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Final report on relationships between biodiversity, ecosystem services and values in case studies

Introduction to, and synthesis of, Parts I, II and III

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Introduction to, and synthesis of, the Part I, II and III reports on the analysis of relationships between biodiversity, ecosystem services and values in case studies

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1. Introduction

BESAFE aims to help policy-makers understand the effectiveness of various types of arguments for biodiversity protection under varying circumstances. Within this project, work package 1 (WP1) compiled a list of commonly used arguments for biodiversity protection, and WP2 set up a series of case studies to investigate how effective these arguments were in a range of different socio-ecological situations. The third work package analyses how these arguments can be transferred across different governance scales (local, regional, national and global).

This report presents the results of the fourth work package (WP4), which explores the links between biodiversity and ecosystem services, and whether different understanding of these links can affect people's valuation of biodiversity. WP4 focuses on the following three research questions:

1. Can the importance of biodiversity (or a sub-set of biodiversity) for ecosystem service delivery be characterised?
2. Under what circumstances does a focus on ecosystem service delivery create opportunities or threats for biodiversity conservation?
3. How do uncertainties or gaps in scientific knowledge on the relationship between biodiversity and ecosystem services affect stakeholder's perception of the value of biodiversity, and decisions related to biodiversity conservation?

The linkages between biodiversity, ecosystem services and values are analysed using the 'cascade' model of Haines-Young & Potschin (2010) as a conceptual framework (Figure 1.1). This shows that biodiversity is linked to ecosystem processes or functions that provide ecosystem services and disservices, which in turn provide benefits or costs that have a value to society. We have added a loop to this framework showing how the value placed on ecosystem services can affect the policy response, which in turn can affect biodiversity.

In WP4 we focus on the diagonal linkages in Figure 1.1, from biodiversity (top left) through to values (bottom right). This means that we explore the linkages between biodiversity, ecosystem services and values through analysing the scientific literature and through national and local case studies. The case studies use a variety of methods, including Q analysis (ranking of opinion statements) to explore the attitudes of different stakeholders.

Deliverable 4.1 is the only external deliverable from WP4 and as such it covers results related to all three tasks within WP4:

- Task 4.1: Review of existing evidence on the relationship between biodiversity, ecosystem services and values, and summarising this information in a typology of biodiversity – ecosystem service relationships to structure essential background information for use in the BESAFE case studies.
- Task 4.2: Development of criteria for the final selection of the BESAFE case studies to ensure they contribute knowledge relevant to the major research questions being considered in WP4, as well as creating guidelines for collecting and analysing evidence from the case studies using the Q methodology.
- Task 4.3: Coordination of the gathering of data within case studies in cooperation with WP2 and analysis of data in cooperation with WP's 2 and 3, specifically concentrating on the WP4 research questions.

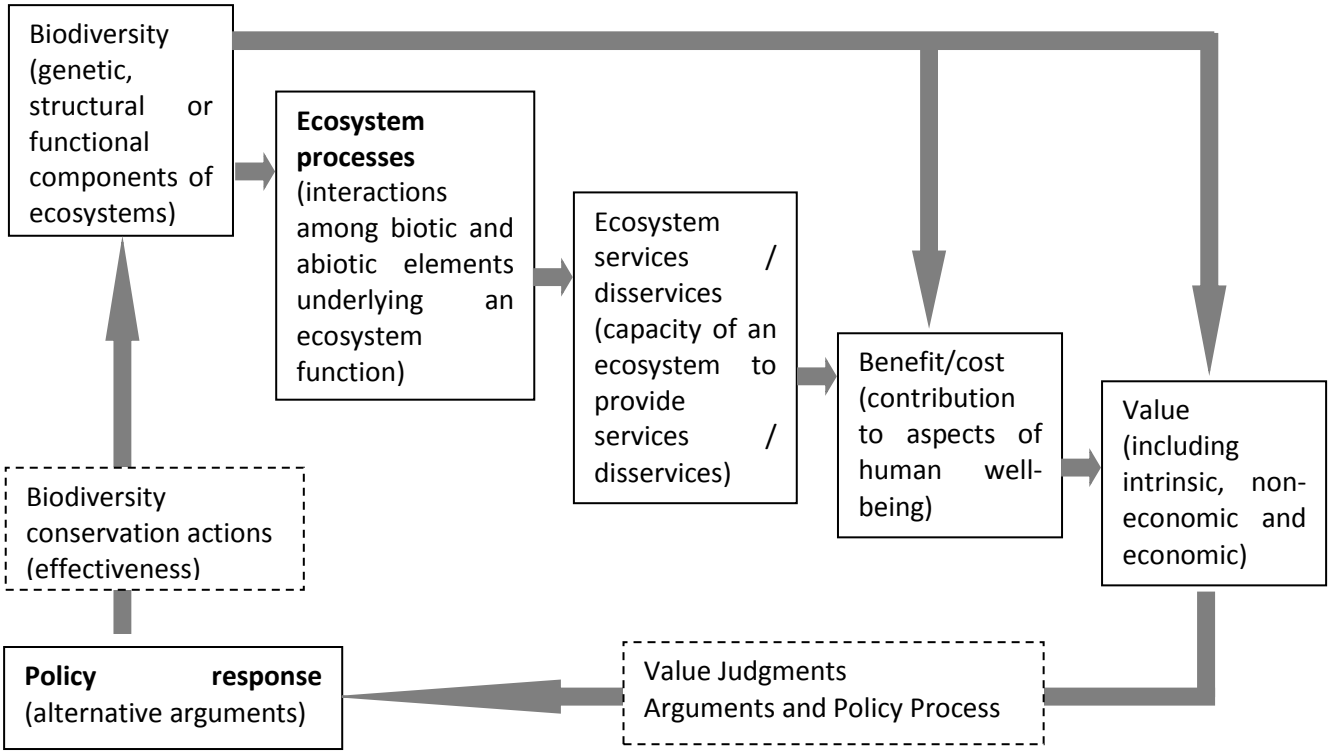

Figure 1.1: Schematic representation of the relationship between biodiversity, ecosystem services and values. Adapted from the ecosystem service cascade of Haines-Young & Potschin (2010) and de Groot et al. (2010).

The deliverable is structured into three parts to improve readability:

- Part I presents the literature review of existing evidence on biodiversity, ecosystem service and value relationships undertaken for Task 4.1, and maps the typologies of relationships using network diagrams.
- Part II presents the Q study of stakeholder perceptions of the value of biodiversity and ecosystem services for nine national case studies undertaken as part of Tasks 4.2 and 4.3.
- Part III uses five local case studies, undertaken as part of Tasks 4.2 and 4.3, to explore the relationships between biodiversity, ecosystem services and values in more detail, including the ways in which arguments are constructed by different stakeholders, and the implications for resulting decisions on the conservation of biodiversity and provision of ecosystem services.

This synthesis document provides summaries of the three parts.

2. Executive summaries

2.1 PART I: Literature review of the relationships between biodiversity, ecosystem services and values

Two literature reviews have been undertaken to analyse the linkages between biodiversity, 11 ecosystem services and their values. The first review focused on biophysical aspects, gathering evidence of linkages between different biodiversity attributes and the 11 services. The second review focused on socio-economic aspects, gathering evidence of linkages between the 11 ecosystem services, their beneficiaries and how they are valued. This second review restricted its

literature search to papers that also made a link to biodiversity attributes, in order to access the availability of information across the full chain of linkages.

Results for the biophysical part of the review show that the majority of relationships between biodiversity attributes and ecosystem services cited in the 530 studies were positive. For example, the services of water quality regulation, water flow regulation, mass flow regulation and landscape aesthetics were improved by increases in community and habitat area. Functional traits, such as richness and diversity, also displayed a predominantly positive relationship across the services, most commonly discussed for atmospheric regulation, pest regulation and pollination. A number of studies also discussed a positive correlation with stand age, particularly for atmospheric regulation. Species level traits were found to benefit a number of ecosystem services, with species abundance being particularly important for pest regulation, pollination and recreation, and species richness for timber production and freshwater fishing. Instances of biodiversity negatively affecting the examined ecosystem services were few in number for all ecosystem services, except freshwater provision. The review showed that ecosystem services are generated from numerous interactions occurring in complex systems. However, improving understanding of at least some of the key relationships between biodiversity and service provision will help guide effective management and protection strategies.

Results for the socio-economic part of the review showed a large variation in the number of studies valuing the 11 selected services. For example, thousands of studies exist which value recreational services, while only a few studies have attempted to value pest regulation or landscape aesthetics. Most of the 200 studies reviewed have a local or regional scope, and limited evidence exists to conduct large-scale assessments due to the context dependence of the value estimates. The review showed a large variation in the methodologies used to derive the value estimates for changes in levels of service provision. A different choice of methodology often results in different aspects of ecosystem services benefits or costs being captured. The review illustrated that great care is needed when collating literature estimates on ecosystem service values. Lack of attention to research design is likely to lead to large uncertainties and biases in the average estimates. The review clearly showed that only a few ecosystem service valuation studies explicitly link to the valuation of biodiversity. While valuation techniques have been developed and applied for decades, there is still a paucity of valuation studies linking the value of ecosystem service provision to levels of biodiversity for many services.

Note that the biophysical part of the literature review has recently been published and the report in Part I draws heavily on this publication (Harrison et al. 2014).

2.2 PART II: Q study of heterogeneous perceptions of the relationships between biodiversity, ecosystem services and values in national case studies

Understanding different perspectives on the rationale for biodiversity conservation is potentially important for understanding different actors in the biodiversity and ecosystem service research, management and policy field. To understand potential divergence between perspectives across EU stakeholders we conducted nine comparative studies with national decision-makers, NGOs and researchers (in Finland, Norway, Denmark, UK, Spain, Austria-Salzburg, Poland, Hungary and Romania). We analysed the three stakeholder groups independently to reveal whether different views on the value of biodiversity characterise the groups. The analysis shows a very complex pattern of perspectives. The emerging perspectives do not uniquely associate with individual stakeholder groups; many aspects unite all stakeholders to a large degree but we also find conflicting perspectives. We show that it is generally accepted that economic analysis has a role to play in biodiversity conservation, but that ethical arguments are perceived to be fundamental to biodiversity and ecosystem service decision-making.

The analysis shows that the ecosystem service framework thinking is now prevalent across the EU Member States participating in this study. It also shows that many other perspectives are clearly expressed among stakeholders in the field. Many of the perspectives express conflicting views on priorities in biodiversity and ecosystem service conservation. The results illustrate that the conflicting views cannot be reduced to a conflict between stakeholder groups: while differences exist between stakeholder groups, there is also a large variation in perspectives on the value of biodiversity within each group. This poses challenges to policy-making in the biodiversity and ecosystem services field; however, recognising the conflicting perspectives can potentially help to facilitate decision-making processes.

2.3 PART III: Detailed analysis of relationships between biodiversity, ecosystem services and values in local case studies

Five local case studies were selected, to explore the relationships between biodiversity, ecosystem services and values in more detail. The case studies, chosen to cover a range of ecosystems (mountains, coasts, wetlands, forests, freshwater) and socio-economic settings, were:

- The Andalusia national parks, Spain
- The Lower Danube River Catchment, Romania
- Large mammals conservation, Norway
- Water companies investment planning, UK
- Tidal Energy, Northern Ireland

All case studies analysed the following topics:

(i) The relationship between biodiversity and ecosystem service delivery;
(ii) Stakeholder perspectives on biodiversity and ecosystem services, and how these perspectives change with increased scientific knowledge;
(iii) Opportunities, threats and trade-offs between biodiversity conservation and ecosystem service provision; and
(iv) Arguments associated with biodiversity conservation and ecosystem services.

All the case studies began by identifying the main stakeholders affected by conservation policy in the area, and classifying them into groups. The classifications varied between case studies, but typically included:

1. Key stakeholders: strong dependence on ecosystem services; exert considerable control.
2. Secondary stakeholders: little dependence on ecosystem services; considerable control.
3. “Vulnerable” primary stakeholders: high dependence on ecosystem services; little control.
4. External stakeholders: little dependence; little control.

The allocation of stakeholders to these groups varied between case studies. In Spain and Romania, for example, the vulnerable group included local residents and workers (farmers, fishermen, forestry labourers) who had a strong dependence on provisioning services, and the key stakeholder group included government officials and NGOs. In Norway, however, the vulnerable group included animal welfare NGOs, with farmers and hunters being included in the group of powerful key stakeholders.

A variety of methods were used to analyse the ways in which arguments are constructed by different stakeholders, and the implications for the resulting decisions on conservation and the provision of ecosystem services. These included analysis of policy documents, and gathering the viewpoints of stakeholders through interviews, questionnaires and focus groups, including the use of Q-analysis

(ranking of opinion statements) and Fuzzy Cognitive Mapping (mapping perceived positive and negative relationships between different factors).

Synthesising the results of the five different case studies, a number of fairly robust conclusions can be drawn.

1. **Different stakeholder groups have different views**. Local people are often more concerned with provisioning services and the associated socio-economic benefits (jobs and income from farming, fishing, timber etc.), though they often also place a high value on cultural heritage and the local distinctiveness of the area. Governments and regulators tend to be more aware of regulating services (water, air, climate, soil). Tourists may be more concerned with cultural, recreational, landscape and aesthetic benefits, and species abundance for charismatic species, though some also value the more well-known regulating services, e.g. clean air or wildlife habitat.
2. **Improved scientific knowledge can increase the value placed on ecosystem services**. The different case studies provided interesting contrasts here. In Spain and Romania, scientific knowledge raised awareness of, and concern about, regulating services among local people who were previously focused on provisioning services. In the UK, scientific knowledge led a key policy-maker (the UK water regulator) to become more supportive of catchment management to improve water quality. In Northern Ireland, on the other hand, a high initial level of concern over the impact of a marine turbine on biodiversity and other ecosystem services was gradually alleviated by improved scientific knowledge resulting from a monitoring programme.
3. **The message needs to be tailored to the audience**. For example, in the Danube catchment, messages building on local traditional knowledge regarding water management were more effective, especially when using key local people to transmit the message.
4. **There are important synergies and trade-offs between different ecosystem services.** Despite strong synergies between biodiversity and many regulating and cultural services, there were also many trade-offs, typically between extractive provisioning services and regulating or cultural services. The nature of the extractive service was crucial: intensive activities (e.g. agriculture in Doñana, rice plantations in the Danube) and over-exploitation created the most trade-offs (e.g. eutrophication, erosion, landscape damage, species loss), whereas less intensive or traditional activities had a wider range of synergies with other ecosystem services and fewer trade-offs (e.g. the cultural value of traditional livestock in Spain).
5. **Often trade-offs result from differences in value judgements**. In Norway, for example, different attitudes towards nature amongst groups who are pro-hunting, pro-farming or pro-conservation led to significant controversy over the management of large mammals such as wolves, lynx and bears, yet stakeholders recognise that these differences stem from value judgements, and agree that broad debate is crucial to reach consensus.
6. **It is necessary to reach a balance between economic activity and conservation objectives**, in order to maintain a viable rural population, but human activity must be controlled in order to limit damage to biodiversity and ecosystem services. Opportunities exist that can maximise multiple benefits and minimise trade-offs, e.g. by promoting and supporting sustainable activities such as eco-tourism, traditional agriculture and organic farming.

3. Overall synthesis

In this overall synthesis, we summarise the findings of Work Package 4 concerning the three research questions which it set out to answer. In a concluding section, we then consider the implications for policy-makers, researchers, NGOs and other stakeholders working in areas related to biodiversity conservation and ecosystem service provision.

1. Can the importance of biodiversity (or a sub-set of biodiversity) for ecosystem service delivery be characterised?

The literature review presented in Part I of this report clearly demonstrates strong links between biodiversity and ecosystem service delivery. In many cases, the primary link was to the entire community or habitat, demonstrating for example the benefits of forests for carbon storage or flood regulation, and wetlands for water purification. In these cases, there was often a simple relationship between the area of the beneficial habitat and the level of service provision. The physical structure of the community was also significant for some services, with more complex structures (such as old-growth forests, or wetlands with varied vegetation heights) often providing a greater level of service.

However, for most services we also found evidence of positive links to classic biodiversity measures, such as species richness and functional diversity. This can be explained by the theory of niche complementarity: a greater variety of functional groups (e.g. root depths, canopy heights or prey types) allows a community to exploit resources such as water, sunlight or nutrients more fully. Similar relationships were observed in the case studies. For example, a study of wetland vegetation in the Donãna region of Spain showed that different functional groups of plants provided different services, such as water purification (provided mainly by underwater plants) and aesthetic pleasure (provided by above-water flowering plants).

For some provisioning and regulating services, the main link was to species abundance of a single species or a small number of species, because those species were high performers in delivering the service (e.g. commercial species of fish or timber, or large species of trees that store greater amounts of carbon). For certain cultural services such as nature-watching, species diversity is important but so is the abundance (and sometimes the size) of certain charismatic species such as whales or dolphins.

The main example of a negative link between biodiversity and ecosystem services is for freshwater provision, where several biodiversity attributes of forests (such as forest area, tree size, tree age and root density) tended to decrease the provision of freshwater. This is simply because trees intercept rainfall and absorb groundwater through evapotranspiration – precisely the qualities that lead to a positive contribution to another ecosystem service: flood prevention. Other examples often referred to a negative impact associated with non-native species, such as invasive alien species with no natural predators, tree species grown in plantations, or non-native honey bees (due to competition with native bees).

The other exception was that, unsurprisingly, there was a negative link between species mortality rate and ecosystem delivery (especially for studies of the impacts of forest fires). As mortality rate in this case is negatively correlated with most other measures of biodiversity, this does not really indicate a negative link between biodiversity and ecosystem services.

The literature review also found evidence of significant values of ecosystem services to society. Large differences exist in the focus that each of the services has received in the valuation literature. There is still a need for more empirical research linking aspects of biodiversity to levels of ecosystem service provision and to values to society, for many services or bundles of services.

While the literature review summarised the state of scientific knowledge about the way in which biodiversity contributes to ecosystem services, the case studies and Q analysis investigated stakeholder perceptions of these links, and thus the importance that different people place on various aspects of biodiversity. We found considerable variation in the awareness of ecosystem services, the attitudes to biodiversity conservation, and perceived linkages between biodiversity and ecosystem services, both between and within stakeholder groups. The local case studies found, for example, that local people often valued provisioning services more highly, whereas government and regulators placed more importance on regulating services, and tourists preferred recreational and cultural services.

The Q analysis investigated the attitudes of expert stakeholders: researchers, decision-makers and NGOs. A complex pattern was revealed, with some stakeholders attaching significant importance to the role of biodiversity in the provision of ecosystem services because of their practical and monetary value to humans, some valued ecosystem services without emphasising the role of biodiversity, but others focused more on biodiversity as a good in its own right, based on the rights of all species to exist irrespective of their value to humans.

2. Under what circumstances does a focus on ecosystem service delivery create opportunities or threats for biodiversity conservation?

For many regulating and cultural ecosystem services there are strong synergies with biodiversity conservation. For example, the literature review and case studies demonstrated the ability of rich and diverse ecosystems to deliver services such as carbon storage, flood protection, soil fertility and landscape aesthetics, as well as providing habitat for wildlife.

Despite these synergies, there are also a number of important conflicts. In particular, extractive provisioning services such as farming, fishing and timber extraction often lead to loss of, or damage to, wildlife habitat, and reduce the ability of ecosystems to provide regulating or cultural services. Thus a focus on these provisioning services could lead to a loss of biodiversity and damage to other services. Conflicts between different provisioning services can also occur, especially where benefits accrue to different stakeholder groups (e.g. fertiliser runoff from farmland causing eutrophication, leading to reduced catch for fishermen).

It is interesting to consider these conflicts in the light of the results from the Q analysis, which identified conflicting attitudes to biodiversity conservation and ecosystem service provision. One set of attitudes focuses on the economic benefits of ecosystem services for human society, while others place a higher value on the intrinsic value of nature. The implication this has for attitudes to biodiversity conservation largely depends on how stakeholders perceive the link between biodiversity conservation and long-term ecosystem service delivery. It is likely that stakeholders with a pure economic perspective will only prioritise conservation if convinced that this will favour optimal exploitation of services directly benefitting people. Those with a pure nature-based perspective might argue for greater conservation and protection of nature irrespective of the functional role of biodiversity. Despite these differences, all the expert stakeholders agreed that biodiversity conservation was a moral matter.

This underscores the importance of maintaining a balanced view of biodiversity and ecosystem service delivery. As one stakeholder put it: "*biodiversity conservation cannot be accomplished by placing a glass bell over a protected area; you have to take into consideration the fact that nature is a resource and a provider of services for the socio-economic activities within an area".* They also emphasised the importance of demonstrating the economic value of ecosystem services, in order to engage stakeholders with utilitarian views.

Policy-makers have a number of options for maximising delivery of a wide range of ecosystem services whilst also conserving biodiversity. In particular, careful policy design can reduce the negative impacts of provisioning services, for example, by avoiding over-extraction of resources such as fish or freshwater, by reducing pollution (e.g. from fertiliser runoff) and protecting important wildlife habitats. Opportunities include the development of sustainable activities such as eco-tourism and traditional low-impact farming, which can provide livelihoods to the local community while preserving vital ecosystem services that are important both locally and globally. However, even eco-tourism has the potential to cause damage to the environment (e.g. through water use, pollution, waste generation and road building) and so careful regulation is necessary.

3. How do uncertainties or gaps in scientific knowledge on the relationship between biodiversity and ecosystem services affect stakeholder's perception of the value of biodiversity, and decisions related to biodiversity conservation?

There is clear evidence from the case studies that improved transfer of knowledge from the scientific community to other stakeholders can increase awareness of, and concern for, ecosystem services and the biodiversity that underpins them. In Spain and Romania, for example, local people were initially largely concerned with provisioning services such as fishing and farming, but the value they placed on cultural and regulating services increased following provision of better information. In the UK, a key policy-maker (the water regulator) also changed their approach following scientific demonstration of the benefits of catchment management to prevent water pollution. However, it is interesting to note that little quantitative evidence was produced in the UK case: instead, all stakeholders responded positively to the simple argument that prevention of pollution at source was better (and cheaper) than clean-up after pollution had occurred.

The Q analysis investigated differences in perspectives between scientific experts (researchers) and other expert stakeholder groups (decision-makers and NGOs). The functional role of biodiversity was found to have a more prominent role in many researcher's opinions and attitudes towards biodiversity conservation, but investment in biodiversity, as a means to protect ecosystem service delivery, was also expressed by many NGOs and decision-makers. Perhaps surprisingly, the results showed a widespread acceptance of the role of economic valuation in biodiversity decision-making. This suggests the need for further studies to strengthen the evidence base for societal values of a range of ecosystem services, for which the literature review found limited information. The Q-study also found, that irrespective of the perspective on whether or how biodiversity is valued, stakeholders displayed a widespread acknowledgement of the ethical dimension of biodiversity decision-making.

The findings from the local case studies show that improved scientific knowledge has great potential to increase the value that stakeholders place on biodiversity and ecosystem service provision, especially for the cultural and regulating services that are often under threat from trade-offs and conflicts with extractive provisioning services and other economic activities. Yet it is also clear that transfer of this knowledge is far from perfect at present. Experts in Doñana identified a need for better communication between scientists and managers; better coordination among governance sectors; improved public participation; and tackling the power and interest bias in conservation. The Romanian case study found that the message needs to be tailored to individual stakeholder groups, according to their different perspectives and their existing knowledge base. For example, they found that local people responded best to arguments that built on local traditional knowledge, and that it was most effective to use important local people to help impart new knowledge to the community.

Overall, the project results highlight the need for improved scientific knowledge, and for better communication of that knowledge to key stakeholders, especially where there are conflicting perspectives and existing support for ecosystem services is low. Even with the best scientific

knowledge, however, it is important to acknowledge that sometimes decisions will involve value judgements, as in the case of the Norwegian large mammals controversy. In this case, all stakeholders felt that the way forward lies in encouraging a wider debate and discussion about the values attached to different ecosystem services, so that society can reach a consensus.

4. Conclusions: how should we frame arguments for biodiversity conservation?

BESAFE aims to help enhance biodiversity protection by improving the way we frame arguments for the conservation of ecosystems. Work Package 4 has contributed to this by undertaking an in-depth analysis of stakeholder attitudes to biodiversity and ecosystem services, through a literature review, five local case studies and a Q study in nine national case studies. Here we summarise the key findings that have implications for the way we construct arguments for biodiversity conservation.

1. Ecosystem services of value to humans depend strongly on maintaining biodiversity, but this is under threat from the damage caused by certain extractive provisioning services and other human activities. Policy-makers need to encourage a better balance between the supply of different ecosystem services, some of which are in conflict with each other, and the protection of supporting biodiversity. Synergies can be achieved, and conflicts minimised, through exploiting opportunities for sustainable activities such as eco-tourism; restricting the damage caused by extractive provisioning services by encouraging sustainable agriculture and halting over-extraction of resources such as fish and freshwater; and restricting the negative impacts of cultural services such as tourism.
2. Stakeholder awareness of ecosystem services varies considerably depending on their location, occupation, socio-economic situation and their degree of dependence on those services. Awareness of provisioning services and some cultural services is generally widespread, but there is less awareness of many regulating services.
3. Lack of scientific knowledge about the value of ecosystem services, and the way in which these services depend on underlying biodiversity, partly affects the value that stakeholders place upon those services. There is evidence from the case studies that better transmission of this knowledge to stakeholders can improve the value they place on some services, e.g. local stakeholders in Spain and Romania valued regulating services more highly after being presented with information on these services. However, stakeholder values and preferences partly reflect their personal interests and dependence on ecosystem services, so better information cannot be expected to result in a complete shift in attitudes.
4. The way in which information is presented to stakeholders is important: to be effective, it should be carefully tailored to their needs and interests. This will vary depending on the exact situation. In the Danube catchment in Romania, for example, local stakeholders responded best to messages building on traditional knowledge and practices regarding water management, especially when presented by key local community members.
5. The Q analysis revealed that attitudes to nature conservation varied considerably within different expert stakeholder groups. It is not possible, therefore, to assume that all decision-makers will respond to the same arguments. Within each group of experts (researchers, decision-makers, NGOs) there were people who supported the rights of non-human species or the intrinsic value of nature; those who responded best to emotional arguments about the beauty of nature and how nature gives meaning to life; those who rejected emotional arguments in favour of arguments based on the value of ecosystems to humans; and those who favoured protecting ecosystems as an insurance policy against future change.

This diversity of views might prompt us to consider whether we should adopt a wider range of arguments for the conservation of nature. There may be a tendency to assume that decision-makers

are forced to rely largely on financial arguments, and that monetary valuation of ecosystems is the only way of demonstrating their importance. It is clear from our study that many stakeholders from all walks of life attach considerable important to the intrinsic value of nature, and place a high value on cultural and aesthetic ecosystem services. For example, all our expert stakeholders agreed with the statement that biodiversity conservation is a moral issue. On the other hand, our expert stakeholders also rejected the concern that valuation of ecosystems is likely to provide a justification for their destruction.

The results of our study imply that there is a role for several lines of argument supporting the protection of biodiversity: for example, those based on the rights of species to exist; those based on the value to humans, and those based on the "insurance policy" approach. Perhaps the key to improving biodiversity protection is to ensure a better balance between these arguments, and wider dissemination of these arguments to all stakeholder groups, rather than assuming that, for example, decision-makers will only respond to financial arguments.

In particular, these results could be used to justify a stronger emphasis on ethical and moral arguments for biodiversity conservation, as it seems that many decision-makers and other stakeholders respond to those arguments. However, there is clearly also a demand from policy-makers for better data to inform economic analysis about alternative biodiversity conservation strategies. In particular, evidence to support the analysis of the role of biodiversity conservation as an insurance policy is currently limited.

In summary, the results of our study imply that to restore the balance between the supply of provisioning services, the supply of other services and biodiversity conservation, it is necessary to:

1. Improve awareness of ecosystem services and their dependence on biodiversity among all stakeholder groups;
2. Tailor the message depending on stakeholder needs and interests;
3. Improve valuation of ecosystem services where possible, but emphasise more strongly that many important cultural and aesthetic services cannot be valued in monetary terms, and that many values are highly uncertain;
4. Improve the evidence for conducting valuation studies of biodiversity conservation as insurance for future ecosystem service delivery;
5. Employ a wider range of arguments for biodiversity conservation, especially through acknowledging the validity of the ethical and moral arguments concerning the rights of species to exist, and promoting the "insurance policy" argument more widely.

5. Papers published or in preparation from WP4

Berry, P., Blicharska, M., Bredin, Y., Fabók, V., García-Llorente, M., Geamana, N., Harrison, P.A., Haslett, J., Primmer, E. & Termansen, M. (in preparation). Why invest in biodiversity? A multi-national exploration of stakeholders views on the arguments for biodiversity conservation. Possible journals: Environmental Science and Policy or Conservation Biology.

Bredin, Y., Lindhjem, H., van Dijk, J. & Linnell, J.D.C. (in preparation). Mapping value plurality in the case of Norwegian wildlife management: A Q analysis. Possible journals: Ecological Economics or Ecosystem Services: Science, Policy and Practice.

García-Llorente, M., Harrison, P.A., Berry, P.M., Palomo, I., Martín-López, B., Iniesta-Arandia, I., Gomez Baggethun, E. & García del Amo, D. (in preparation). Ecosystem service integration within conservation policies. Possible journal: Environmental Science and Policy.

García-Llorente, M., González, L., Harrison, P.A., Berry, P.M., Martín-López, B., Iniesta-Arandia, I. & García del Amo, D. (in preparation). Traditional livestock practices within protected areas planning: Seeking a common ground. Possible journal: Ecology and Society.

Harrison, P.A., Berry, P.M., Simpson, G., Haslett, J.R., Blicharska, M., Bucur, M., Dunford, R., Egoh, B., Garcia-Llorente, M., Geamănă, N., Geertsema, W., Lommelen, E., Meiresonne, L. & Turkelboom, F. (2014). Linkages between biodiversity attributes and ecosystem services: A systematic review. Ecosystem Services, DOI 10.1016/j.ecoser.2014.05.006i.

Primmer, E., Bredin, Y., Termansen, M., Jääskeläinen, T., Bela, G., Berry, P., Blicharska, M., Fabok, V., Gaemana, N., Garcia-Llorente, M., Harrison, P.A. & Haslett, J. (in preparation). Personally held values meet values dominating in decision-making: A Q-analysis of biodiversity conservation arguments in Europe. Possible journals: Environmental Policy and Governance or Plos ONE.

Termansen, M., Berry, P.M., Primmer, E., Andersen, A.H., Blicharska, M., Bredin, Y.K., Bucur, M., Cosor, G., de Neergaard, V.M.M., Fabók, V., García-Llorente, M., Geamana, N., Harrison, P.A., Haslett, J.R., Jääskeläinen, T., Stanciu, A. & Thisted, C.N. (in preparation). On the value of biodiversity: A Q-study on alternative perspectives. Possible journal: Ecology and Society.