory (no direct link is possible with the amount of visitors, K expresses WTP in €/ha/yr, not per household)
The available alternatives (substitutes) for the ecosystem service	Other Dutch lakes and marshes under the Natura 2000 protection (quite abundant)	Idem	Good
Conclusion for Value Transfer	Basis for valuation is satisfactory. It is not possible to measure the WTP of a change in biodiversity by sheep grazing. As a result a rough %estimate of change in biodiversity is needed, which lowers the strength of the valuation (see page 8).		

[8] Oost-vaardersplassen, de Vechtstreek, het IJmeer, Friese meren, het Volkerak-Zoommeer, de Horstermeerpolder, Zwemlust en Wolderwijd Nuldernauw.

Assessment of Value Transfer for Tourism/recreation: Studies: Kuik, et al; 2006; (K) Policy Site: Naardermeer Natura 2000 site (NM)

Characteristic	Study (K)	Policy Site (NM)	Match
The ecosystem services studied	Tourism/recreation	Tourism/recreation	Good
The location / geography of the site	Lakes and marshes in the Netherlands[8]	Naardermeer Lake	Good
The change to the ecosystem services	WTP for recreation in the ecotype “lakes and marshes”	Additional WTP for presence of sheep	Poor (K doesn’t measure additional WTP due to a conservation measure. As a result only the estimated % change of visitors is taken into account)
The people affected	Visitors	Visitors	Satisfactory (no direct link is possible with the amount of visitors, K expresses WTP in €/ha/yr, not per household)
The available alternatives (substitutes) for the ecosystem service	Other Dutch lakes and marshes under the Natura 2000 protection (quite abundant)	idem	Good
Conclusion for Value Transfer	Basis for valuation is satisfactory. It is not possible to measure the presence of sheep to the WTP on a visit of Lakes and Marshes. As a result a rough estimate of extra visitors is needed, which lowers the strength of the valuation. Although the WTP in K is based on 17 Dutch studies.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

CONSERVATION MEASURE 2	Extensive grassland management by Galloways
A. ECOSYSTEM TYPE	**Grasslands + rivers and lakes**
B. DESCRIPTION OF CONSERVATION MEASURE(S)	Although the management method (grazing by Galloway cattle) does not change, there is an optimalisation of the yield of the meat of the cattle. The meat is sold as labeled “wilderness meat” to local restaurants and in the bioshop of the natural reserve.  
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): marketing campaign: no extra personnel will be hired. Ongoing cost (e.g. for maintenance works): selling the meat in local shop/to restaurants: no extra investment in personnel costs (fits into the work package of the shop owner) Cost per year: 0 euro Expected total additional maintenance costs: 0 euro Total Additional Costs of conservation measure (One-off + ongoing): 0 euro
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**IV. Food**
E. CHANGE in ES	More value on provisioning services
F. AFFECTED AREA	Pastured zone of Naardermeer reserve: 400ha
G. AFFECTED PEOPLE	The conservator: Natuurmonumenten
H. CHARACTERISTICS OF AFFECTED PEOPLE	/
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	- Number of cows to sell per year: 30-35 - Selling price per cow as “Wildernisvlees”: 800 € - Selling price per cow in regular meat circuit: 400€

	- Increased value of 400€/cow Total increased value for the cattle stock: 12.000 – 14.000 €
J. MARKET or NON-MARKET VALUES	Market value
K. VALUATION METHOD	Market price: difference between price before and after conservation measure
L. VALUATION	Net Benefits: 0.012 - 0.014 m €/year
Present Value	**Minimum net benefits: 0.171 m €** (present value of 12.000 €) **Maximum net benefits: 0.199 m €** (present value of 14.000 €)
SOURCE	G. Lemmen, conservator (2011)
M. CONFIDENCE	Ok
N. KNOWLEDGE GAPS	/
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	/

CONSERVATION MEASURE 3	Retention of nutrients from the lake	
A. ECOSYSTEM TYPE	**rivers and lakes**	
B. DESCRIPTION OF CONSERVATION MEASURE(S)	a) purification of inlet water from the lake Ijmeer to the lake Naardermeer via chemical water treatment plant (phosphate removal) b) prevention of inundation of the nutritious marsh forests (prevention of sediment transfer) via water pumping by an old wind mill 	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: (1) One-off costs (e.g. for infrastructural works): // a) Amortized: water treatment plant is built in 1984. b) Amortized: wind mill is build > 200 years ago Ongoing cost (e.g. for maintenance works): purification of the water: a) 30.000€/year[9] b) 30.000€/year Total costs per year: 60.000 €	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**V. Water purification**	**VI. Genetic/ Species diversity**
E. CHANGE in ES	Less nutrients in the water	Preserving the low nutritious properties of the lake (is unique for the Netherlands)[10]
F. AFFECTED AREA	342 ha	342 ha

[9] According to "Waterschap Amstel, Gooi,Vecht (www. Agv.nl) costs are between 200 and 300 €/kg P-removal.

[10] Typical species are Rhodeus sericeus amarus , Cobitis taenia,Myotis dasycneme, Liparis loeselii, Graphoderus bilineatus, Anisus vorticulus

G. AFFECTED PEOPLE	/	Conservationists: 145.500 households (based on the weighted total number of members of Natuurmonumenten of the province of North Holland)[11] .
H. CHARACTERISTICS of affected people	/	/
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Yearly benefits: **a) Chemical defosfate water treatment plant** Quantification: (1) & (3) Flow: 0.6 - 2.5 mio m³ /year Inlet: 0.08 mg P/l[12]. Outlet: 0.028 mg P/l. P-removal per l: 0.052 mg P/l. Total P-removal: 31.2 – 130 kg P Monetization: (2) P: between 8.5 &11 €/kg[13] Whole area: Minimum: 265 €/yr (P=8.5 €/kg) Maximum: 1430 €/yr (P=11 €/kg) **b) Water pumping by an old wind mill** No data available	Yearly benefits for non-use value: • 527 €/ha (N2K type: lakes and marshes. (4) • Estimated change in biodiversity: 20-40% (1) • Whole area: 36.000- 72.000 €

[11] Natuurmonumenten is the largest Dutch NGO working on the protection of nature, with 830.000 members in 2009. Weighted for the province of North Holland: 16,6% of total population in the Netherlands.

[12] Inlet water comes from the lake "Ijmeer" and is already relative low on nutrients.

[13] 8,5 euro/kg P (Based on the costs of water purification in NL); 11€/kg P (Prevention cost method based on the highest charge/fines on wastewater/sewage for the Netherlands).

J. MARKET or NON-MARKET VALUES	Market Values	Non market value
K. VALUATION METHOD	Market Values	CVM value
L. VALUATION	Benefits for a): 265 - 1430 €/yr Benefits for b): not available	Benefits: 36.000- 72.000 €/yr
Present Value	**Minimum net costs: 0.337 m €** (present value of 23.735 €) **Maximum net benefits: 0.191 m €** (present value of 13.430 €)	
SOURCE	(1) G. Lemmen, conservator ; 2011 (2) Ruijgrok. et al; 2011 (3) Van Liere, et al; 2002. (4) Kuik, et al; 2006	
M. CONFIDENCE	Ok	Non-use value: Moderate/Low: no data available for non-use value for change from good water quality to optimal water quality (although this change is necessary to obtain the unique fauna and flora of the Naardermeer, a rare ecotype in the Netherlands)[14] (sensitivity analysis is needed). + data is based on a national study .
N. KNOWLEDGE GAPS	/	Number of affected people and their willingness to pay + The non-use value for a change from mechanical mowing to grazing by sheeps.
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	/	CVM study for the Naardermeer (or near area)

[14] Only data available on the aggregate value for the habitat, of which expert judgment is applied. Although, judgment is very difficult: which fauna and flora will survive a slight increase in nutrients, how can species counts be applied in the lake, ….?

Assessment of Value Transfer for Genetic/species diversity: Studies: Kuik, et al; 2006; (K) Policy Site: Naardermeer Natura 2000 site (NM)

Characteristic	Study (K)	Policy Site (NM)	Match
The ecosystem services studied	Non-use value	Genetic/species diversity	Good
The location / geography of the site	Lakes and Marshes in the Netherlands[8]	Naardermeer Lake	Good
The change to the ecosystem services	WTP for non-use value in the ecotype "lakes and marshes"	Additional WTP for non-use value of more biodiversity through minimal nutrients in the lake.	Poor (K doesn't measure additional WTP due to a conservation measure. As a result we had to estimate the %change in biodiversity)
The people affected	Not specified (aggregate value of 9 Dutch studies)	Conservationists in the Province of North Holland	Satisfactory (no direct link is possible with the amount of visitors, K expresses WTP in €/ha/yr, not per household)
The available alternatives (substitutes) for the ecosystem service	Other Dutch lakes and marshes under the Natura 2000 protection (quite abundant)	There are only a few lakes in the Netherlands with the same pure waterquality	Poor
Conclusion for Value Transfer	Basis for valuation is satisfactory. It is not possible to measure the WTP of a change in biodiversity by water purification. As a result a rough %estimate of change in biodiversity is needed, which lowers the strength of the valuation.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

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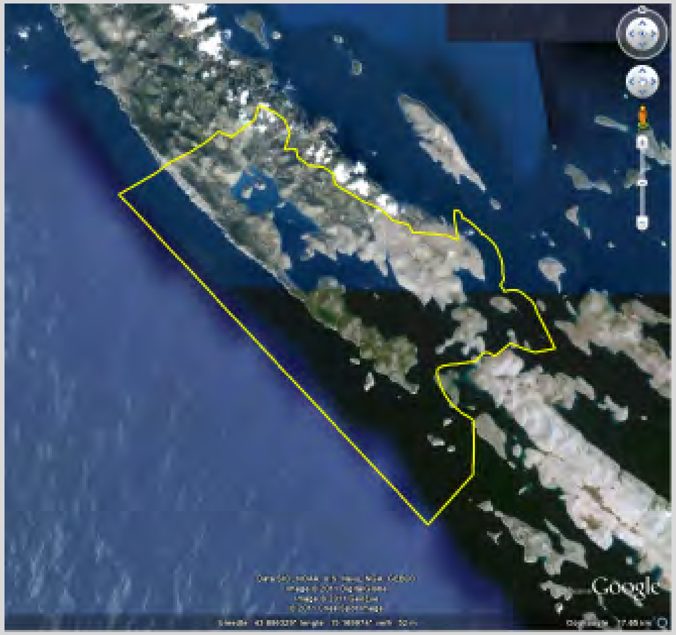
NATURA 2000 SITE	Name : **TELASCICA – CROATIA** **Natura 2000 number : HR4000002 (proposed NATURA 2000 site)** **Biogeographical region : Mediterranean** **Surface : 7 050 ha**
Site description	Nature Park Telašćica is situated in the central part of the eastern Adriatic coast, in the SE part of the island of Dugi otok. Thanks to its extreme beauty, and ecological richness and importance, this bay surrounded by 13 islands and islets, together with 6 islets inside the bay of Telašćica itself, was proclaimed a Nature Park in 1988. Telašćica Nature Park is characterized by a wide variety of landscapes. The marine part covers 4455 ha and consists of coastal lagoons, Posidonia beds, large shallow inlets and bays, reefs and even submerged sea caves. The terrestrial part covers 2595 ha and is characterized by quiet beaches and a shallow coastline on one side and wild and rough cliffs on the other, cultivated meadows and fields of vineyards and olive-trees, dry and rocky scrubs, and Mediterranean forests. The whole area of Nature Park "Telašćica" is included in the Croatian national ecological network and is a proposed NATURA 2000 site (part of bigger SPA and SCI).  **Map** *(on Google Earth, from Natura 2000 Viewer)*

Impression	
Managing Authority	Public institution "Nature Park Telašćica" (www.telascica.hr), which is under supervision of the Ministry of Culture

Threats	Current threats: fishing, tourism (including recreational diving), waste Expected pressures: similar
Conservation objectives	A site management plan is in preparation and will cover the period 2012-2022. Revisions are foreseen every 5 years. Action plans will be prepared as part of the management plan. Currently there is only a Programme of Work which is prepared every year. The marine habitats have a favourable conservation status, as well as most of the terrestrial habitats. However the status of the habitat type 62A0 'Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)' is unfavourable (inadequate).
Main conservation measures	Some of the management measures that are already in place since this area is a Nature Park, are measures that are and will be preserving key habitats and species of this proposed NATURA 2000 site like: • Regulation of maritime navigation and placement of berths • Regulation of underwater activities (recreational and sport diving, underwater photography, diving courses, etc) through issuing of concessions • The delimitation of special protection zones where visiting, recreation, fishing and other activities are restricted • Regulation of fishing (fishing tools, fishing areas, size of the ships, etc) • Prohibition to introduce non indigenous species • Regulation of hunting & forest management Thanks to the implementation of these conservation measures the land and sea inside this site have been preserved in high proportion in favourable status. As the dry grasslands have to be preserved against succession by forests (due to land abandonment) a number of agri-environmental measures are planned on short term. Also new measures to prevent forest fires and additional visitor management measures (to address negative impacts of disturbance and damage by anchors and waste water from boats; swimming restrictions in 20,5 ha of coastal lagoon) will be taken.
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • The **total set of additional measures** (grassland management, forest fire prevention, extra visitor management measures) is selected as 'Conservation measure 1' as this combination of measures will affect mainly the ecosystem services '<u>recreation and ecotourism</u>' and '<u>genetic/species diversity</u>'. • **Marine zoning and management** measures; next to both ecosystem services already covered under the first conservation measure this measure also affects the ecosystem service '<u>food'</u> • **Prevention of forest fires**. Related to this measure the following ecosystem services are selected: <u>cultural values</u>, <u>carbon</u>

	sequestration and air quality. • **Grassland management**. This measure will affect the ecosystem services 'food' and 'landscape amenity value'.
Contact person who participated in the case study	Nikolina Baković, Conservation Manager, telascica@zd.t-com.hr, Public institution "Nature Park Telašćica" (www.telascica.hr) Milena Ramov, milena.ramov@telascica.hr, Public institution "Nature Park Telašćica"

Summary of economic valuation	Ecosystem service	Present value 2012 - 2030 (€2010 prices)	Notes
	I. Ecotourism and Recreation	2.05 – 5.12m	Forest values to visitors. Higher value may also capture visitors values for genetic/species diversity.
	II. Genetic/species diversity	-	
	III. Food (fish)	1.54m	Based on assumed avoided loss of 10% of productivity from Posedonia meadows
	IV. Forest landscape/amenity & genetic/ species diversity	1.95m	These values assume that conservation reduces risk of fire that would have occurred otherwise, completely preventing loss of forest landscape, and avoiding loss of 50% of carbon stored in forest.
	V. Carbon	4.43 – 8.24m	
	VI. Air Quality	-	
	VII. Food (cheese)	44.13m	Based on good knowledge of farming system
	VIII. Grassland landscape/amenity	0.33m	Transfer of value from Slovenia, adjusted for relative income per capita in Croatia
	Costs	1.51m	€150k to establish anchorage bouys. Annual conservation activities: €4.2k to maintain bouys; €20.1k in agri-environment payments; €34k to prevent fires, €14k on equipment and €20k on infrastructure works.
	Net value of conservation measures analysed	52.9 - 59.8 m	Most of the major values have been quantified with some reliability
	Key non-monetised impacts	Some important potential impacts are omitted from the valuation figures, e.g.: • Recreation value to local population. • Value of the site in conserving genetic and species diversity.	
	Assessment of results and risk of double-counting	There is a risk of double counting between the recreation and amenity/diversity values, in that the latter may include values related to recreational use. However, the amenity values are based on average landscape figures, so would be expected to be an underestimate of the value of the site, and genetic/species diversity is only partly valued for forests, so is undervalued overall.	
	Sensitivity Analysis	The largest service value is from agriculture and is considered robust. Figures for ecotourism and recreation	

		are based on a relevant study in Croatia. The carbon and forest landscape values are subject to uncertainty over the extent of fire damage prevented by conservation measures. However, halving these values would only reduce the gross figure by less than 10%. Lack of productivity data on fish from Posedonia meadows may mean a value is significantly underestimated, it is feasible that loss of 20% - 50% of fish productivity is avoided by conservation measures, in which case value of this service would increase to €3.08m - €7.69m.

CONSERVATION MEASURE 1	Combined set of additional measures	
A. ECOSYSTEM TYPE	**Whole site**	
B. DESCRIPTION OF CONSERVATION MEASURE(S)	Habitat management measures to deliver favourable status are: • prevention of forest fires, • maintenance of traditional grasslands • visitor management to address negative impacts of disturbance and damage by tourism and recreational activities (eg. anchors and waste water from boats; swimming restrictions in 20,6 ha of coastal lagoon). The site gains revenues from fees from entrance tickets, permits for fishing, commercial filming and photography, and from visitor guidance.	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): € 150,000 to establish 110 anchorage buoys. Developing visitor and habitat management plans. Ongoing cost (e.g. for maintenance works): Maintenance of new anchorage bouys, €4,200/yr. Implementing visitor and habitat management plans Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing): € 411,800.	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Recreation and ecotourism**	**II. Genetic/species diversity**
E. CHANGE in ES	Use and option values of visitors.	Maintain and enhance existence, landscape and amenity value for the species and habitats at the site. In particular *Posidonia oceanic* meadows are a breeding habitat and a home for many species of fish such as for the endangered grouper *Epinephelus marginatus,* protected seahorse *Hippocampus ramulosus*, colorful *Serranus cabrilla* and *Thalassoma pavo*, peculiar *Sygnathus spp.* and for the commercially important species as well (see service III, food).
F. AFFECTED AREA	7,000 ha	

G. AFFECTED PEOPLE	Visitor numbers est. 100,000 per year. Tourism and recreation businesses in Zadar and local area. Local population.	Local, Regional, national populations
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities in this rural area have below national average incomes.	Local community in this rural area has below average incomes.
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Number of visitors. Value per visit.	Condition of site, as this relates to its total economic value (TEV) of site.
J. MARKET or NON-MARKET VALUES	Non-market values	Non-market value, related to TEV.
K. VALUATION METHOD	Value Transfer (see table below)	Not available, visitors values may be partly captured in recreation and ecotourism values
L. VALUATION	Forest values to visitors of €1.39 – 3.48 per visitor. For 100,000 visitors = €139,000 – 348,000 /yr	-
Present Value (20 years, 3.5% discount rate)	€2.049 – 5.123m	
SOURCE	Navrud (2001)	
M. CONFIDENCE	Low-Moderate. Transfer is from highly relevant study, but value may significantly underestimate value of whole site due to importance of marine and non-forest coastal habitats.	
N. KNOWLEDGE GAPS	Visitor values for coastal lagoons and marine environments	
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	More detailed surveys of visitor motivations	

Assessment of Value Transfer for visitor values: Study: Value of Coastal Forests for Tourism in Croatia. Policy Site: Telescica (TE) Natura 2000 site.

Characteristic	Study Site (Croatia)	Policy Site (TE)	Match
The ecosystem services studied	Value of forested landscape to visitors to Croatian coast		Good, similar forested landscapes and visitor profiles.
The location / geography of the site	Croatian coast.	Natura 2000 site with extensive forests, also coastal and marine areas attractive to visitors. Previous visitor survey has shown that visitors are attracted by the landscape, coast and clean sea.	Good, TE has similar characteristics to Croatian coast, although lagoons and undeveloped nature may give it higher value.
The change to the ecosystem services	Maintaining views of forested coastal environments	Preventing decline of unspoilt forested coastal and marine environments	Satisfactory, TE may represent an increment of total value for Croatia.
The people affected	Visitors staying overnight.	Visitors to site highly likely to stay overnight in surrounding area.	Satisfactory, TE mainly attracts day-visitors, who may not stay near forests, but all will benefit from prolonged views of forested coast during visit.
The available alternatives (substitutes) for the ecosystem service	Extensive – Croatia has extensive and attractive coastline.		Good
Conclusion for Value Transfer	The Croatia values can be transferred, but with some uncertainty as they may not reflect special features of TE, and are based on overnight stays rather than day-visitors. Therefore range of values ($1 – 2.5/visitor, 2001) is used = €1.39 – 3.483/visitor.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

CONSERVATION MEASURE 2	Marine zoning and management measures (restrictions on mooring, no take zones)
A. ECOSYSTEM TYPE	**Marine – *Posedonia oceanic* meadows**
B. DESCRIPTION OF CONSERVATION MEASURE(S)	Establish special protection zones where recreation, fishing, anchoring and other activities are restricted (no take zones). Prevent damage to Posedonia on seabed by industrial and urban sewage discharges, fish farming, trawl fishing and boat anchoring. Anchoring is related to visitor values (see Ecosystem Service I) but impacts can be mitigated through provision of moorings points fixed to seabed (avoiding use of mobile anchors). Lately, the reason for additional concern is expansion of two invasive tropical algae species such as *Caulerpa taxifolia* and *C. racemosa*.
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): € not known Ongoing cost (e.g. for maintenance works): € opportunity cost of previous use of floodplain land. Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing):
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**III. Food .**
E. CHANGE in ES	Increase fish populations – Posedonia oceanica meadows provide food and shelter as breeding and nursery habitat for fish.
F. AFFECTED AREA	4,359 ha
G. AFFECTED PEOPLE	Fishing communities. Recreational fishing?
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities in this rural area may have below average incomes.
I. AFFECTED VARIABLES – units used to measure change in ecosystem	Productivity of fish, recruitment of fish to mature population of valued landing size. *Posidonia* is a breeding habitat and a home for commercially important species, including: herbivore fish *Sarpa salpa* or cow bream, varieties of fish of gender *Diplodus*, scorpion fish *Scorpaena scrofa*, seabream *Sparus aurata*, for mollusks like cuttlefish *Sepia officinalis* and octopus *Octopus vulgaris*. The price of

service	this commercial species is about 20 euro/kg.
J. MARKET or NON-MARKET VALUES	Market. Across Mediterranean, productivity of *Posedonia* meadows valued at €238/ha/yr (Mangos et.al, 2010), implying total value of site = €1.04m/yr.
K. VALUATION METHOD	Assume conservation measure avoids loss of 10% of fish productivity (€24/ha/yr).
L. VALUATION	For 4,359 ha of meadows = €104,616/yr
Present Value (20 years, 3.5% discount rate)	€1.54m
SOURCE	Productivity assumptions applied to Mangos (2010).
M. CONFIDENCE	Low
N. KNOWLEDGE GAPS	Quantification of role of habitats (esp. Posedonia meadows) in fish life-cycles.
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Assess role of site and species supported by Posedonian meadows in activities of local fishing fleets

CONSERVATION MEASURE 3	Prevention of forest fires.		
A. ECOSYSTEM TYPE	**Forest**		
B. DESCRIPTION OF CONSERVATION MEASURE(S)	Prevention of wildfires in forest, heath and scrub habitats, by means of:. • Developing new trails that will ensure access of vehicles and fireman to certain areas • Maintenance of video fire detection system that helps detect fire at its very beginning,		
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): € not known Ongoing cost (e.g. for maintenance works): € not known. Apply management to 50 ha of habitat through cooperation with local community for cleaning up covering vegetation to control fires. Expected life time: More than 20 years Total Additional Costs of conservation measure (One-off + ongoing):.		
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**IV. Landscape/amenity and species/genetic diversity**	**V. Climate - Carbon sequestration**	**VI. Air quality**
E. CHANGE in ES	Preventing fires avoids loss of cultural value as a result of fires - It takes about 50 years for alepo pine tree to recover	Preventing fires avoids loss of carbon stored in forest into atmosphere	Increase in airborne particulates as a result of fires
F. AFFECTED AREA	Measures reduce fire risk on 501 ha of vulnerable forest		
G. AFFECTED PEOPLE	Local, regional, national population, 100,000 visitors to site/yr	Global population	Local population, 100,000 visitors to site/yr
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities in this rural area have below average incomes		
I. AFFECTED VARIABLES – units used to measure change in ecosystem	Avoided loss of value per ha of forest	Avoided one-off loss of emissions from carbon stored in forest due to fire. Assume an additional 50% of the forest's carbon	Reduction in air quality experienced by local population and visitors

service		store would be lost to fires without conservation measures.	
J. MARKET or NON-MARKET VALUES	Non-market values	Market and non-market values	Non-market values
K. VALUATION METHOD	Value Transfer of forest 'passive values', see Table below.	Transfer of forest carbon storage values	n/a
L. VALUATION	Marginal passive use value = €264/ forest ha/ yr, for 501 ha = €132,260/yr	For 501 ha of forest, storing 280 TC/ha = 140,280 TC. Assume 50% loss = 70,140 TC. Valued at €63.12 – 117.44 (low) per TC.	
Present Value (20 years, 3.5% discount rate)	€ 1.945m	€4.427m - €8.237m	
SOURCE	Chiabai et al (2007)	IEEP et. al (forthcoming)	
M. CONFIDENCE		Moderate. Rate of carbon sequestration is an average for European warm forests.	
N. KNOWLEDGE GAPS		Degree of carbon loss in forest fires uncertain, hence lower estimate of value of carbon used.	
O. RECOMMENDATIONS FOR IMPROVING ACCURACY		Research more detailed data relating to carbon storage in this forest type and cycle of carbon loss during fires.	

Assessment of Value Transfer for forest cultural services: Study: EU values in Meta-analysis of global forests. Policy Site: Telescica Natura 2000 site.

Characteristic	Study Site (EU)	Policy Site (TE)	Match
The ecosystem services studied	Value of 'passive use' values for forests.	Loss of cultural services as a result of fire.	Good, similar forest services.
The location / geography of the site	Average for EU forests	Designated Croatian coastal forest habitat.	Satisfactory, TE may have higher values due to designated features.
The change to the ecosystem services	Marginal value per ha of forest	Preventing loss of cultural values due to fire	Poor, extent of losses in event of a fire uncertain.
The people affected	European and national populations.	European and national populations.	Satisfactory, extent to which European population holds values for TE uncertain, but overall values for TE should be higher than average due to designated features.
The available alternatives (substitutes) for the ecosystem service	Extensive – Croatia has extensive forests.		Good
Conclusion for Value Transfer	The EU values can be transferred, but with some uncertainty as they may not reflect special features of TE, but assume complete loss of services in event of fire. Average passive use values = € 264/ha/yr for warm mixed European forest.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

CONSERVATION MEASURE 4	Prevent decline of and restore extensive grazing to manage grasslands	
A. ECOSYSTEM TYPE	**Grassland**	
B. DESCRIPTION OF CONSERVATION MEASURE(S)	Cooperation with local community to encourage cattle-breeding - introduction of grazing regime to maintain grassland against habitat succession. Agri-env subsidy paid to support grazing.	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): € not known Ongoing cost (e.g. for maintenance works): 30kn = €4.02/sheep/yr = € 20,100/yr for 5,000 sheep Expected life time: More than 20 years Present Value of Additional Costs of conservation measure (One-off + ongoing): €295,700+	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**VII. Food**	**VIII. Landscape/amenity**
E. CHANGE in ES	Productivity from herds grazing grassland	Maintaining traditional agricultural landscape
F. AFFECTED AREA	1,232 ha	1,232 ha
G. AFFECTED PEOPLE	Herdsmen.	Local, regional and maybe national
H. CHARACTERISTICS of affected people (e.g. income levels above or below average?).	Communities in this rural area have below average incomes.	Communities in this rural area have below average incomes.
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Number of grazed animals increase by 5,000 Products from herds: milk, cheese and meat.	Avoided loss of grassland landscape, for a proportion of grassland that is currently undergrazed (assume half of site = 616 ha would eventually revert to forest, but welfare losses assumed due to interim loss of landscape value for 10 years of scrub growth, and because traditional mixed landscape more highly valued than pure forest landscape.

J. MARKET or NON-MARKET VALUES	Market value	Non-market value
K. VALUATION METHOD	Market price	Value transfer of stated preference studies
L. VALUATION	1 sheep produces milk for approx 30kg cheese/yr @ €20/kg = €600/yr, for 5,000 sheep = €3 m/yr	Value of grassland €36.9/ha/yr (2010 prices) for 616 ha s = 22,600.
Present Value	€44.13 m	€ 332,500 for 10 year
SOURCE	Site estimates	Ciaian & Paloma (2011)
M. CONFIDENCE	Moderate – good	Low
N. KNOWLEDGE GAPS		Relative value of grassland compared to forest landscape and its value in maintaining mixed landscape.
O. RECOMMENDATIONS FOR IMPROVING ACCURACY		Research into non-use values for habitats.

Assessment of Value Transfer for grassland landscape: Study: EU Meta-analysis ←→ Policy Site: Telescica Natura 2000 site.

Characteristic	Study Site (EU meta-analysis)	Policy Site (TE)	Match
The ecosystem services studied	Provision of grassland/ traditional agricultural landscapes	Provision of traditional grassland agricultural landscape	Good, similar agricultural landscapes.
The location / geography of the site	Agricultural grasslands of Slovenia.	Grasslands in coastal forested landscape	Satisfactory, similarity of habitats. Slovenia is closest country valued in EU study
The change to the ecosystem services	Marginal value of maintenance of traditional grassland landscape rather than arable landscape	Conservation programme to prevent loss of grassland within forested landscape	Satisfactory, both involve marginal value of grassland compared to lower value habitat type.
The people affected	Slovenian population.	Croatian population.	Poor, Slovenia has significantly higher income/capita that Croatia.
The available alternatives (substitutes) for the ecosystem service	Traditional agricultural areas with extensive substitutes on national scale.		Good
Conclusion for Value Transfer	EU values for Slovenia (difference between grassland and arable values = €61, 2007) can be transferred, but with adjustment for income/capita to Croatia (0.579). There is uncertainty over this adjustment as values may not have linear relationship with income, particularly over such a large difference.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

References:

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NATURA 2000 SITE	Name : **VINDELFJALLEN – SWEDEN** **Natura 2000 number : SE0810080 (Vindelfjallen) and SE0810443 (Ammarnäsdeltat)** **Biogeographical region : Alpine** **Surface : 555.500 ha + 280 ha**

Site description

Vindelfjallen is the largest protected site in Sweden, and consists of more than 5500 square kilometers of alpine heath, rocky habitats, mires, alpine birch and spruce forests at an altitude between less than 600 m to a peak of 1767 m.

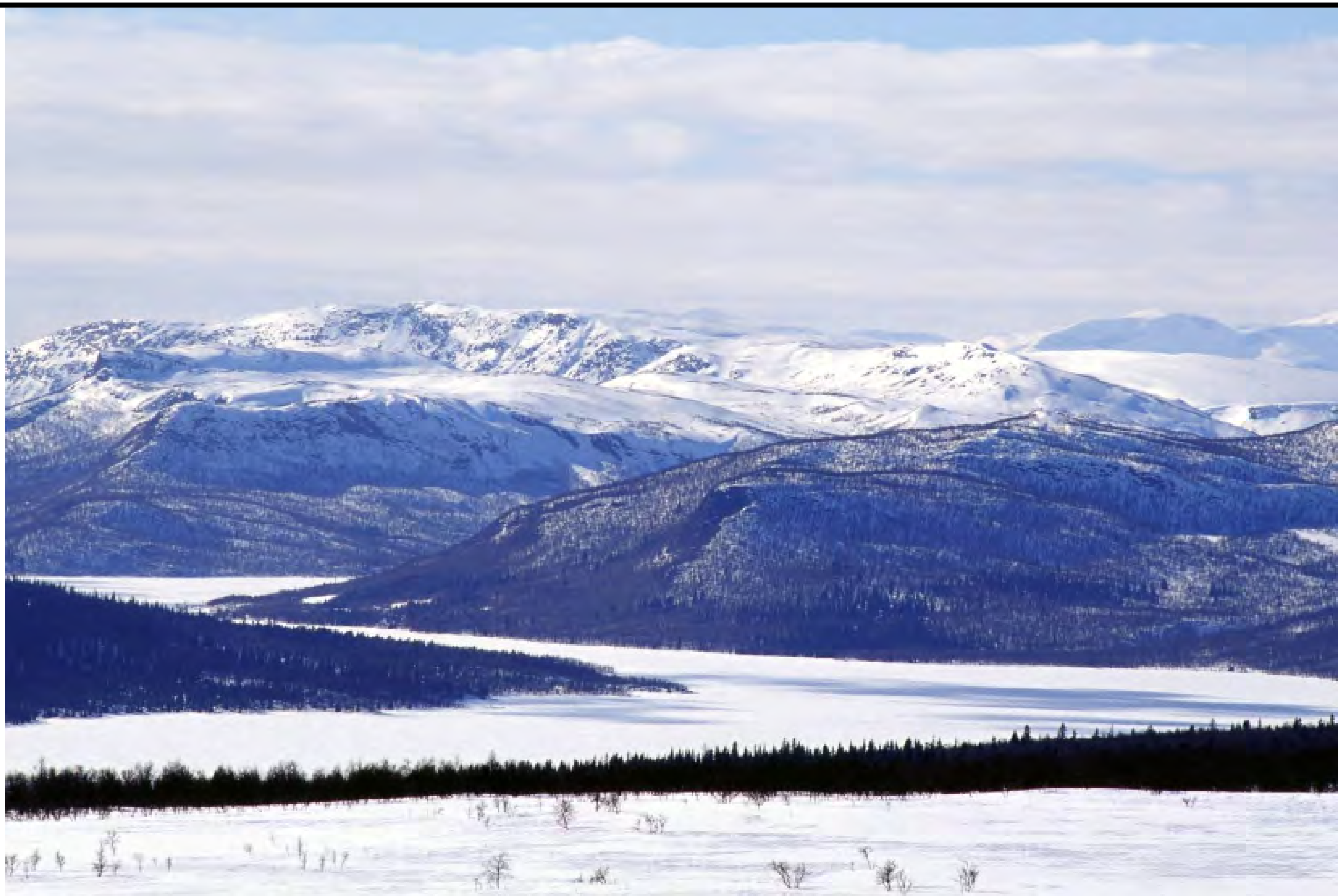
The large river Vindelalven has its source up in the Vindelfjallen area and there are several large lakes. Some parts of the area consist of lime stone and harbour a lot of rare plants. It is an important breeding place for many birds and mammals, among others the emblemic Gyr Falcon, Golden Eagle, Arctic Fox and Wolverine.

Map *(on Google Earth, from Natura 2000 Viewer)*

Although many think of Vindelfjallen as a wilderness, it is actually a cultural landscape traditionally used by the Sami people, especially for reindeer husbandry, fishing and hunting. Reindeer husbandry is still important, but nowadays tourism is also big business. Most of the farming has ceased in this part of Sweden, but one can still see the trace of former land in the form of meadows, now largely abandonned but in a few cases mown by the site manager. Ammarnäsdeltat is a separate and much smaller site (280 ha) situated adjacent to Vindelfjallen and of great importance as a spring staging place for birds breeding in the mountains, among these the globally threatened Lesser White-fronted Goose.

It has the largest managed meadows in the area, near Ammarnäs village in the delta where the Vindel river meets Lake Gautsträsk. In the villages of Hemavan and Ammarnas there are visitors centres and there are plenty of tracks for hiking in the area.

Impression



Managing Authority

County Administrative Board of Vasterbotten; the County Adminstration works under the Swedish Environmental Protection Board (www.naturvardsverket.se). The County Administrative Board of Vasterbotten manages circa 250 Natura 2000 sites and an additional 100 protected areas outside the Natura 2000 network.

Threats	**Current threats**: Infrastructure development near tourist centres; disturbance from tourism on habitats, on vulnerable species or on the reindeer herding; mining or investigations for mining; local over-fishing or over-hunting (Willow and Rock Ptarmigan); climate change. **Expected pressures**: climate change; increased tourism pressure
Conservation objectives	An updated site management plan is being prepared. At this moment all forests and heath and scrub habitats are in a favourable condition. About 10% of the wetlands, rivers and lakes has an unfavourable/inadequate condition. However only 50% of the agro-ecosystems has a favourable status. Important conservation objectives are the restoration of the agro-ecosystems (grazed meadows) and the maintenance/reintroduction of Arctic Fox and Lesser-fronted Goose, which are both very endangered species. Ammarnasdeltat is the uppermost site of grazed meadows in the Vindel river natural grassland project, managed by the Word Wildlife Fund (WWF) together with local farmers and the County Administration. Measures on Arctic Fox and Lesser-fronted Goose in Vindelfjallen are part of (mostly) national programs. The designation as a Natura 2000 site resulted or contributed significantly to the current situation where large clear-cuttings, construction of dams or water power systems et cetera are not allowed, which is believed to have a positive impact on water quality and nutrient cycles in the area, compared to the opposite situation. The large river Vindelalven has its source inside the area, and damming (previously suggested) would have altered the water regime, damaging ecosystems all along the river right down to the coast. The management measures to restore the wet meadows have a positive impact on the river as well.
Main conservation measures	• Agri-environmental measures to restore the meadows • Hunting and fishing restrictions • Visitor management measures to avoid or reduce disturbance • Protection program for Arctic Fox • Reintroduction program for Lesser-fronted Goose
Selection of conservation measures and ecosystem services	The following measures and ecosystem services were selected: • **Fishing restrictions**: stronger regulation of fishing bags and prohibiting introduction of non-indigenous fish species, in particular in lakes; associated ecosystem services which are investigated are 'food', 'genetic/species diversity' and 'recreation and ecotourism' • **Protection program** for **Arctic Fox** (a.o; hunting of Red Fox and food provision to Arctic Fox) and **reintroduction program** for **Lesser-fronted Goose**; also these measures will affect the 'genetic/species diversity' and 'recreation and ecotourism', and additionaly the impact on 'cultural and landscape amenity' is valued
Contact person who participated in the case study	Jonas Grahn, Natura 2000 coordinator, jonas.grahn@lansstyrelsen.se , County Administrative Board of Vasterbotten (www.lansstyrelsen.se/vasterbotten) (www.vindelfjallen.se)

Summary of economic valuation	Ecosystem service		Present value 2011 - 2030 (€2010 prices, 3.5% discount rate)		Notes
			Min	Max	
	I.	Genetic/species diversity *from Arctic fox/ LWF Geese*	13.74m	16.66m	Transfer of value of WTP for protecting wolf and white-backed woodpecker
	II.	Ecotourism/recreation *from Arctic fox/ LWF Geese*	15.28m	15.28m	Increase in utility of recreational visits from chances to see Arctic fox (to a lesser extent LWF Geese), based on estimated increase in visitors
	III.	Food *from fishing regulation*	-0.29m	-0.16m	Based on WTP for accessibility of a fishing lake nearby; second-best valuation method due to absence of effective loss in catch (kg fish)
	IV.	Genetic/species diversity *from fishing regulation*	-	-	Unable to connect impact of management measure to valuation evidence
	V.	Ecotourism/recreation *from fishing regulation*	-0.24m	-0.12m	Recreational loss due to fishing restrictions, based on estimated decline in visitors
	Costs		0.95m	0.99m	Except for measure 3 (fishing regulation), most of the major costs have been quantified with some reliability
	Net value of conservation measures analysed		**29,4m**	**32,6m**	Some uncertainty, as values only capture part of the impacts of conservation measure
	Key non-monetised impacts		The value of the lakes and rivers in conserving genetic/species diversity (due to restrictions in fishing and fish introduction) are omitted from the valuation figures.		
	Assessment of results and risk of double-counting		There is a risk of double counting between the recreation and genetic/species diversity values for the first measure (fox/geese). The latter may include values related to recreational use. However, the non use values (based on valuation of the wolf) would be expected to be an underestimate of the value of the Arctic fox, a cuddlier mammal. Figures for ecotourism and recreation are based on a relevant study in Swedish mountains[1].		

[1] There is a well developed Swedish database of contingent valuation studies (CVM), on all domains.

		Lack of data on genetic/species diversity from the 2thd measure (fishing regulation) significantly underestimate the total value. In order to make this measure break-even, a WTP per conservationist of 0.12 to 0.24 eurocent is needed (supposed a yearly management cost of 2500 to 7500 euros).
	Sensitivity Analysis	The recreational values are subject to uncertainty regarding the % increase or decrease of visitors. Halving these values would reduce the total benefits by more than 30%. The main reason of this uncertainty of visitor behaviour is that the treated conservation measures are relatively new. Future evaluation will finetune the obtained results. Another ecosystem service were sensitivity analysis is applied on is genetic/species diversity of the fox and geese measure. Taken into account the total Swedish population, (in stead of only Swedish nature conservationists), rises the total value with a factor 24 to 26.
Summary	**The evaluation of conservation measures in Vindelfjallen captures the values of some specific ecosystem services from the site. It suggests these are significant benefits that could result from implementing conservation measures. The Swedish mountains are frequently visited by Swedish inhabitants and they are expected to hold high values for its wilderness.** **Key sensitivities in the analysis are the assumptions around the decrease/increase of visitor in reaction of the measures. Less optimistic assumptions in the sensitivity analysis do not influence the scale of the result significantly.**	

Lesser White-fronted Goose project

Lesser White-fronted Geese are long-distance Palearctic migrants, currently breeding discontinuously in the sub-arctic zone from northern Fennoscandia to eastern Siberia. The global population of Lesser White-fronted Goose has declined rapidly since the middle of the 20th century. There is a fear that the species may go extinct. Overhunting and habitat loss are considered to be the main threats. BirdLife International estimates a decrease in numbers in the range of 30% to 49% during the period 1998–2008. The LWF Goose population is now the smallest goose population in Eurasia and is among the most endangered bird species in the world. BirdLife International ranked the goose as 'SPEC 1' within Europe, denoting a European species of global conservation concern. As late as the 1970s, the Mountains of Vindelfjällen held the largest Lesser Whitefront population in Sweden. Nowadays, their occurrance is rare, data provided by BirdLife International, show that in March 2005, only 1 couple of breeding LWFGoose was spotted.

The International Single Species Action Plan for the Conservation of the Western Palearctic Population of the Lesser White-fronted Goose deals with conservation of the wild populations of the LWF Goose. The Action Plan also takes into account the population derived from captive-bred birds and used for restocking in Swedish Lapland, migrating to winter in the Netherlands.

The Swedish Association for Hunting and Wildlife Management started a project to release LWF Geese in Swedish Lapland to support the remnants of the natural population. In the scope of this project, LWF Goose eggs were bred by semi-domestic Barnacle Geese (Branta leucopsis), which were known to winter in the Netherlands. During wing moult of the Barnacle Geese and before the goslings fledged, the Young Lesser White-fronted Geese were released together with their foster-parents in an original Lesser White-fronted Goose breeding habitat in Swedish Lapland. In autumn, the families migrated to the wintering sites of the Barnacle Geese in the Netherlands. Until 1999, 348 Lesser White-fronted Geese were released. As a result of the project a first breeding pair was recorded in Sweden in 1987. In 2005, the total Swedish breeding population of re-established birds was estimated at about 100–120 individuals

Source: http://www.unep-aewa.org/activities/working_groups/lwfg/lwfg_ssap_130109.pdf

Arctic fox project

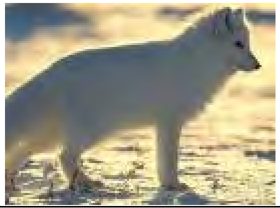
The County Administration and Vindelfjällen are involved in the EU LIFE project SEFALO, running between 2003-2008. SEFALO is a collaborative project involving 17 authorities, research institutions, organisations and businesses in Sweden, Finland and Norway.

In Vindelfjällen, the County Administration's rangers carry out censusing and supplementary feeding of Arctic foxes and culling of competing red foxes to try to save the Arctic fox. The ecotourism companies Lapplandssafari and Fjällhästen in Ammarnäs are also involved with the project.

The Arctic fox Alopex lagopus is threatened with extinction in Sweden, Finland and the rest of Europe. The Arctic fox is a priority species according to the EU Habitat Directive.

The overall aims are:
(1) to stop the decline in the Arctic fox population and to increase its chances of recovery,
(2) to reduce disturbance at inhabited dens,
(3) to increase the awareness of the general public to the threats to the Arctic fox's survival, and
(4) to identify important land areas that are not sufficiently protected by nature reserve or national park status, or that ought to obtain conservation status.

Source: http://www.vindelfjallen.se/default.asp?ML=2588

CONSERVATION MEASURE 1	SPECIES PROTECTION AND REINTRODUCTION PROGRAMMES	
A. ECOSYSTEM TYPE	**Heath and Scrub**	
B. DESCRIPTION OF CONSERVATION MEASURE(S)	Hunting red fox, food provision for Arctic fox and introduction of Lesser White-fronted goose (LWF Goose)  	
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: One-off costs (e.g. for infrastructural works): none Ongoing cost (e.g. for maintenance works): • Hunting bonuses to local hunters to kill red foxes (30 € per fox): 1300 € • Hunting time of conservator: 4000 € • Food for Arctic fox: 12,000 € • Costs for introduction of LWF Goose (captive breeding): 20,000 € • Time spent on censusing (fox & geese): 17,300 € • Time spent on increasing the awareness of the general public to using information campaigns, in co-operation with local tourist companies …. : 10,000 € Cost per year: 64,600 euro NPV of costs (for 20 yrs): 0,9 m €	
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	**I. Genetic/species diversity**	**II. Ecotourism/recreation**
E. CHANGE in ES	More Arctic foxes and LWF Geese.	More tourism as chances to see Arctic fox will be enhanced (to a lesser extent LWF Geese).
F. AFFECTED AREA	200,000 ha	200,000 ha

G. AFFECTED PEOPLE	Conservationists. 190,000 persons (members of the Swedish Society for Nature Conservation)	25.000 tourist coming to enjoy nature (eg backpackers, not skiers) (estimation from 1)
H. CHARACTERISTICS of affected people	/	Perhaps 10% of visitors is from abroad, mostly the Nordic countries but also a lot of people from Netherlands and Germany. Most are 25-40 ys old
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	<u>Benefits for non-use value:</u> Willingness to pay for preservation of arctic foxes (one time payment) (2): • 96 – 123 € per person for Sweden • Part of heath & scrub in Vindefjallen in total Swedish habitat area: 4% (200,000ha/5,000,000 ha) (1) • Value for Vindeljfallen: o Per person: 3.84 - 4.92 € o Total: 729,600 – 934,800 € Willingness to pay for preservation of LWF Geese (one time payment) (3): • 57 € per person for Sweden • Part of Vindefjallen in Sweden: 2,2% (22,000ha/1,000,000 ha) • Value for Vindeljfallen: o Per person: 1.25 € o Total: 237,500 €	<u>Yearly benefits for recreation:</u> 10% extra tourists (skiers not included) (1)[2] • 430 € per visitor per stay[3] (4) • Total: 1,075,000 €
J. MARKET or NON-	Non market value	Non market value

[2] The number of guest nights at a hotel near the Stekenjokk area (where the Arctic fox project is executed) has increased by 30% in the summer of 2011, as a result of good numbers of foxes. (Grahn, J.; 2011)

[3] Double check with a study from Fredman, P. (2008) obtained a WTP of 389 € per visitor per stay (for backpackers, based on a national sample of mountain visitors)

MARKET VALUES		
K. VALUATION METHOD	CVM (Willingness to pay)	CVM (Willingness to pay)
L. VALUATION	On time benefit: 967,100 - 1,172,300 €	Yearly benefits: 1,075,000 €
Present Value	**Total Benefits:** 28,1 – 32 m €	
SOURCE	(1) Grahn, J., conservator; 2011 (2) Boman, et al; 1997 (Deflator 1997 → 2010: x1,26) (3) Fredman, P; 1995 (Deflator 1995 → 2010: x1,3) (4) Bostedt et al; 1995 (Deflator 1995 → 2010: x1,3)	
M. CONFIDENCE	**Costs**: good, data from conservator **Benefits: A & B:** moderate: WTP for protection of wolf and white backed woodpecker **C:** good: WTP for consumer surplus for recreation in area near Vindelfjallen (Arjeplog)	
N. KNOWLEDGE GAPS	WTP for Arctic fox and LWF Goose	/
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	CVM study for Arctic fox and LWF Goose	/

Assessment of Value Transfer for genetic/species diversity: Studies: Boman et al (1997) & Fredman,P. (1995) (B & F) Policy Site: Vindelfjallen Natura 2000 site (V)

Characteristic	Study (B & F)	Policy Site (V)	Match
The ecosystem services studied	Genetic/species diversity	Genetic/species diversity	Good
The location / geography of the site	Sweden	Vindelfjallen (Stekenjokk area)	Satisfactory (Vindelfjallen area is a small part of Sweden)
The change to the ecosystem services	Additional willingness to pay for guaranteeing the survival of the wolf (B) and white-backed woodpecker (F)	Additional willingness to pay for guaranteeing the survival of the Arctic fox/LWF Goose	Satisfactory (wolf in stead of Arctic Fox, both are Canidae. White-backed woodpecker in stead of LWF Goose, both are birds). They are similar in terms of their abundance/ conservation status.
The people affected	Swedish citizens	Residents of Vindelfjallen + Conservationists in Sweden	Satisfactory (A conservative approach is applied by taking into account only the conservationist part of the population)
The available alternatives (substitutes) for the ecosystem service	No substitute: the alternative is extinction of wolf/white-backed woodpecker population	Arctic fox/LWF Goose population in other areas (although this site is important for their survival).	Good
Conclusion for Value Transfer	Basis for value transfer is good, although the studied species in B&F differ from V to the extent of being endangered and being appreciated by society.		

Assessment of Value Transfer for Ecotourism; recreation Studies: Bostedt et al (1995) (B) Policy Site: Vindelfjallen Natura 2000 site (V)

Characteristic	Study (B & F)	Policy Site (V)	Match
The ecosystem services studied	Recreation	Ecotourism, recreation	Good
The location / geography of the site	Arjeplog	Vindelfjallen	Good (Vindelfjallen lies next to Arjeplog)
The change to the ecosystem services	Willingness to pay for visiting the area	Willingness to pay for visiting the area	Good
The people affected	Tourists	Additional visitors due to more Arctic foxes (to a lesser extent LWF Geese)	Good
The available alternatives (substitutes) for the ecosystem service	Other mountainous regions in the North of Sweden	Other mountainous regions in the North of Sweden	Good
Conclusion for Value Transfer	Basis for value transfer is good, although the B does not include the aspect of seeing Arctic foxes/lwf geese.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

CONSERVATION MEASURE 3	Fishing Restrictions		
A. ECOSYSTEM TYPE	**Rivers and lakes**		
B. DESCRIPTION OF CONSERVATION MEASURE(S)	Stronger regulation of fishing bags and stopping introductions of fish species (especially in lakes). This measure was intended to prevent over-fishing in lakes and streams (through harder bag limits and/or channeling of angling) and to "restore" formerly fish free lakes with introduced fish (native or alien species).  		
C. COSTS of CONSERVATION MEASURES	Additional cost as a result of taking the conservation measure: The conservator does not have any firm plan for these measures. The conservation measure are in a conceptual phase for the moment. The following cost components are relevant. These components need to be budgeted by the conservator as preparation for the measure. One-off costs (e.g. for infrastructural works): investment of conservator to inform and sensitize. E.g. via an explicative “roadshow”, communication (local radio/ tv, bilboards). Ongoing cost (e.g. for maintenance works): Periodic control around the lakes[4]. Administrative work to penalize offenders.		
D. AFFECTED ECOSYSTEM SERVICE(S) (ES)	III. Food	IV. Genetic/species diversity	V. Ecotourism/recreation
E. CHANGE in ES	Less fish for food caught by locals. Marginal impact for tourists, as they mostly fish for recreation in stead of food provision.	<u>Above the threeline:</u> Lakes are originally fish free. By stopping introductions of fish species, the original composition of the lakes (with a typical fauna and flora in absence from fish) is in mind[5].	Less recreation possibilities (minor impact)

[4] Very difficult to stop species introduction as this is a sudden action in stead of fishing.

[5] The fish free lakes in Vindelfjallen are important breeding places for red-listed bird species as the Long-tailed duck and red-listed invertebrates as the arctic tadpole shrimp (Lepidurus arcticus), threatened by continuing introductions of fish.

		Under the threeline: Less harm from dominant exotes, more diversity through less fishing..	
F. AFFECTED AREA	1,100 ha (5% of 22,000 ha, total rivers & lakes)	1,100 ha (5% of 22,000 ha: total rivers & lakes)	1,100 ha (5% of 22,000 ha: total rivers & lakes)
G. AFFECTED PEOPLE	10% of 100 + Sami + 2000 people living in adjacent valleys: 210 persons (estimation) (1)	Conservationists: 190,000 persons (members of the Swedish Society for Nature Conservation)	1000 fishing days per year (5% of 20,000 for the whole reserve), from which 80% is assigned to tourists and 20% is assigned to locals. (1)
H. CHARACTERISTICS of affected people	Sami are the reindeer people previously known as Lapps. They are the native / indigenous people of Scandinavia. Income lower than average.	/	/
I. AFFECTED VARIABLES – units used to measure change in ecosystem service	Ideal valuation: Avoided caught fish must be replaced by other protein rich food. For eg: fish/meat from shops. a) Value of fish caught: (3) • Small fish <30 cm: 2 €/pc • Medium fish 30-40 cm: 13 €/pc • Large fish: > 40 cm: 41 €/pc • Per kg: 3 € b) Local prices for fish/meat: Fish 25 €/kg, red meat 15 €/kg (*)(1) c) Difference: 12 – 22 €/kg Number of fish that will be avoided to	Above the threeline: Hectares or number of intended free fish lakes. Under the threeline: Decrease in number exotes Better growing chances for fish through less fishing. No relevant studies were found after desk research and contact with 4 Swedish professors. A study measuring the change in biodiversity in wetlands was taken into consideration for value transfer, but too much differences occur:	Yearly welfare loss for recreation Less tourist because of fishing restriction? Since the measure will affect only a minor proportion of the area, it will probably have a minor impact on fishing tourism: estimation of 2,5 - 5% less tourists. (1) • 430 € per visitor per stay[6] (2) • Total: 8,600 – 17,200 €

[6] Double check with a study from Fredman, P. (2008) obtained a WTP of 389 € per visitor per stay (for backpackers, based on a national sample of mountain visitors)

	catch: not possible to estimate. <u>Subsidiary valuation :</u> WTP for using a fishing lake near home: • 54 – 96 €/person/year (4) • Total: 11,340 – 20,160 €/year	• Different ecotype (wetland vs heath and scrub in the mountains) • Different location (densely populated South of Sweden vs low populated North)	
J. MARKET or NON-MARKET VALUES	Non Market value, except for (*)	/	Non Market Value
K. VALUATION METHOD	CVM studies (quite abundant in Sweden for fishing)	/	CVM study
L. VALUATION	11,340 – 20,160 €/year	/	8,600 – 17,200 €
Present Value	**Net costs: 0,283 - 0,531 m €** (no costs of conservation measures and value of benefits for Genetic/species diversity included)		
SOURCE	(1) Grahn, J., conservator; 2011 (2) Bostedt et al; 1995 (Deflator 1995 → 2010: x1,3) (3) Paulrud et al; 2003 (Deflator 2003 → 2010: x1,125) (4) Toivonen et al; 2000 (Deflator 2000 → 2010: x1,21)		
M. CONFIDENCE	Moderate: ideally the number of avoided fish is used as an input variable.	/	Good
N. KNOWLEDGE GAPS	The number of avoided fish	/	Recreation value for locals (20% of fishing days)
O. RECOMMENDATIONS FOR IMPROVING ACCURACY	Difficult to estimate the number of avoided fish	/	/

Assessment of Value Transfer for Food Studies: Paulrud et al; 2003 (P) Policy Site: Vindelfjallen Natura 2000 site (V)

Characteristic	Study (P)	Policy Site (V)	Match
The ecosystem services studied	Food & recreation	Food	Satisfactory
The location / geography of the site	Kaitum River (Lapland)	Vindelfjallen	Good (Kaitum river is 550 km north from Vindelfjallen, similar region)
The change to the ecosystem services	Willingness to pay for catching fish	Loss of welfare due to stronger regulation of fishing bags	Good
The people affected	Tourists (anglers)	Especially locals (to a lesser extent visitors)	Poor (locals depend on fish for their diet, fish is mostly caught for food)[7]
The available alternatives (substitutes) for the ecosystem service	Other lakes and rivers in the neighbourhood of Kaitum	Other lakes and rivers in the neighbourhood of the lakes where the measure is in effect	Good
Conclusion for Value Transfer	Basis for value transfer is good, although P does not include the WTP for food for locals. The focus of P is on recreation and food for tourists.		

Assessment of Value Transfer for Food Studies: Toivonen et al; 2000 (T) Policy Site: Vindelfjallen Natura 2000 site (V)

[7] Tourists mainly fish for recreational purposes, via the "catch and release" method.

Characteristic	Study (T)	Policy Site (V)	Match
The ecosystem services studied	Food & recreation	Food	Satisfactory
The location / geography of the site	Sweden	Vindelfjallen	Satisfactory (Vindelfjallen is characterised by wild nature and low population density[8])
The change to the ecosystem services	Willingness to pay for a fishing site near their home	Loss of welfare due to stronger regulation of fishing bags: the need to go fishing farther away.	Good
The people affected	Residents	locals (to a lesser extent visitors)	Good
The available alternatives (substitutes) for the ecosystem service	Other fishing sites more far away from home	Other fishing sites more far away from home	Good
Conclusion for Value Transfer	Basis for value transfer is good, although the T does not include the specific situation where local inhabitants of the Vindelfjall region are partly dependent on fish.		

Key for Match: Good (characteristics similar enough to support value transfer with good degree of confidence), Satisfactory (characteristics have some similarities but also differences that reduce reliability of value transfer), Poor (differences in characteristics mean value transfer results are heroic/unreliable).

[8] In opposite of the South of Sweden with high population density and coastal ecotype and small hills inland.

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