



What Science
Can Tell Us

Natura 2000 and Forests

– Assessing the State of Implementation
and Effectiveness

Metodi Sotirov (editor)



What Science Can Tell Us

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The editorial office can be contacted at publications@efi.int

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Authors

Annemarie Bastrup-Birk, European Environment Agency (EEA), Denmark

Mareike Blum, University of Freiburg, Germany

Lluís Brotons, InForest Joint Research Unit (CTFC-CREAF) and CSIC, Spain

Louise Ecochard, Laboratoire d'Economie Forestière, Institut National de Recherche Agronomique (INRA), AgroParisTech, France

Serge Garcia, Laboratoire d'Economie Forestière, Institut National de Recherche Agronomique (INRA), AgroParisTech, France

Sarah Greenwood, University of Stirling, UK

Carol Grossmann, Forest Research Institute of Baden-Württemberg

Virgilio Hermoso, CTFC Forest Sciences Centre of Catalonia, Spain

Emeline Hily, Laboratoire d'Economie Forestière, Institut National de Recherche Agronomique (INRA), AgroParisTech, France

Alistair Jump, University of Stirling, UK

Marco Marchetti, University of Molise, Italy

Grzegorz Mikusiński, Swedish University of Agricultural Sciences (SLU), Sweden

Jari Parviainen, Independent Expert for Sustainable Forest Management, Dr. For., Finland

Giovanni Santopuoli, University of Molise, Italy

Zuzana Sarvašová, National Forest Centre, Slovakia

Andreas Schabel, Forest Research Institute of Baden-Württemberg, Germany

Sebastian Schmack, Forest Research Institute of Baden-Württemberg, Germany

Metodi Sotirov, University of Freiburg, Germany

Matteo Vizzarri, University of Molise, Italy

Gerhard Weiss, University of Natural Resources and Life Sciences (BOKU), Austria and Central-East and South-East European Regional Office of the European Forest Institute (EFICEEC-EFISEE)

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Dr Georg Winkel has acted as the What Science Can Tell Us –series editor for this volume.

Executive Summary

Background

Natura 2000 is the core pillar in the European Union's (EU) biodiversity conservation policy. It is an EU-wide ecological network of protected areas that cuts across countries' borders, administrative levels, policy sectors and socio-economic contexts. The network is established and managed according to the legally-binding provisions of the 1979 EU Birds Directive (79/409/EEC, revised in 2009) and the 1992 EU Habitats Directive (92/43/EEC).

Natura 2000 aims to achieve biodiversity conservation and to combine it with the sustainable development of land and natural resources. It can allow for continuation of land uses (eg agriculture, forestry) as long as they do not significantly compromise conservation objectives for habitats and species within and beyond the network.

The Natura 2000 network now covers almost 18% of the EU's territory. Forests are of crucial importance for Natura 2000 and vice versa. Almost 50% of the whole coverage of the network is comprised of forests. This means that nearly 25% of the total forest area in the EU-28 is part of the EU-wide network of protected areas. Yet knowledge about the implementation of Natura 2000 in forests and its effects on biodiversity, forest management and other land uses across the EU is fragmented.

This science-based study aims to narrow the gaps in the scholarly, practical and policy-related knowledge. It looks from policy, economic and ecological perspectives at the monitoring of forest biodiversity in Europe, as well as the challenges, achievements, effectiveness and efficiency of the implementation of Natura 2000 in forests in the EU-28. The study provides conclusions and recommendations that can support decision-making in policy and practice.

Forest biodiversity monitoring

Recently, decision makers in forest policy and practice in Europe have faced partly contradicting information about the state of biodiversity in Europe's forests from the two main monitoring processes in Europe (FOREST EUROPE and Natura 2000).

This can be explained to a large extent by important differences in terms of the processes' key concepts and definitions, assessment tools (criteria and indicators; thresholds), levels and units of analysis, data collection and data analysis methods, knowledge-production traditions, policy objectives and governance context.

Recommendations

- Improve data quality, harmonization and standardization between FOREST EUROPE and Natura 2000, for example by a systematic integration of additional key biodiversity variables in FOREST EUROPE's assessment frameworks and national reports, and using FOREST EUROPE's updated Pan-European Criteria and Indicators in the Natura 2000 process.
- Create a deeper understanding of changes in forest biodiversity status over space and time, for example by reframing current indicators, parameters and drivers (social and economic).
- Secure appropriate European and national level financial and administrative support for forest biodiversity monitoring activities.
- Strengthen stakeholder consultation and the inter-sectoral exchange of knowledge, especially at national and local scales and between nature protection and forestry domains.
- Strengthen the transfer of knowledge from science to policy and practice and vice versa, using existing platforms.

Implementation of Natura 2000 in forests and other land uses

Domestic approaches to the implementation of Natura 2000 over the last 25 years have been characterized by a series of challenges. These include failures in formal implementation as regards the full transposition of the EU Nature legislation into national law on time, and the identification and establishment of sufficient Natura 2000 sites. The formal and practical implementation of the Natura 2000 network has triggered substantial policy and management conflicts. It has been a long and complex process for the responsible authorities and the stakeholders involved.

These challenges can be explained by the ambitious goals of the policy, the significant regional differences related to bio-geographical conditions and ecological processes, traditional practices in biodiversity conservation and land use, political systems, policy priorities and administrative capacities, and socio-economic factors across the EU Member States.

There is a need to reconcile biodiversity conservation and different land uses (e.g. forestry, agriculture), to establish cooperation between public and non-state actors, to practice an integrated and participatory approach to formulate conservation objectives and implement appropriate management measures, and to secure a multi-level monitoring and reporting of implementation and impacts.

Recommendations

- Tackle ideological and information challenges in Natura 2000 implementation, for example by improving two-way communication between distinct responsible authorities and stakeholders, and clearly spelling out both win-win situations and trade-offs for nature conservation and forest management practices.
- Tackle economic interest-based challenges in Natura 2000 implementation, by encouraging co-funding from all administrative levels, and from nature conservation and forestry/agriculture.

- Tackle institutional challenges in Natura 2000 implementation, by improving the consistency of the overall policy framework, including all relevant policies, strengthening coordination and creating co-responsibility between the nature conservation sector and the forestry/land-use sectors.

Ecological effectiveness of the implementation of Natura 2000 in forests

The effectiveness of Natura 2000 in forest systems can be difficult to assess from an ecological perspective. Succession in forests occurs over timescales that make it difficult for the effectiveness of relatively recent policy measures to be gauged, and unequal research coverage of impacts among different biogeographical regions, Member States, habitats and taxonomic groups also imposes constraints. While Natura 2000 can be an effective instrument to protect, or restore habitats and species to favourable conservation status if appropriately implemented across the EU-28, its current “real” effectiveness is much more difficult to evaluate with the available scientific information.

We need a better understanding of the impacts of climate change, nitrogen emissions and forestry operations on biodiversity and the effectiveness of Natura 2000 policy in the future. For effective conservation, we must consider landscape-scale, long-term change and create a connected, flexible network that can cope with these changes.

Recommendations

- Improve the positive effects of Natura 2000 in forests, with flexible, integrated and adaptable site designation and management planning, to allow species and habitats to remain represented despite changes over time. The protection offered by site designation must not be undermined as a result of this flexibility.
- Improve the consistency of Natura 2000 management, by better policy coordination across the EU, a more standardized and consistent approach in data collection, and the involvement of forest managers in assessing conservation status and providing guidelines.
- Account for ecosystem goods and services within and beyond Natura 2000, understanding the trade-offs that can occur between services, and between services and management objectives. Educate forest managers and users on the relevance of services in protected areas.
- Share and apply best practice examples of Natura 2000 management planning.

Efficiency and economic aspects of the implementation of Natura 2000 in forests

Protected areas are sometimes seen as expensive, partly because the benefits they generate are not easily measurable and not directly comparable to the costs they involve. Specifically, the implementation of Natura 2000 could trigger significant costs for forest owners and enterprises. The value of benefits and ecosystem services provided by Natura 2000 largely overcomes the implementation costs. However, the establishment and management of Natura 2000 is faced with a low legitimacy and acceptance from forest owners and land users, who feel they are not well compensated for changing their practices. This mismatch results in a lack of cost-effectiveness as well as conflicts and implementation barriers.

The available EU-level funding instruments can cover only a small amount of the estimated costs of the implementation of Natura 2000. The budget gap is not filled sufficiently by national or alternative funding sources. The funding problem is not limited to a lack of funds, but also to an ineffective use of existing funds. This is because of lack of integration across policy sectors, diverging policy priorities at different policy levels, and conflicting interests between land-use and conservation.

Funding schemes in forests should be designed specifically for long-term dynamics and commitments, should include agricultural and forestry interests as well as environmental groups, and should include financial commitments from public and/or private local-level beneficiaries.

Recommendations

- Support more research and exchange of knowledge, to compare the cost-effectiveness and efficiency of different financial incentives for Natura 2000 in forests, including pilots for result-based payments.
- Strengthen incentive-based conservation instruments, with further enhanced use of compensation payments to trigger sufficient participation of forest owners.
- Design economic incentives for flexibility and the long-term, to take account of ecological, climate and societal changes as well as new scientific information.
- Support the integration between EU and national agricultural/rural development policy (and funds) and Natura 2000 in view of better supporting the implementation of nature conservation objectives in forests.
- Clarify political and administrative responsibilities for biodiversity conservation in view of creating an effective, efficient and integrated policy framework.

Introduction

Metodi Sotirov and Gerhard Weiss

Natura 2000 is the core pillar in the European Union's (EU) biodiversity conservation policy. It refers to an EU-wide ecological network of protected areas that cuts across countries' borders, administrative levels, policy sectors and socio-economic contexts. The network is established and managed according to the legally binding provisions of the EU's 1979 Birds Directive (79/409/EEC, revised in 2009) and the 1992 Habitats Directive (92/43/EEC). In line with the EU's Nature Directives, habitats and species must be maintained, or restored, to a favourable conservation status within bio-geographical regions. Accordingly, the EU Member States, inter alia, have to establish and manage Natura 2000 as a comprehensive network of protected areas for the conservation of habitats, animal and plant species.

Natura 2000 is not designed to be a system of strictly protected areas that works by excluding various land uses (such as agriculture, forestry, fisheries). It allows these uses to continue as long as they do not significantly compromise the conservation objectives for habitats and species within and beyond the network. The Natura 2000 policy aims to combine biodiversity conservation with sustainable development based on economic use of land and natural resources. As such, it is an exemplary European approach to biodiversity conservation in cultural landscapes formed by traditional human management. This integrative approach to nature conservation of Natura 2000 is seen as beneficial for mitigating potential conflicts between nature conservation and the economic use of natural resources, improving acceptance by land users, increasing the effectiveness and efficiency of EU and national conservation instruments, and contributing to a sustainable use of natural resources.

Forests are of crucial importance to Natura 2000 and vice versa. Almost 50% of the whole coverage of Natura 2000 is comprised of forests. This means that nearly 25% of the total forest area in the EU-28 is part of the EU-wide network of protected areas. Yet, knowledge about Natura 2000 implementation in forests and its effects on biodiversity, forest management and other land uses across the EU is limited. While several scientific studies have analysed different cases and aspects of the implementation of Natura 2000 in forests and other land uses, a systematic synthesis and assessment of this knowledge is still lacking.

This study aims to help narrow gaps in the knowledge regarding the implementation and effectiveness of Natura 2000 in forests. Its added value lies not only in the compilation and synthesis of different fragments of the available scientific and expert knowledge. It also offers a systematic and comprehensive assessment of the overall state of scientific and expert knowledge in relation to the key questions listed below. Based on this scientific assessment, this study not only summarises issues and challenges but also achievements and best practice examples. In addition, it identifies existing knowledge gaps and

suggests areas for future research. Based on this, we draw policy-relevant conclusions and suggest recommendations that could support decision-making in policy and practice.

More specifically, this study tackles the following key questions:

- 1) What is the state of biodiversity in Europe's forests? What do we know about the state of biodiversity in Europe's forest ecosystems, how is it monitored through different processes and how do these processes compare to each other?
- 2) What do we know about the implementation of Natura 2000 in forests in the 28 EU Member States? What are the challenges and how are they managed by the relevant administrations and stakeholders? What can be regarded as best practice examples?
- 3) How effective is Natura 2000 in forests? What do we know about the effects of the policy on biodiversity and sustainable development/sustainable natural resource management? More specifically, how is policy effectiveness monitored?
- 4) What do we know about the economic effects of Natura 2000 in forests and related funding? What are the costs and the benefits of the policy and how is the policy funded?
- 5) What are the policy-relevant conclusions that can be drawn based on the scientific knowledge related to Natura 2000 in forests?

To address these questions, a review of the available scientific and expert literature and knowledge was carried out. In particular, several dozen peer-reviewed scientific research and review papers were identified and reviewed. Their core findings were extracted and summarised in relation to the main questions of this study. In addition, key European and national reports and technical documents were identified and reviewed. The expert knowledge and practical experience of all the authors of this study was used to complement the literature review. This knowledge and experience is based on recent policy support work and/or research projects using stakeholder/expert interviews and surveys. Due to time constraints, publications in national languages were not systematically sought. More methodological details can be found in the individual chapters of this study and/or in an annex that can be obtained from the authors.

The remainder of the study is structured as follows. After setting the scene in this Introduction, Chapter 2 presents and discusses how forest biodiversity in Europe is monitored under the Forest Europe and Natura 2000 processes. Chapter 3 summarises what is known from a policy and management perspective about the main challenges and achievements during the implementation of Natura 2000 in forests and other land uses. Chapter 4 considers the experience of implementing of Natura 2000 in forests across EU-28 through best practice examples. It also presents a Central European case study of an integrated policy and management approach.

Chapter 5 provides a comparative analysis of what is known about the ecological status of Natura 2000. This chapter also contains explanations for the effectiveness of the Natura 2000 policy in forests. It is aimed at better understanding questions about the ecological effectiveness and socio-economic impacts of the Natura 2000 policy in forests and beyond. Chapter 6 summarises the evidence about costs, benefits and the financial aspects of the implementation of Natura 2000. This overview seeks to understand and explain the effectiveness and efficiency of Natura 2000 in forests and other land uses from economic and policy perspectives.

Finally, Chapter 7 sums up the evidence and assessments gathered from the three main disciplinary perspectives, including ecology, policy studies and economics. It draws conclusions and suggests policy-relevant recommendations.

The state of biodiversity in Europe's forest systems

Lead authors: Marco Marchetti, Annemarie Bastrup-Birk, Jari Parviainen

Contributing authors: Giovanni Santopuoli, Matteo Vizzarri, Alistair Jump, Metodi Sotirov

2.1 Introduction

Decision-makers in forest policy and practice in Europe have recently faced contradicting information about the state of biodiversity in Europe's forests. The reason is that the two most relevant monitoring processes have provided different assessments and contradictory findings on the overall state of forest biodiversity in Europe. These processes include the State of Europe's Forests report under FOREST EUROPE (formerly, Ministerial Conference on the Protection of Forests in Europe – MCPFE) and the report State of Nature in the European Union, which considers Natura 2000 monitoring according to the EU's Habitats Directive (Article 17) and the EU's Birds Directive (Article 12).

The most recent **State of Europe's Forests** report was published in October 2015. The report assesses the status of and trends in sustainable forest management, including forest biodiversity in Europe, in the reporting period 2011–2015. Some trends for the periods 2005–2015 or 1990–2015 are also provided. The main findings in the report indicate that forest management for enhancing biodiversity in Europe has improved and/or is doing well. This is justified by assessments that domestic forest policies have a stronger focus on the biodiversity aspects of sustainable forest management as well as the fact that more than 30 million hectares of forests in Europe have been protected with the main objective to conserve biodiversity or landscape, arguably in part due to the establishment of the Natura 2000 network of protected areas [1]. In fact, protected forest area with active management for biodiversity has increased rather than strictly protected forest areas [2]. However, only 4% of European forests are undisturbed by humans. The report outlines that mixed tree species stands tend to dominate, deadwood is slightly increasing, and introduced tree species occupy only 4.4% of European forests. Forest fragmentation trends show local reductions as the result of the natural expansion of forests caused, in some cases, by land abandonment [2]. The results also show that forests

are important habitats for threatened species (birds, mammals, trees, other plants, etc.). Most forest tree species in Europe are not threatened, even if many plants and insects depend on the type and abundance of deadwood or veteran trees. Last, but not least, the report concludes that the areas managed for the conservation of forest genetic resources and for seed production have increased over the last 25 years. In short, the FOREST EUROPE process report considers these developments to be contributing to the maintenance and improvement of biological diversity in forest ecosystems in Europe [3].

The most recent **State of Nature in the European Union** report was published in May 2015. It assesses the conservation status of habitats and species (plants, animals) protected under the two EU Nature Directives for the reporting period 2007–2012. The report indicates that, in general, forest habitats and species have not reached a favourable conservation status (FCS). The results show that only 15% of the assessments were in favourable conservation status, while 80% were “unfavourable” as regards all forest habitat types in the nine terrestrial bio-geographical regions in the EU-28. The report concludes that there is still much work to do if the 2020 policy targets of forest biodiversity conservation set in the EU Biodiversity Strategy and the new EU Forest Strategy are to be achieved. By comparing these results with the assessments in the previous State of Nature report for the period 2001–2006, important findings about trends in forest biodiversity can be drawn. Firstly, there is some improvement in knowledge about the conservation status of forest habitats and species. Secondly, the percentage of forest habitat types assessed as having “unfavourable” conservation status is higher (80%) than in the previous period (63%). Finally, in general, species and habitats depending on forest ecosystems share a similar and worrying conservation status compared to other species and habitats (e.g., those depending on agricultural or marine ecosystems). In short, according to the Natura 2000 monitoring process, a significant part of forest biodiversity in Europe (EU-28) is still threatened and/or not improving [4].

Forest biodiversity monitoring under the FOREST EUROPE process

Short overview of data sources and assessment tools (criteria and indicators)

Since 1990, FOREST EUROPE has organised a series of high-level forest policy dialogues between governments, governmental and non-governmental organisations, civil society and the private sector. Through the FOREST EUROPE process, a set of Criteria and Indicators (C&I) for Sustainable Forest Management (SFM) has been developed, used and conceived as an internationally agreed policy instrument for assessing, evaluating and reporting on SFM at pan-European and national levels. The set is composed of six criteria, covering the three equally important pillars of SFM: the ecological, economic and socio-cultural aspects. The set further consists of 35 quantitative indicators, describing the status and changes in forest ecosystem and forest management conditions, and 17 qualitative indicators [5,6]. So far, the pan-European set of C&I for SFM has been used as a basis for the four State of Europe's Forests (SoEF) reports that were published in 2003, 2007, 2011 and 2015. At the Madrid Conference in 2015, ministers approved an updated C&I set (Table 1), which will be used for the next SoEF report to be prepared for the ministerial conference to be held in the Slovak Republic in 2019. The updated set now includes 34 quantitative and 11 qualitative indicators.

The rationale behind the updating process mainly concerns the need to generate more information without excessive amounts of data, removing indicators whose data is not available or reliable, and promoting a further harmonisation of terms, definitions, and parameters¹. The linkage between the quantitative and qualitative indicators was improved and strengthened, and some new indicators were developed. In particular, the names of indicator “4.1. Diversity of tree species” and “4.7. Forest fragmentation” were changed, and a new indicator on “Common forest bird species” (no. 4.10) was developed. The latter is still in a test phase for assessing whether data according to this new indicator can be collected in systematic and reliable ways.

The updates aim to enable a tighter relationship between the indicators and the policy instruments across countries with refinement of names and definitions, measurement units, and current periodicity of data availability. Although these indicators report on forest management for biodiversity conservation, other indicators also provide relevant information related to the conservation status of forest habitats (i.e., criterion 1 refers to forest area and structure; criteria 2 includes air pollutants, defoliation and soil condition).

¹ http://www.foresteurope.org/sites/default/files/ELMS_2015_1_ProposalUpdatingIndicators.pdf

Table 1. Updated pan-European indicators for Criterion 4: biological diversity in forest ecosystems (adopted at the ministerial conference in Madrid, Spain 2015 ⁽²⁾). The current set consists of 10 quantitative indicators, and one qualitative indicator. The first column reports the indicators adopted in Vienna 2003 and used as such until 2015. The second column shows the latest updates as suggested at the Madrid Conference in 2015. The last column displays the description of indicators.

Criterion 4 - Maintenance, Conservation and Appropriate Enhancement of Biological Diversity in Forest Ecosystems			
Indicators as adopted in Vienna 2003		Updated indicators as adopted in Madrid 2015	
Indicator number and name	Full text	Indicator number and name	Full text
	C.4 Policies, institutions and instruments to maintain, conserve and appropriately enhance the biological diversity in forest ecosystem		
4.1 Tree species composition	Area of forest and other wooded land, classified by number of tree species occurring and by forest type	4.1 Diversity of tree species	Area of forest and other wooded land, classified by number of tree species occurring
4.2 Regeneration	Area of regeneration within even-aged stands and uneven-aged stands, classified by regeneration type	4.2 Regeneration	Total forest area by stand origin and area of annual forest regeneration and expansion
4.3 Naturalness	Area of forest and other wooded land, classified by “undisturbed by man”, by “semi-natural” or by “plantations”, each by forest type	4.3 Naturalness	Area of forest and other wooded land by class of naturalness
4.4 Introduced tree species	Area of forest and other wooded land dominated by introduced tree species	4.4 Introduced tree species	Area of forest and other wooded land dominated by introduced tree species
4.5 Deadwood	Volume of standing deadwood and of lying deadwood on forest and other wooded land classified by forest type	4.5 Deadwood	Volume of standing deadwood and of lying deadwood on forest and other wooded land
4.6 Genetic resources	Area managed for conservation and utilisation of forest tree genetic resources (in situ and ex situ gene conservation) and area managed for seed production	4.6 Genetic resources	Area managed for conservation and utilisation of forest tree genetic resources (in situ and ex situ genetic conservation) and area managed for seed production
4.7 Landscape pattern	Landscape-level spatial pattern of forest cover	4.7 Forest fragmentation	Area of continuous forest and of patches of forest separated by non-forest lands
4.8 Threatened forest species	Number of threatened forest species, classified according to IUCN Red List categories in relation to total number of forest species	4.8 Threatened forest species	Number of threatened forest species, classified according to IUCN Red List categories in relation to total number of forest species
4.9 Protected forests	Area of forest and other wooded land protected to conserve biodiversity, landscapes and specific natural elements, according to MCPFE Assessment Guidelines	4.9 Protected forests	Area of forest and other wooded land protected to conserve biodiversity, landscapes and specific natural elements, according to MCPFE categories
		4.10 Common forest bird species	Occurrence of common breeding bird species related to forest ecosystems

² http://www.foresteurope.org/sites/default/files/Changes_List_Updated_Indicators_Vienna_vs_Madrid.pdf

Key facts and assessments of the state of forest biodiversity according to the pan-European State of Europe's reports on sustainable forest management

Tree species composition refers to the area of forests and other wooded land (OWL) that is classified by the number of occurring tree species, and by forest type [3]. Tree species composition reflects the tree species richness, which is in turn assumed to be positively correlated with other ecosystem services [3]. On the other hand, it may be argued that a mixture of non-native tree species negatively affects biodiversity conservation at a local scale. Mixed forests composed of multiple tree species are often richer in biodiversity than monospecific forest stands. Assessments regarding the tree species richness indicator show that approximately half of European forests are composed of two to three tree species whereas one third of European forest is dominated by a single tree species. Forests built up from four to five tree species occupy 14% of European forest area, and 4% of the forests are composed of six or more tree species. Between 1990 and 2010 there was a slight decrease in forests dominated by single tree species. According to SoEF 2015, Sweden and Spain reported the largest forest and OWL area with more than one tree species, as well as the highest relative increases from 1990 to 2010 [3].

Regeneration by natural seeding, vegetative regeneration or combined planting and seeding ensures the perpetuation of forests. Regeneration can take place within the forest or through afforestation or natural expansion on land that was previously subject to other uses (such as agriculture). Occasionally, replanting is necessary where wildfires, storms or insect outbreaks have caused large amounts of damage to the forest (e.g., reforestation programmes). In 2010, approximately 68% of European forests (EU-28) were regenerated through natural regrowth or expansion. According to SoEF, afforestation and regeneration by planting or seeding correspond to 27% and coppicing to 5% of the total forest regeneration area in Europe. Between 2005 and 2010 there was a slight increase in natural regeneration and expansion (9%) in European countries, except for the region of North Europe (-5%) [3].

Naturalness is expressed as the area of forest ecosystem classified either as “undisturbed by human interventions”, “semi-natural” or “plantation”, each by forest type. The 2015 SoEF report shows that in Europe and in the EU-28 only 4% (7.3 million hectares) and 2% of the forest area respectively is undisturbed by human interventions. The semi-natural forest area corresponds to 87% (174 million hectares) and 89% of the total forest area in Europe and in the EU-28, respectively. Plantations cover approximately 20 million hectares (9% of the total forest area) and 13 million hectares in Europe and in the EU-28, respectively. The largest portion of undisturbed forests within the forest area is found in Central-East and South-East Europe. Over the last 20 years the trend has been for the area of both semi-natural forests and plantations to increase while undisturbed forests have slightly decreased. The concept of naturalness has been proposed and used to describe the ecological value of forest ecosystems, evaluating forest management efforts to conserve biodiversity, and identifying natural, old-growth forests, with the main purpose of establishing protected forest areas (e.g., [7, 8, 9]).

Introduced tree species are species occurring outside their natural geographical range and, in most cases, introduced for economic or ornamental purposes [3]. Such species are planted for various reasons, such as the need to obtain wood rapidly (e.g., short rotation forestry as a renewable energy source; increase in timber yields), to increase forest cover, to introduce species for horticultural purposes, and to reduce soil erosion. Introduced

tree species cover 4.4% of the European forest area, of which 0.5% is composed of invasive ones (i.e., species whose introduction and consequent spread cause socio-cultural, economic and/or environmental harm; p144 [3]). Although some introduced tree species are considered to contribute to wood production, the presence of invasive alien species may induce changes of forest ecosystem structures and dynamics over time [3]. The largest areas of introduced tree species are found in South-West and Central-West Europe, with the smallest ones in North Europe. The total area of introduced tree species in Europe, as well as in the EU-28, remained stable over the last 15 years. However, information on annual changes in forest cover by European Forest Categories reveals a multifaceted picture at country level, in terms of gain and loss of forest habitats dominated by native and introduced tree species [10].

The conservation and use of **genetic resources** are important components of SFM. In Europe, approximately half a million hectares of forests was managed for in situ conservation in 38 countries in 2015. The total area managed for ex situ conservation was about 11,000 hectares. In addition, one million hectares of forests was established for seed production. A total of 145 tree species is reported to grow on those areas, including subspecies and hybrids. The area of in situ genetic resources steadily increased during the last 25 years. Nevertheless, few genetic conservation areas are managed for in situ conservation of the scattered tree species (e.g., *Populus nigra*, *Sorbus domestica*), which are important for maintaining a certain forest biodiversity status and ecosystem stability [3]. In the case of introduced tree species, a trade-off between conserving in-situ genetic resources and protecting native tree species should be considered in order to maximise biodiversity.

Landscape pattern means how continuous the forest cover is in the landscape, or whether the forest areas are distributed in patches within the non-forest area. In 2012, 65% of European forest land was in a “core natural landscape pattern”, implying that it was not fragmented³. On the other hand, 35% of European forests were significantly fragmented due to agricultural uses and urban sprawl, even though the methodology followed (European Commission’s Joint Research Centre – JRC) seems to underestimate connectivity due to the scale used. Habitat fragmentation is considered to be one of the major threats to biodiversity [11]. The trend between 2000 and 2012 shows that, in half of the reporting European countries, the forest area in a “core natural pattern” tended to increase due to natural expansion and planting.

Deadwood refers to the volume of standing and lying dead trees in forest ecosystems and represents an important habitat for a large number of plant and animal species [12]. Deadwood can be considered to be an array of microhabitats, which evolve continuously over time. The total amount of deadwood, its distribution across different stages of decomposition, and the associated species are very important for assessing the status of forest biodiversity [13, 14, 15]. The presence of deadwood depends on whether woody biomass has been removed for timber production, wood fuel and/or for protection against forest fires. However, the quantity of it in undisturbed and managed forests varies considerably. The late development phase of natural forest (old-growth forests) is characterised by large trees, a large amount of growing stock and a diversity of deadwood. In European forests, such late phases are largely missing due to long-term forest management. Thus, several deadwood-dependent species (such as saproxylic invertebrates,

³ “Forest landscape fragmentation pattern” is measured for a forest neighborhood of 1km² and three fragmentation patterns types are deduced (core natural, mixed natural, some natural) (p153; [3]).

woodpeckers, and a wide range of mosses and lichens) are endangered. Accumulated fresh deadwood can cause insect outbreaks, which contributes to revenue losses for forest owners. The natural expansion of insect populations may contribute to improved forest resilience (for example, spruce-dominated forests being affected and replaced by beech forests in Germany, Slovakia, etc). The total standing and lying deadwood volume in European forests is 11.5 metres³ hectares⁻¹, on average. The amount of deadwood varies from eight to 20 metres³ hectares⁻¹ in North and Central-West Europe, respectively. During the last 20-year period, the amount of deadwood in forests has continuously increased. According to the SoEF report, this has been a consequence of the increasing interest in biodiversity conservation in silvicultural practices and forest policies [3], which have been recently targeted towards favouring nature-oriented forest management and leaving deadwood on the harvesting site. According to both scientific and expert knowledge, another additional cause might be the fact that many forest areas in Europe are not actively managed (e.g., for timber production) due to changing the socio-economic objectives and lifestyles of private forest owners [16,17], although the quantification of its effect has not been studied yet.

Threatened forest species reflects the number of threatened forest species, classified and listed by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, in relation to the total number of forest species. The IUCN Red List of Threatened Species has been widely applied at country level to map the living conditions of species. A species is listed as threatened if it falls within one of the following categories: critically endangered, endangered, vulnerable. The requested information includes the number and interrelationships of threatened forest-related species, such as forest trees, birds, mammals, other vertebrates, invertebrates, vascular plants and cryptogams, and fungi. The collection of data for different species groups is a highly demanding and time-consuming task. Nevertheless, the number of reporting countries has slightly increased in 2015 compared to the past, even if the information is still lacking in countries in South-East, South-West and Central-East Europe. The data coverage is more extensive for threatened forest-occurring tree species, followed by mammals, birds and vascular plants. Data for the threatened forest-occurring tree species was reported by 28 out of 44 countries. However, the data is still heterogeneous and fragmented. Fourteen European countries have monitored the whole organisms' set of threatened forest-occurring species in their forest area [3]. The highest total number of threatened species is reported for fungi, vascular plants and other invertebrates, with 11, two and three countries having more than 500 threatened species, respectively. The number of extinct tree species, according to the 2015 SoEF report, is three in the EU-28 and four in Europe (two in Belgium; one each in Albania and Hungary). The highest total number of extinct species is reported for fungi (314), other invertebrates (150) and vascular plants (63). The reporting situation has improved in Europe and EU-28 with more countries providing information in 2015.

Protected forest areas. In the European context, protected forest areas are often located in fragmented landscapes, and in areas characterised by a heterogeneous forest ownership structure. They are protected through various management options and regimes. According to the 2015 SoEF report, the protected forests for biodiversity and landscape conservation cover 47.2 million hectares (19.4% of the total forest area), and are managed by the following approaches: "No active intervention" (1.5%), "Minimum intervention" (3.1%), "Conservation management" (7.6%), and "Landscape protection" (7.2%) [3]. According to the IUCN classification scheme, the minimum size of a single protected

area is often in the 1,000–2,000 hectares range. In Europe, the minimum size of protected forest areas is often smaller, typically between 30 and 1,000 hectares. The largest forest areas protected for biodiversity are located in Spain, Italy, Finland, and Sweden [3]. Sizeable areas under “no active intervention” over 100,000 hectares are also found in Italy, Estonia, Sweden and Belarus. The largest areas managed through minimum interventions are located in Italy, Sweden, Spain and Norway. Large areas under active conservation management can be found in Italy, Belarus, Finland and Portugal. A clear increase in the area of forests protected for biodiversity and landscape was observed in Europe during the last 15 years (500,000 hectares annually). This trend may be explained by an increase in forest area under active biodiversity conservation (e.g., Natura 2000 network area), more awareness by Member States about the effective implementation of biodiversity conservation policies and, in most cases, the implementation of multi-functional or close-to-nature forest management [3].

Forest biodiversity monitoring according to the Natura 2000 process

Short overview of data sources and assessment tools (criteria and indicators)

The EU's Birds and Habitats Directives aim to ensure that species and habitats are maintained and restored in order to attain a favourable conservation status throughout their natural range in the EU-28, within and beyond the Natura 2000 network. The network was established with the primary purpose of preserving particular species and habitats in Europe. The Natura 2000 network encompasses 27,312 sites designated under the EU's Habitats (Council Directive 92/43/EEC) and Birds Directives (Directive 2009/147/EC), and covers 18.1 % of the EU's land area [4]. The sites refer to Special Protection Areas (SPAs) for the conservation of wild birds and their habitats as well as Special Areas of Conservation (SACs) targeting the protection of rare, representative and common natural habitats, and threatened animal and plant species, all considered from a European scale (EU-28). Natura 2000 includes public and privately owned lands, as well as both strictly protected nature reserves and protected areas where human activities are allowed. The Natura 2000 integrative approach to the conservation of nature is largely centered on people working together with nature, avoiding or reducing disturbance to the habitats and species for which the sites are designated. Human activities and land use can play a crucial role in maintaining habitats that are positively conserved, and restoring habitats that are degraded.

According to recent estimates [18], approximately 37.5 million hectares of forests in the EU-28 are included in the Natura 2000 network, representing around 50% of the total area in Natura 2000, and more than 20% [19] of the total forest area in the EU-28. The area of forests under Natura 2000 comes with significant differences between countries and bio-geographical regions, ranging from 4% (41,000 hectares in total) in Ireland to 68% (751,000 hectares in total) in the Czech Republic. The overall high percentage of forests in Natura 2000 reflects not only the wide distribution of forests across Europe (around 30% of the land cover in the EU-28) but also their overall importance for biodiversity.

Many forests in Natura 2000 are seen as valuable for biodiversity conservation because they host rare and threatened species and habitat types, along with typical species of various forest habitat types that also need to be protected. Other forests designated as Natura 2000 sites have a high biodiversity value because they possess structures and functions similar to primary forests (old-growth forests) and/or they have been subject to little, if any, human intervention. Some of the largest areas of such old-growth forests can be found in the boreal and continental regions [19].

As required by Articles 11 and 17 of the Habitats Directive, the 28 Member States of the European Union are committed to monitor the conservation status of the habitats and species present on their respective territories that are listed in the Annexes of the Directive. Annex I and Annex II provide the list of natural habitat types as well as animal and plant species to be proposed and designated by the Member States as Special Areas of Conservation. Annex IV lists those habitats and species that must be strictly protected, and Annex V indicates those animal and plant species whose exploitation may be subject to management measures. Annex I of the Birds Directive lists wild bird species and their habitats in need of protection. Article 17 requires Member States to report to the European Commission every six years, following an agreed format, and to make the reports accessible to the public⁴. The European Commission, in association with the European Environment Agency, has developed a publicly available Natura 2000 database and interactive maps, which can support the exploration of Natura 2000 sites across Europe⁵.

The most important criterion for assessing the state of and trends in biodiversity conservation within the Natura 2000 network is the maintenance of habitats and species in a Favourable Conservation Status (FCS), which is explained in Article 1 of the Habitats Directive. The term “conservation status” was also used by the former Natura 2000 Standard Data Form for describing the condition of each habitat type and species present on an individual site by using classes A (excellent), B (good) and C (average or reduced). For reporting purposes under Article 17, “conservation status” is assessed across the whole of a bio-geographical region within a member state⁶. The “conservation status” is correlated with the IUCN Red List of Threatened Species. It is an expression of the relative risk of extinction of a habitat or a species, in relation to the population dynamics of species, and trends in the range of species and habitats. Assessing and reporting on FCS are important to monitor the conservation status of habitat types and species, and evaluate trends in nature conservation efforts across Europe.

National reporting under Article 17 of the Habitats Directive comprises (i) general information about the implementation of the Habitats Directive; (ii) assessments of conservation status of species; and (iii) assessments of conservation status of habitats. The conservation status is assessed based on the status and trends in key parameters (see Box 1). For species, these parameters include *natural range*, *population dynamics*, *suitable habitat* and *future prospects*. For habitats, these parameters include *natural range*, *area*, *structure and functions*, *typical species* and *future prospects* [20] (Box 1).

Range, population (species), and area (habitat types) all require threshold values to be set to determine and assess whether the parameter is favourable or unfavourable. These are referred to as Favourable Reference Values (FRV). They should be based on scientific (ecological) grounds only, and may change between reporting cycles as the understanding of a habitat type or species changes. Where scientific data is insufficient, the Member States are encouraged to use expert knowledge and expert opinions, e.g., to weigh and then evaluate the individual parameters, which targeted value should be set to assess the conservation status⁷. Data for each of the key parameters is collected

4 http://bd.eionet.europa.eu/activities/Reporting/Article_17

5 http://ec.europa.eu/environment/nature/natura2000/data/index_en.htm

6 <https://circabc.europa.eu/sd/a/2c12cea2-f827-4bdb-bb56-3731c9fd8b40/Art17%20-%20Guidelines-final.pdf>

7 <https://circabc.europa.eu/sd/a/2c12cea2-f827-4bdb-bb56-3731c9fd8b40/Art17%20-%20Guidelines-final.pdf>

Box 1. Parameters and definitions for the reporting under Articles 17 of the EU Habitats Directive.

Habitat

- **Natural range:** the outer limits of the overall area in which a habitat is found (an envelope containing areas that are actually occupied, since often not all the range is actually occupied).
- **Area covered by habitat type within range:** assessed using an estimate of the surface area covered by the habitat, information on the trends in the area and rate of change since 1994, and with reference to the “favourable reference area”.
- **Specific structures and functions** (*including typical species*): which are necessary for its long-term maintenance and are likely to continue to exist for the foreseeable future.
- **Future prospects** (*as regards range, area covered and specific structures and functions*): assessment of the conservation measures already in place, the potential future threats to the habitat, and an analysis of the possible future habitat condition based on the same Common Standards Monitoring data used to assess structures and functions.

Species

- **Range:** a measure of the geographical limits of the species distribution, informed by an estimate of current surface area (and data quality), trends in surface area, and the “favourable reference range”.
- **Population:** status assessment includes a current population estimate (taking account of data quality and methods used), population trends, and consideration of a “favourable reference population” value.
- **Suitable habitat:** area thought suitable for the species, both currently occupied and currently unoccupied but suitable (km²).
- **Future prospects:** related to significance of pressure and threats for long-term (no clear definition as to the timescale) survival prospect.

by Member States and reported to the European Commission in a standardised way for each bio-geographical region. They are subsequently subject to a common assessment procedure. According to the guidance documents of the European Commission, conservation status represents “the distance from a defined favourable state” rather than from extinction as defined by the IUCN. Habitats are thus classified as (i) Favourable (“FV”); (ii) Unfavourable-Inadequate (“U1”); and (iii) Unfavourable-Bad (“U2”). In this way, the overall conservation status is considered “favourable” when all thresholds are met, although allowing for one unknown; it is considered “unfavourable – bad” when one or more variable is below the threshold; and “unfavourable – inadequate” when the state of habitats or species is in any other combination (e.g., two “favourable”, one “unknown”, one “unfavourable – inadequate”).

Several, albeit not all, EU countries assess the conservation status in forest habitats and species from existing forest monitoring and inventory on forest biodiversity. The national forest inventories (NFIs) are the most comprehensive and representative sources of information on forest resources. The majority of European NFIs can contribute partly or completely to forest biodiversity assessments [21]. Some countries have developed

Box 2. Assessing the conservation status of forest-related habitats and species in Natura 2000 network: the case of Austria.

The Austrian assessment of structures and functions for woodland habitat types in the 2001-2006 Article 17 reporting procedure was based on the Austrian National Forest Inventory, which provides a large set of parameters for more than 11,000 permanent plots. Data for the tree species composition, forest stand age, deadwood amount and timber harvesting intensity were used to assess the local (site) conservation status ('degree of conservation' in the revised Standard Data Form; SDF) for structures and functions using SDF for conservation status (A, B, C). Thresholds for the assessment of the parameter were set as follows: Favourable Conservation Status (FV) was considered to be reached if more than 30% of the habitats and species are in a good condition (A); unfavourable-inadequate conservation status (U1) according to any other combinations; and unfavourable-bad conservation status (U2) if more than 70% of the habitats and species are in bad conditions (C). For example, the *Asperulo-Fagetum* beech forest (Habitat code: 9130) in the Alpine region of Austria is represented by 944 NFI plots. The proportion of the local conservation status is 33 % C, 59 % B and 8 % A. FCS of this forest type is thus considered unfavourable-inadequate (U1).

an indicator-based assessment of the conservation status of habitats and species at local scale (Natura 2000 site level), such as Austria (Box 2). However, Natura 2000 forest habitat types and forest-related species, as well as the amount of deadwood, were found to be ecological indicators about which little information from NFIs was provided in a variety of European countries.

Key facts and assessment results on the favourable conservation status of habitats and species under Article 17 of the EU's Habitats Directive

Annex I of the Habitats Directive lists 81 forest habitat types (Table 2) and four other habitat types dominated by woody vegetation, and two types of "wooded dunes", such as the wooded dunes with *Pinus pinea* and/or *Pinus pinaster* (Habitat code: 2180), and two types of wooded meadows.

Table 2. Number of forest habitat types according to Annex 1 of the EU Habitats Directive.

Forests of boreal Europe	8 types
Forests of temperate Europe	37 types
Mediterranean deciduous forests	13 types
Mediterranean sclerophyllous forests	10 types
Temperate mountain coniferous forests	3 types
Mediterranean and Macaronesian mountain coniferous forests	10 types

The 10 most common Annex I forest habitat types are summarised in Table 3. In total, these forest habitats cover 11% of the area of forest and OWL in the EU-25⁸ and almost 67% of the total Annex I forest habitats' area. The Western taiga forest habitat type is the dominant one (3.6 million hectares), followed by the *Asperulo-Fagetum* beech forests (2.6 million hectares).

Table 3. The 10 most common forest habitat types, their surface coverage (1,000 hectares), percentage out of forest and OWL, number of favourable conservation status assessments out of all assessments.

Forest Habitat Code	Forest habitat description	Coverage (1,000 ha)	Area (%) of Forest and OWL	No. FCS (out of all assessments)
9010	Western taiga	3,555.4	2.1	2(8)
9130	<i>Asperulo-Fagetum</i> beech forests	2,558.1	1.5	12(26)
9340	<i>Quercus ilex</i> and <i>Quercus rotundifolia</i> forests	2,146.8	1.3	5(8)
91D0	Bog woodland	2,038.9	1.2	8(30)
9110	<i>Luzulo-Fagetum</i> beech forests	1,740.2	1.0	13(27)
9040	Nordic subalpine/subarctic forests with <i>Betula pubescens</i> ssp. <i>czerepanovii</i>	1,595	1.0	1(3)
91M0	Pannonian-Balkan turkey oak –sessile oak forests	1,561.8	0.9	1(4)
9540	Mediterranean pine forests with endemic Mesogean pines	1,550.4	0.9	2(7)
9230	Galicio-Portuguese oak woods with <i>Quercus robur</i> and <i>Quercus pyrenaica</i>	920.1	0.6	0(1)
91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>)	884.2	0.5	7(41)

The coverage of the Annex I-related forest habitat types in EU-25 was about 19% of the EU-25 forest area (27.4 million hectares out of 147 million hectares of forests in the EU-25), and mostly located in the Mediterranean (32%), boreal (23%), and alpine (20%) bio-geographical regions (8.8, 6.3 and 5.6 million hectares, respectively). The percentage of Annex I forest habitat types varies greatly among the EU-25, from 1% to 57% of the forest area and OWL. According to the Article 17 reports, the conservation status of 54% of the European forests included in Natura 2000 is evaluated as “unfavourable-inadequate”, 26% as “unfavourable-bad”, 15% as “favourable”, while the status of 5% is “unknown” [19]. The biodiversity conservation trend is “unfavourable-deteriorating” in more than 25% of forests included in Natura 2000; 40% is assessed as “unfavourable-stable”, while only 15% presents a “favourable-stable” conservation trend. Less than 5% of the European forests included in Natura 2000 show an “unfavourable-improving” trend, while the trend in biodiversity conservation is “unknown” for the remaining percentage. Most “favourable” assessments are found in the Alpine and Mediterranean regions, while most “unfavourable-bad” are in the Continental region (Figure 1).

The reporting procedure under Article 17 pertains to the assessment of the conservation status of all habitat types and species listed in the annexes of the Habitats Directive for the whole territory of the Member States. The selection of habitats is based on assessing their potential risk of disappearance, natural range, or representativeness of one or more of Europe's bio-geographical regions. The habitats, animal and plant species

⁸ Bulgaria and Romania did not report, and Croatia was not part of the EU in 2012.

that are listed in the Habitats Directive's annexes are protected in distinct ways, such as the designation of Site of Community Importance of core areas for specific species of Habitats Directive, or applying strict protection regimes across their entire natural range⁹. More than 17,000 datasets on individual species and habitats have been collated to assess the status of 450 wild bird species, 233 habitat types and more than 1,200 other rare, threatened or endemic species of wild animals and plants of European importance. About 2,000 vulnerable species and habitats are found in Europe [4].

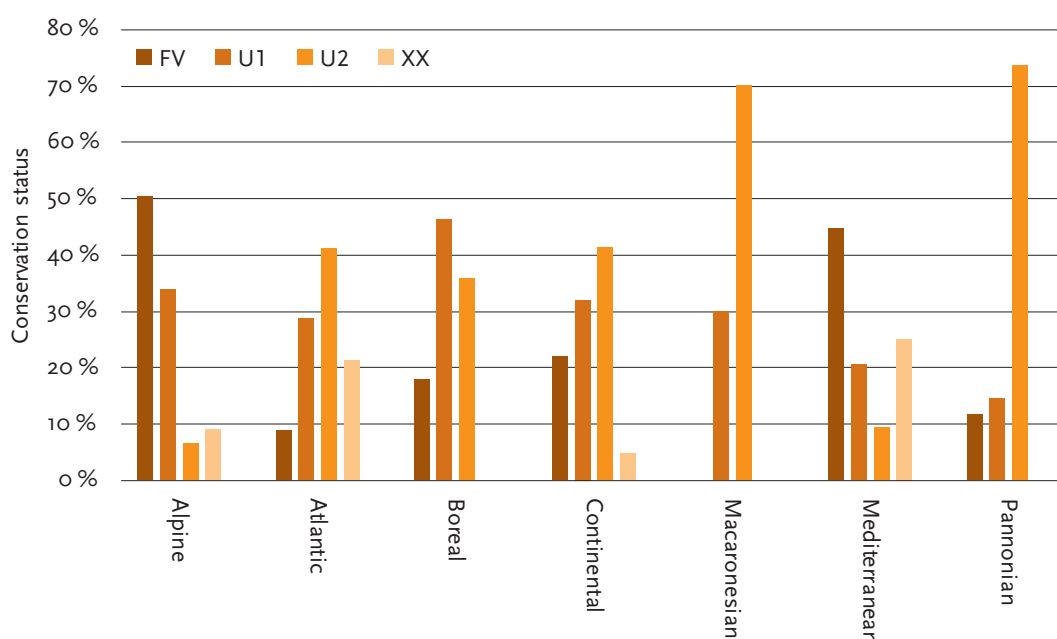


Figure 1: Conservation status assessed per bio-geographical region (2007-2012). Favourable “FV”, Unfavourable-Inadequate “U1”, Unfavourable-Bad “U2”, Unknown “XX”.

⁹ http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

Comparative assessment and overall conclusions

What do we know about the state of biodiversity in Europe's forest ecosystems?

The FOREST EUROPE process highlights that forest management is moving towards more sustainable and multipurpose targets. It finds that over the last two decades:

- Forest management practices are moving towards a more holistic/ecosystem-based approach.
- Forest naturalness increased and less than 5% of European forests is dominated by introduced tree species.
- The amount of deadwood in forests increased.
- The area for conservation of genetic resources increased from 1990 to 2015.
- Connectivity of forest habitats remained stable or reduced, while forests in core natural landscape pattern increased over the 2000–2012 period.
- Knowledge about threatened forest species improved (in comparison with Natura 2000 – IUCN, SEBI indicators).
- The area of forest in Europe designated for biodiversity and landscape protection increased by half a million hectares, annually.

On the other hand, the assessment of the conservation status of biodiversity in forest ecosystems under the Natura 2000 process (Article 17 Habitats Directive; Article 12 Birds Directive) depicts a more critical picture [19]. The information on the status and trends of forest habitats and species shows that [4]:

- Forests have been significantly modified over the last centuries, even if they represent one of the managed ecosystems in Europe with the highest degree of biodiversity.
- A majority of forest habitats and species remain in unfavourable conservation status.
- The conservation status of forest habitats and species critically depends on forestry operations that play a role as either major threats or enabling factors.
- Forests undisturbed by human activities occupy a rather limited area.
- The lack of information about the conservation status of forest habitats is still significant, especially in the Mediterranean bio-geographical region.

How do these processes compare to each other?

The study finds that *FOREST EUROPE* and *Natura 2000* represent the two most policy-relevant processes to monitor forest biodiversity in Europe. They contain information that supports policy actors and stakeholders in making decisions about forest biodiversity as part

of sustainable forest management or the maintenance and restoration of the conservation status of forest habitats and species. They are also used to guide forestry and nature protection policies towards the fulfilment of European and international commitments to halt the loss of biological diversity.

However, there are *important differences between both processes regarding their forest biodiversity assessments*. FOREST EUROPE reporting finds that *forest management contributes to the maintenance and improvement of biodiversity in forest ecosystems in Europe* (pan-Europe, including EU-28). In contrast, according to Natura 2000 monitoring, a significant part of *forest biodiversity in Europe (EU-28) is not improving and still threatened by forestry and land use, and climate change*.

How is forest biodiversity monitored in different processes in Europe?

FOREST EUROPE and Natura 2000 reporting systems differ in some important aspects in relation to the assessment and monitoring of forest biodiversity conservation (Table 4). The main differences refer to (i) targets, scales and units of analysis; (ii) key concepts and definitions including knowledge production and disciplinary traditions; (iii) the assessment frameworks (C&I, thresholds); (iv) data sources and methods for analysis; and (v) the legal framework, policy objectives and governance contexts.

The FOREST EUROPE reporting process applies forest-focused indicators (both qualitative and quantitative) to assess the biodiversity aspects of all forest ecosystems. This process considers biodiversity conservation mainly from the point of view of forest structures, forest management and forestry targets, predominantly through forest biodiversity-related quantitative indicators. In contrast, the NATURA 2000 process mainly uses ecological assessment of conservation status of individual and/or types of forest habitats and species (animals, birds, plants) within and outside the designated sites. It also includes the current and future ecological and human threats (such as forestry, land use, climate change) to forest habitats and species. The holistic assessment under the NATURA 2000 process hence offers a more comprehensive evaluation of conservation status from a biological conservation point of view.

Beyond these differences, both processes have in common that their assessments of biodiversity of forest ecosystems remain currently underdeveloped as regards some key parameters. For example, the biodiversity of soil and related elements (e.g. fertility, living organisms, soil organic matter) as well as the tree-related microhabitats are scarcely considered in both processes.

Table 5 further summarises the main strengths and weaknesses of both forest biodiversity monitoring processes as well as their differences and commonalities in more detail.

The FOREST EUROPE reporting process applies forest-focused indicators (both qualitative and quantitative) to assess the biodiversity aspects of all forest ecosystems. This process considers biodiversity conservation mainly from the point of view of forest structures, forest management and forestry targets, mainly through forest biodiversity-related quantitative indicators. In contrast, the NATURA 2000 process mainly uses ecological assessment of the conservation status of individual and/or types of forest habitats and species (animals, birds, plants) within and outside the designated sites. It also includes the current and future ecological and human threats (e.g., forestry, land use, climate change) to forest habitats and species. The holistic assessment under the NATURA 2000 process hence offers a more comprehensive evaluation of conservation status from a biological conservation point of view.

Table 4. Comparison between FOREST EUROPE process and Natura 2000 (Article 17 of the Habitats Directive) for monitoring the state of and trends in biodiversity conservation in Europe's forests.

Evaluation categories	FOREST EUROPE process	Natura 2000 process (Article 17 – Habitats Directive)
Scope and objectives of monitoring	Monitoring, assessing and reporting on state of and trends in Europe's forests and on sustainable forest management, including aspects of forest biodiversity.	Monitoring, assessing and reporting on biodiversity conservation through conservation status of habitats and species.
Legal framework	Not legally binding – voluntary high-level political process for dialogue and cooperation on sustainable forest management in Europe.	Legally binding – Article 17 of Habitats Directive and Article 12 of Birds Directive require EU Member States to present country reports and the European Commission to present a consolidated EU report (EU-28) based on the national reports.
Geographical representativeness	Country level, pan-Europe, (47 signatories including 46 European countries and the European Union). Not all indicators are available for all countries. Data also includes national forests within Natura 2000 network sites.	EU-28, bio-geographical regions, local assessments within and outside Natura 2000 sites. Forests within Natura 2000 sites cover 21% of the total forest area in the EU-28 (more than 38 million hectares).
Reporting frequency	Every four years (2003–2007–2011–2015), next reporting will be in 2019.	Every six years (2000–2007–2013), next reporting will be in 2019.
Criteria and indicators	Nine forest biodiversity-related quantitative indicators: • Tree species composition • Regeneration • Naturalness • Introduced tree species • Deadwood • Genetic resources • Landscape pattern/forest fragmentation • Threatened forest species • Protected forests One qualitative indicator (B6: Policies, institutions and instruments for biodiversity).	Parameters for forest habitats: • <i>Natural range</i> • <i>Area within range</i> • <i>Structure and functions</i> • <i>Typical species</i> • <i>Future prospects</i> Parameters for forest species: • <i>Natural range</i> • <i>Population dynamics</i> • <i>Suitable habitats</i> • <i>Future prospects</i> • Four assessment classes of (Un-) Favourable Conservation Status of forest habitats and species; • Pressures and threats for habitats and species (eg forestry, other land uses, climate change) • Number of sites (SCIs and SACs), proposed and designated • Number of sites with comprehensive management plan (adopted or under preparation)
Assessment thresholds	None. In SoEF 2011, “key parameter” (eg percentage of change over time, index of data availability) for each indicator was chosen in order to facilitate the comparison among countries. They did not refer to the threshold values of indicators. They were excluded in 2015.	Yes (see main text for more details).

Evaluation categories	FOREST EUROPE process	Natura 2000 process (Article 17 – Habitats Directive)
Types of reports, background information and data sources	State of Europe's Forests reports (including cross-country overviews of status and trends, best practice examples, output tables per country and indicator). Data from national correspondents (ministries in charge of forest) based on: • Joint FOREST EUROPE/UNECE/FAO Questionnaire on Pan-European Indicators for SFM - Quantitative Indicators. • Questionnaire on Pan-European Qualitative Indicators for SFM. • National Forest Inventories (NFIs), • Data sets from International Data Providers (eg EUFORGEN, JRC, etc) In addition to the assessments made by national correspondents, data is aggregated and analysed at pan-European/cross-country level by the advisory group, and reviewed by teams of specialists, including representatives from European countries, FOREST EUROPE, UNECE, FAO, EC and EFI.	State of Nature in the EU reports (including status of and trends in bird species as well as assessments of conservation status of bird species, habitat types and animal/plant species; pressures and threats from agriculture, forestry, other human activities, and natural processes) and national summary reports. Natura 2000 monitoring processes based on 17,000 datasets and assessments of individual species (450 wild bird species; 1,200 other species of community interest) and habitats (231 habitat types) according to four reference parameters for assessing conservation status of habitats and species conservation. The information is usually based on field data and mapping. Threshold assessments for conservation status are often based on expert judgment. Increasingly these are calibrated to results/information from NFIs or other monitoring schemes. In addition to the assessments made by member states, data is aggregated and assessed at EU bio-geographic level by the EEA and its European Topic Centre on Biological Diversity (ETC-BD).
Public consultation/experts involvement	National correspondents (usually forestry ministries), expert level meetings (eg forest and landowners' federations, forest industry, the forest scientific community, some environmental and social NGOs).	National correspondents (usually environmental ministries or agencies responsible for nature conservation). Public consultation through Article 17 web tool (available from June to July 2014).
Governance setting and relevance for policy makers and stakeholders	Assessment of sustainable forest management (including forest ecosystem health and vitality, maintenance and enhancement of protective functions and sustainable timber use).	Evaluation of the state of biodiversity conservation in view of current and future pressures and threats from land uses (eg agriculture, forestry) and other impacts (eg climate change) across bio-geographical regions in the EU.
Main academic disciplines through which assessment tools are designed and data is collected and interpreted	Forest sciences: silviculture, forest growth, forest ecology, forest protection, forest management planning, forest economics, forest policy, etc.	Conservation biology, ecosystem ecology, landscape ecology, biogeography, botany, population biology, zoology, etc.
Main policy paradigm that guides data collection, assessments and reporting	Forests are viewed as valuable managed ecosystems to protect and to use actively as renewable natural resources providing multiple products and services to the society in a sustainable way. Biodiversity conservation through sustainable forest management and active forestry ("protection through use"). Groups of greatest concern: forest resources and ecosystem goods and services (including flora, fauna and soil), forest sector (forest owners, forest enterprises, forest industries) and the multiple needs of society (of both ecosystem services and goods).	Forests are viewed as natural ecosystems that require mainly conservation and restoration, but also sustainable and extensive management. Biodiversity conservation through natural processes, protection and positive conservation management ("working with nature"). Groups of greatest concern: all living organisms, plants, animals, needs of pluralistic and ecologically minded society.

Table 5. Strengths and weaknesses of FOREST EUROPE and Natura 2000 monitoring processes.

	FOREST EUROPE process	NATURA 2000 process
Strengths	• Directly linked to forest biodiversity aspects. • Robustness of quantitative information (hard data). • In some cases, availability of qualitative information (forest policy goals and instruments). • Allow forest biodiversity comparison among European countries. • Available trends of the forest biodiversity key variables. • Available information on current forest management sustainability (forest management intensity, fragmentation). • Communication with other sectors.	• Ecological evaluation of the current status and future prospects of forest biodiversity. • Evaluation of external disturbances/pressures and threats on forest biodiversity. • Wider applicability: – Not only focused on forests, but also on other land uses. – Consideration of the overall connection and interplay of habitats, plants and animals, and ecosystems (including forests). – Biodiversity evaluation within and outside Natura 2000 network of protected areas. • Legally binding requirements; standardised data assessment and reporting formats. • Allow comparison of FCS of habitats and species with similar characteristics (bio-geographical level) among member states. • Provision of maps (ESRI format), if available. • Open to public consultation.
Weaknesses	• Absence of conservation status assessment. • In some cases, lack of qualitative (forest policy goals and instruments) information • Lack of some forest biodiversity-related information, such as soil microhabitats, birds. • Lack of information for some indicators on OWLs. • Protected forest area is assessed on formal statutes but not on actual forest management practices. • No assessments of trade-offs between biodiversity and other ecosystem goods and services (eg timber production, recreation). • No clear-cut (ecological) thresholds to assess status of forest biodiversity. • Incomplete information / missing reports due to voluntary nature of reporting. • Partly non-standardised / harmonised data collection on forest biodiversity across the signatories.	• An aggregation of data submitted by member states can mean that many positive developments achieved on a local, regional or even national level may no longer be visible on the larger EU scale. • Partly restrictive expert judgments on FCS. • Dynamism of FCS evaluation, depending on the change of the environmental threats. • Mandatory information missing due to insufficient knowledge, mainly about species reported as marginal, occasional, newly arriving, regionally extinct before the Habitats Directive came into force and introduced species are excluded from evaluation. • Although the reporting format is standardised, the information required for FCS evaluation at national level can draw from different methodological approaches. • No holistic assessment of the trade-offs between biodiversity and other ecosystem goods and services (eg timber production, recreation): existing trade-off assessments are made from a biodiversity point of view (eg forestry often as main threat to forest biodiversity).

Beyond these differences, what both processes have in common is that their assessments of biodiversity of forest ecosystems currently remain underdeveloped for some key parameters. For example, scarcely considered in both processes are the biodiversity of soil and related elements (e.g., fertility, living organisms, soil organic matter) as well as tree-related microhabitats.

Moreover, the voluntary FOREST EUROPE process is focused on the economic, social and environmental dimensions of sustainable forest management on a country basis in Europe. The NATURA 2000 process that the European Commission and the Member States are formally committed to mainly addresses the conservation status of (forest) habitats and species in the European Union (EU-28). It also considers the current status and the future prospects of habitat types and species. Hence, biodiversity aspects are strongly considered under the NATURA 2000 process.

The main sources of information to monitor and assess forest biodiversity are the NFIs, the IUCN Red List of Threatened Species (including Red Lists at national and local scales), and specific forest habitat and species mapping/assessments. Several countries undertake inventories in five to 10-year cycles. It depends on the importance of the forest sector, and the availability of funding to carry out inventories. In Southern European countries with very wide species' diversity, the detailed analyses required for the IUCN Red List of Threatened Species are difficult to implement. Only few countries, such as Finland and Sweden, carried out these analyses twice in 10-year intervals. Data was also collected from country statistics at country and European level (e.g., EUROSTAT, EEA).

An important critical aspect in both processes is the lack of data. On the one hand, not all countries within FOREST EUROPE possess data about all forest biodiversity indicators. On the other hand, 5% of forest habitat types is conservation status "unknown" in the NATURA 2000 process.

Generally, the quality of data and assessments depends on the knowledge of country correspondents. This in turn increases uncertainty about the estimates and cross-country comparability. Without clear and/or generally agreed assessment tools and thresholds, interpreted data can reflect specific experts' and decision-makers' beliefs, knowledge and policy goals. However, expert judgment is important to detect variations across scales, habitats and bio-geographic regions, especially when forest biodiversity changes over time together with changes in society and ecology. The quality, validity and reliability of information could be further improved in both processes, especially if data is collected and analysed through a mix of data sources (e.g., NFIs, habitat/species mapping and surveys) and data interpretation methods (e.g., interdisciplinary expert panels, qualitative and quantitative assessments).

References

1. Parviainen, J., Frank, G., 2003. Protected forests in Europe approaches-harmonising the definitions for international comparison and forest policy making. *J. Environ. Manage.*, 67, 27–36, doi:10.1016/S0301-4797(02)00185-8.
2. Recanatesi, F., et al, 2016. A Fifty-Year Sustainability Assessment of Italian Agro-Forest Districts. *Sustainability*, 8.
3. FOREST EUROPE, 2015. State of Europe's Forests 2015. Madrid: Spain.
4. EEA, 2015. State of nature in the EU. Results from reporting under the nature directives 2007–2012.
5. MCPFE, 2003. Improved Pan-European Indicators for Sustainable Forest Management. Vienna, Austria.
6. Baycheva, T., Inhaizer, H., Lier, M., Prins, K., Wolfslehner, B., 2013. Implementing Criteria and Indicators for Sustainable Forest Management in Europe.
7. Barbati, A., Corona, P., Marchetti, M., 2007. A forest typology for monitoring sustainable forest management: the case of European forest types. *Plant Biosyst.*, 141, 93–103.
8. McRoberts, R.E., Winter, S., Chirici, G., LaPoint, E., 2012. Assessing forest naturalness. *For. Sci.*, 58, 294–309.
9. Bastrup-Birk, A., Marchetti, M., 2014. Developing a forest naturalness indicator for Europe.
10. Barbati, A. et al, 2014. European Forest Types and Forest Europe SFM indicators: Tools for monitoring progress on forest biodiversity conservation. *For. Ecol. Manage.*, 321, 145–157. doi:10.1016/j.foreco.2013.07.004.
11. Wilson, M.C. et al, 2016. Habitat fragmentation and biodiversity conservation: key findings and future challenges. *Landsc. Ecol.*, 31, 219–227, doi:10.1007/s10980-015-0312-3.
12. Christensen, M. et al, 2005. Dead wood in European beech (*Fagus sylvatica*) forest reserves. *For. Ecol. Manage.*, 210, 267–282.

13. Travaglini, D. et al, 2007. ForestBIOTA data on deadwood monitoring in Europe. *Plant Biosyst.*, 141, 222–230.
14. Lombardi, F. et al, 2008. Tree rings used to assess time since death of deadwood of different decay classes in beech and silver fir forests in the central Apennines (Molise, Italy). *Can. J. For. Res.*, 38, 821–833.
15. Lombardi, F. et al, 2013. Investigating biochemical processes to assess deadwood decay of beech and silver fir in Mediterranean mountain forests. *Ann. For. Sci.*, 70, 101–111.
16. Duncker, P. S. et al, 2012. Classification of Forest Management Approaches: A New Conceptual Framework and Its Applicability to European Forestry. *Ecol. Soc.*, 17, doi:10.5751/ES-05262-170451.
17. Duncker, P. S. et al, 2012. How forest management affects ecosystem services, including timber production and economic return: Synergies and trade-offs. *Ecol. Soc.*, 17, doi:10.5751/ES-05066-170450.
18. ForestEurope, UNECE, FAO, 2011. State of Europe's Forests 2011. Status and Trends in Sustainable Forest Management in Europe.
19. EEA, 2016. European forest ecosystems. State and trends. Luxembourg: Publications Office of the European Union.
20. EUROPEAN COMMISSION, 2015. The State of Nature in the European Union 2015.
21. Tomppo, E., Gschwantner, T., Lawrence, M., McRoberts, R. E., 2010. National Forest Inventories. Pathways for Common Reporting. Springer: Netherlands.

Implementation of Natura 2000 in forests

Lead authors: Gerhard Weiss and Metodi Sotirov

Contributing author: Zuzana Sarvašová

In the European Union, directives are binding with respect to the results to be achieved but leave the details of implementation to the Member States. Hence, the EU's Habitats and Birds Directives had to be translated into national laws (*transposition*) and implemented by the Member States (*enforcement*). Accordingly, Natura 2000 rules were implemented in two major subsequent stages: (i) the identification and designation of Natura 2000 sites; and (ii) the implementation of a management regime for the Natura 2000 sites as well as habitats and species (e.g., management plans, funding schemes, administrative rules). Within Natura 2000, different types of ecosystems and land uses - such as agricultural lands, forest or water ecosystems - are distinguished in relation to specific conservation goals but the procedures are the same for any type. The Natura 2000 implementation in forests is therefore largely part of the general policy implementation process. This explains why most policy and social science studies do not distinguish between different ecosystem or land use types. However, a few forest-specific studies do exist. This chapter therefore relies largely on studies on Natura 2000 implementation in general but - as far as differences do exist compared to forest specific studies - they are highlighted in the text. On the basis of a comprehensive literature review, this chapter summarises the Natura 2000 policy process at the EU level, describes the transposition and enforcement at national level and analyses the main implementation challenges of Natura 2000 in forests.

Natura 2000 policy formulation and implementation at the EU level

Knowing the history of how the EU's Habitats Directive was made is important for understanding the different ways it has been implemented domestically and challenges connected to that. This is because the formulation of the Directive had formative impacts on the design and mechanisms of the Natura 2000 policy. Although the implementation is largely the responsibility of the Member States, the EU policy level has remained influential throughout the implementation process by providing guidance and funding while exercising supervision. While the Natura 2000 policy rests on the EU's Birds Directive from 1979, its core design was established with the formulation of the EU's Habitats Directive, which was adopted in 1992. *The formulation and adoption of the EU's Habitats Directive was enabled by a supportive window of opportunity triggered by a "green mood" of European policy-makers and growing environmentalism at the peak of the global policy discourse on sustainable development.* The United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 and the establishment of the global Convention on Biological Diversity (CBD) in the same time period proved to be key enabling contexts.

Environmental NGOs and conservation biology scientists, working together with a few senior EU and Member States policy officials, shaped the ecological science-based rationale and wording of the Habitats Directive [1, 2, 3, 4, 5, 6]. Environmental groups gained the opportunity to influence the Natura 2000 policy, not only in its formulation but also in the implementation process, through direct connections to the European Commission Directorate-General for Environment (DG Environment). By 1991 several environmental NGOs (such as WWF, Bird Life, Friends of the Earth) had created the European Habitat Forum (EHF) as an alliance to pursue nature conservation and landscape management values and interests. In 1993, the EHF made an agreement with DG Environment that allowed for their involvement as an expert group in the work of the Habitats Committee. This Habitats Committee is composed of state officials representing all EU Member States and chaired by DG Environment. It was set up to assist DG Environment in steering and monitoring the domestic implementation of the Habitats Directive. Only later did European forest owners' and hunters' associations form an alliance called the Users' Forum Natura 2000. In contrast to the EHF, the Users' Forum was not given access to the meetings of the Habitats Committee and/or the bio-geographical seminars [1, 2].

Transnational regional seminars and professional forums at the level of bio-geographic regions were held for the identification, assessment, nomination, selection, and listing of candidate Natura 2000 sites (known also as proposed Sites of Community Interest, pSCI). At these decision-making venues, the national nomination lists of pSCI were negotiated and agreed between the Member States and the European Commission. The European Topic Centre on Nature Conservation (ETC-NC) of the European Environment Agency and the EHF provided substantial technical input to the decision making at the bio-geographical seminars [2].

Through the EHF, the large European environmental NGOs were able to bypass national authorities and provide comprehensive ecological data and knowledge on habitats and species (shadow lists) to the European Commission. They forwarded their shadow lists and propositions to DG Environment, when they believed Member States were failing, delaying or approaching inappropriately the establishment of Natura 2000 sites. The European Commission used these information sources as an important means to cross-check the sufficiency of the national lists of pSCI. This information often disclosed substantial implementation delays, failures and deficits in several Member States that triggered administrative and legal interventions by the European Commission and the European Court of Justice (ECJ) [1, 2, 7, 8]. The European Commission initiated infringement procedures that were (re-)enforced by rulings of the ECJ. The ECJ repeatedly overthrew national legal transpositions on the grounds that domestic law was not in line with the EU Nature Directives.

At the same time, the often top-down and science-driven approach towards the designation of Natura 2000 sites, along with lack of communication in the Member States, caused strong resistance from affected landowners and authorities [1, 5]. Underlying interest and value conflicts were often not openly discussed and the question of financial compensation was tackled only later in the implementation process. As a result, the process of domestic implementation of Natura 2000 very often became a complex and lengthy undertaking and one subject to increasing political controversies.

As shown in more detail below, *domestic strategies to manage these conflicts in practice led to a readjustment of the biological conservation science-driven implementation strategy of Natura 2000 towards a more flexible path taking on board local groups and land users (such as farmers, foresters, hunters)*. This was also ultimately mirrored at the EU level: new guidelines from the first decade of the 2000s were much more strongly oriented towards sustainable development where the biodiversity discourse is oriented at balancing ecological and economic goals [6, 9]. More recent policy documents relating to the EU's Habitats Directive even place an emphasis on the economic benefits of biodiversity conservation and the provision of multiple ecosystem goods and services for economy and society.

Natura 2000 policy implementation in forests at the national level

3.2.1 Overview of the literature

There is a growing body of literature on the process of Natura 2000 policy implementation in various Member States and across different policy levels. This literature seldom provides a European overview or comparative analysis, and rarely puts a specific focus on particular land uses and/or ecosystem types, such as forests. Those studies that do look specifically at forests reveal a number of different aspects such as background to the existence of previously protected areas for forests, the precise institutional arrangements for sustainable forest management and conservation, or the specific situation of long development phases in forests. There is a patchwork of local and national case studies that have resulted in findings related to the implementation process of Natura 2000¹⁰.

The literature review presented in this chapter provides information on many EU countries, although no comprehensive overview of the state of implementation across all 28 Member States can be done based on the review of this available literature. More detailed studies exist for a number of EU Member States than for others. Hence, in this chapter we aim to distill some of the common features and cross-country patterns of the implementation process. We found both commonalities and differences in national implementation processes.

To some extent, the existing scientific studies mirror the implementation phases of the Natura 2000 policy over time. Most scientific articles to date have analysed the implementation issues that have arisen in the national transposition and establishment of Natura 2000, including implementation challenges and conflicts [7, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33]. A growing number of studies particularly focus on the implementation processes in new EU Member States in Eastern and South-Eastern Europe [21, 26, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45]. Growing attention is given to issues around public participation and stakeholder involvement [37, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57]. Some studies deal with specific issues of legitimacy [58, 59, 60, 61] and law enforcement and governance [7, 26, 62], or with competing policy discourses [5, 63, 64, 65, 66, 67]. Other studies deal with the evaluation of effectiveness [68, 69, 70, 71, 72, 73, 74, 75] or socio-economic impacts and cost-benefit analyses [76, 77, 78, 79, 80, 81, 82].

Relatively few studies look at the (local) level of management of Natura 2000 [26, 83, 84] and/or questions of funding [43, 85, 86, 87, 88, 89, 90, 91]. Similarly, few studies have focused on cross-sectoral questions, for instance, how to adapt the Natura 2000

¹⁰ Recently, a few comparative studies have been published, among others, under the framework of the interdisciplinary research project BeFoFu, funded under the European ERA-Net Biodiversa research programme (www.biodiversa.org/82) and the INTEGRAL project, funded by the EU's Seventh Framework Programme for Research (www.integral-project.eu).

policy to climate change issues [59, 90]. Only a few larger comparative studies [27, 92] and literature reviews on the implementation of Natura 2000 exist [8, 27, 32, 93].

3.2.2 National policy transposition and establishment of the Natura 2000 network

The transposition of Natura 2000 policy into national law and the establishment of the Natura 2000 network show quite different national approaches, including the level of ambition and timeliness, and which strategies were employed. The countries may be grouped to the following patterns.

Delays occurred at different stages of the policy transposition and Natura 2000 network establishment, sometimes affected by the **complexities of political systems** in the countries, such as federalism. For example, the process of implementing the Habitats Directive in **Germany** was very slow in the initial stages. One reason was that the legal transposition at the federal state level was started only after a new federal nature conservation law for Germany was adopted in 1998 [2, 7, 9, 81]. The German federal states, which are in charge of domestic implementation, identified sufficient Natura 2000 sites only after being confronted with pressure and infringement procedures by the European Commission and the ECJ [13]. The complete list of SACs came as late as 2004. The substantial delays are explained differently in the scientific literature. Explanations include a mismatch between the top-down technocratic governance mode based on the primacy of ecological knowledge and the strong opposition from landowners and sectoral authorities in charge of land use (e.g., agriculture, forestry, water management) [62]. Another explanation is found in “administrative inertia” in that federal states were reluctant to seriously tackle the conflicts between environmental groups and landowners’ and developers’ economic interests and that stakeholder consultation and participation was often rather symbolic [13, 63]. Similarly, **Italy** faced legal action from the European Union for failing to transpose the Habitats Directive into national legislation. Environmental NGOs that criticised Italy for its insufficient implementation put pressure on the state authorities and thus proved to be an important factor for the effective establishment of the Natura 2000 network [19].

In centrally organised **France**, **delays** came about somewhat differently and were **caused by a significant policy shift**. In March 1996, an initial and very comprehensive list of Natura 2000 sites, which included private and public lands, was proposed by the environmental ministry and supported by ecologists. In reaction, private forest owners joined together with hunting associations, fishermen and farmers, and formed the opposition movement “Group 9”. The degree of conflict and the political weight of Group 9 eventually prompted the French prime minister to officially suspend all implementation activities in 1996. Rulings by the ECJ against France followed [16]. The implementation process recommenced in 1997 with a new French government and an environment minister from the Green Party. The Prefects of the regions were then asked to list “unproblematic” Natura 2000 sites, with the identification of the sites completed in 2000. The new lists of pSCI covered only about 6% of the national territory, a significant decrease compared to the original coverage proposed in 1996. In effect, the inclusion of socio-economic interests in the establishment of the Natura 2000 network allowed further implementation steps but at the cost of a reduced coverage and the new priority given to land users. Researchers have interpreted this new implementation

approach as a transformation from a conservation biology to a societal approach [16] and assigned the successful creation of a constructive collaboration to the “bottom-up participatory” approach [63]. Similarly, in **Finland**, which joined the EU in 1995, a strong resistance movement by land and forest users developed after an initial controversial top-down process. Huge local protests against Natura 2000 took place, leading to new constellations of collective action on a local level and a more participatory policy implementation approach [12, 81].

The implementation of the Habitats Directive in **Portugal** was marked by **several policy shifts**. After ignoring the EU requirements in a first phase, a “radical” approach towards nature conservation was chosen aimed at excluding all human and land use activities in Natura 2000 sites in the country. This approach changed gradually again as it could not be implemented effectively due to the opposition of land users and economic development interests [94].

In a number of other countries, implementation delays and problems arose **when countries regarded their existing nature conservation approaches as fully compatible with the EU Nature Directives’ requirements**. This strategy resulted in an inappropriate translation of Natura 2000 policy into national laws. In **the Netherlands**, national state officials believed that the Habitats Directive’s site protection regime was already fulfilled by existing Dutch nature conservation legislation and thus did not act at all. Yet, following complaints from environmental NGOs, the Netherlands faced legal and administrative sanctions by the European Union for failing to transpose the Habitats Directive into national legislation. The Dutch government sought to keep the coverage of the Natura 2000 network in the country as minimal as possible. Only after official sanctions by the European Union was the Natura 2000 site designation eventually completed at a sufficient level between 2000 and 2005 [19, 81].

In contrast, the legal transposition of the Habitats Directive in the **UK** was started **quickly and was formally achieved within the deadlines set by the Habitats Directive**. The legal transposition was achieved through the Natural Habitats Conservation Regulations in 1994 that emphasised the appropriateness of the existing nature conservation policy regime. However, the UK conservation approach was at odds with the Habitats Directive’s rationale of habitat and species protection. **This mismatch between the EU and national nature protection approaches** caused a number of ECJ rulings throughout the 2000s, related to the basic legal provisions, site designations and species protection [7, 95]. Similarly, **Greece** adopted the Natura 2000 approach mainly by building on and broadening the traditional national park system that had been in place since 1938. The national implementation of the Habitats Directive was belated and problems occurred due to the mismatch between the EU and national nature protection approaches. Further problems were caused by an **institutional mismatch** where the forest administration in charge of enforcement of nature conservation in forest areas showed little interest in biodiversity conservation [17, 20, 68].

A few examples are known where **different implementation strategies can be found within the same EU Member States that are organised in federal political systems**. For example, Natura 2000 in **Spain** was implemented in a variety of ways in the different regions [3]. Implementation was delayed in all provinces as the transposition of the Habitats Directive into national law started in 1997 and stretched until 2007 with the adoption of a new biodiversity law. Spain designated a reasonably large extent of Natura 2000 sites and experienced a relatively low level of conflict. As a result, Spain is one of the EU countries with the highest coverage of Natura 2000 areas. This is explained by

an implementation strategy to designate already existing protected areas under previous conservation regimes. Across Spain, 88% of the designated **Natura 2000 sites correspond to existing protected areas**. Even so, the national conservation objectives differ from those of the Natura 2000 policy which caused several EU infringement proceedings.

Similarly, Natura 2000 was implemented in a variety of ways in the different federal states in **Austria** that hold the main competences for nature conservation matters, including legal transposition. After accession to the EU in 1995, the federal states in Austria chose different strategies in terms of legal regulation (for instance, how far conventional forms of land management were generally allowed or subject to administrative approval), selection of sites (extent of Natura 2000 sites and priority given to areas under prior nature conservation regimes or not) or inclusion of stakeholders (consultation of land and forest owners in the Natura 2000 site selection process). Site selection and designation was characterised by different levels of conflict between public authorities and landowners depending on the more top-down or participatory approaches chosen and depending on the extent of the new protection sites that were proposed by the authorities. The implementation also involved criticism and shadow list proposals by environmental NGOs as well as EU infringement procedures which leveled out, to some extent, the original Natura 2000 site selections in the federal states. One federal state, which had started with extensive nomination of Natura 2000 sites, eventually reduced those due to fierce opposition from landowners. Additional designations became necessary in other federal states after EU-level interventions [29, 52].

In the **Central Eastern and South Eastern European countries** that joined the European Union in 2004, 2007 and 2013, implementation of Natura 2000 often meant a **rapid policy and governance change including substantial shifts in nature conservation and land use approaches**. In countries such as **the Czech Republic, Hungary, Poland, Slovakia, Slovenia, Bulgaria, Romania and Croatia**, a transformation from a state government-dominated nature conservation approach to more collaborative governance forms that involved local governments, environmental NGOs and/or land users can be found [21, 26, 37, 73, 81, 96, 97, 98, 99]. Just as in Western European countries, such new participatory approaches were often difficult to implement due to a lack of experience and conflicting interests between authorities and stakeholders. As a result, substantial implementation challenges were addressed by **symbolic implementation** [26]. This refers to the observation that environmental NGOs and nature protection authorities were rather powerful in the legal transposition and Natura 2000 site designation, while the practical implementation was mainly influenced by local governments and land user interests [26, see further details in 21, 33, 34, 35, 36, 37, 39, 40, 41, 42, 43, 45, 100].

The implementation approaches in new EU Member States often differ greatly, which can be illustrated with the examples of Hungary and Slovakia. In **Hungary**, a legal obligation was introduced to revise forest management plans in order to take into consideration the specific Natura 2000 rules. This work was done by the state forestry authority in consultation with the nature conservation authority. In **Slovakia**, the Natura 2000 sites were selected and designated by the environmental authorities mainly by using existing protected areas according to the national nature protection law. Whether forest management plans are to be considered as relevant documents (i.e., Natura 2000 management plans), is the subject of ongoing policy and technical disputes.

In summary, the implementation of Natura 2000 has proved to be a lengthy and politically controversial process. *The domestic implementation processes have been marked not only by conflicts between different public and private actors, but also between national*

governments and the EU. The step of legal transposition was often substantially delayed when compared with the required timelines and sometimes caused already fierce disputes and conflicts. In a number of instances, the European Court of Justice (ECJ) overthrew national legal transpositions for not being in line with the objectives of the EU's Nature Directives.

In the establishment of the network of Natura 2000 sites, countries' chosen implementation strategies differ in various aspects, including the applied selection criteria and the process of selecting the sites. The initial strategies were often altered through interventions from stakeholder groups and/or the EU level (DG Environment and the ECJ). It seems that the political strategies impacted strongly on the final setup of Natura 2000 sites although interventions from landowners, environmental groups as well as EU institutions often levelled out the initial domestic approaches to some extent. *It must be assumed that different shares of land area under the Natura 2000 regime across countries (or federal states) emerged at least to some extent due to domestic political preferences and choice, and not to (ecological) scientific criteria alone.* The same holds for the question of whether to nominate areas as Natura 2000 sites that had been under prior national nature protection regimes. For example, in the new Member States in Eastern Europe, rather larger Natura 2000 sites were designated mostly overlapping with (but sometimes also exceeding) existing nature protection areas, whereas in the older Member States in Western Europe rather smaller sites were established, except for Spain. For example, in France, Germany, Finland, Sweden and the UK, many Natura 2000 sites were designed in remote and less populated areas such as higher mountains and areas with unproductive plains, rivers and low-yield forests where socioeconomic development and (forest) land use is not affected. Different decision-making rationales for the establishment of Natura 2000 sites in other countries have been drawn on, ranging from a more ecological scientific approach to more socio-economically oriented negotiation processes taking account of affected landowners and land users.

3.2.3 National policy enforcement and management of the Natura 2000 network

After the designation of the Natura 2000 sites has largely been completed, in however protracted a manner, policy enforcement and practical management becomes the major task for national authorities. Although there is a common trend for more stakeholder participation, different patterns in policy implementation between countries can be observed.

Austria, France, and Germany are examples of EU Member States in which **the initial top-down implementation has provoked severe resistance** from land and forest owners and forest users' groups. To manage the escalating conflicts between land users and authorities, **changes towards a "user-friendly" governance mode** occurred, which enabled participatory elements but also caused severe delays at the enforcement and management stage [7, 24, 27, 29]. In these countries, stakeholder consultation was often practiced rather symbolically and Natura 2000 management plans were typically worded vaguely and/or remained non-mandatory for private forest owners. Natura 2000 management plans for forests rarely contain purposeful management measures for achieving nature conservation goals in forests. In those cases where ecological thresholds for forest biodiversity were included, they were often far below the recommendations based on biological conservation knowledge and often less strict than those practiced in the current management. As a result, Natura 2000 management plans tend to be disregarded in actual forest

management, and the status quo continues [84]. Given comparable previous developments, the state of domestic implementation can be expected to be similar in other EU Member States, for example in **Bulgaria, Croatia, Finland, Ireland, Italy, or Slovakia** [26, 100, 101].

In addition to severe delays, the **institutional setup** of the enforcement of the EU's Nature Directives and Natura 2000 site management has been described as problematic for a number of countries. For instance, studies on **Italy** and **the Netherlands** reported that most implementation responsibilities were delegated to local authorities. Yet, there seems to be a lack of know-how at these lower policy levels in relation to the management of Natura 2000 sites [19, 32]. In **Greece**, special agencies for managing the Natura 2000 conservation areas were established under the Ministry of the Environment. These agencies involved central and local administrations, local stakeholders, NGOs and scientists. Their work, however, was impaired by political interventions, inappropriate institutional competences, and lack of human and financial resources and knowledge [17, 20, 53]. For **Spain**, the lack of administrative and financial resources was also reported as a main barrier to the practical implementation of Natura 2000 management plans in forests [61, 66]. The situation in **Portugal** seems comparable to Spain: the development of management plans seemed well organised, but the question of financial resources remains unresolved. In consequence, there is little activity related to the establishment of effective management regimes for Natura 2000 sites in forests and other ecosystems [94].

However, it is reported that in **Italy** and **the Netherlands**, environmental NGOs occasionally invoked Habitats Directive provisions in lawsuits to **stop the execution of development plans and projects** in Natura 2000 sites which were likely to have resulted in negative impacts on flora and fauna [81].

Several studies described the Natura 2000 policy enforcement in **France** as being rather positive [11, 16, 63, 80, 83]. The evidence is that **specific local consultations** and drafting of management plans had already begun by 2002, in parallel with the Natura 2000 site nomination procedures. The specific management plans for Natura 2000 sites include the **formulation of conservation objectives for each site**. By 1995, with funding from the LIFE programme, 37 pilot sites had been selected with the objective of establishing a methodology that could be applied across all French management plans for Natura 2000 sites. Furthermore, **voluntary Natura 2000 contracts** between government authorities and public or private landowners were seen to ensure implementation through the provision of **financial incentives** [80]. The contracts consist mainly of a list of operations, financial conditions and the necessary documents to control the contractual commitments. They eventually became the major implementation tool for Natura 2000 management. In contrast to other countries, it seems that France substantially changed the initial ecological scientific-based approach to a “user-friendly” collaborative approach [16, 63, 83, 102].

What this collaborative approach effectively means for a conservation-oriented management of Natura 2000 forest sites was studied by comparing the experience of Natura 2000 management planning in forests in **France** with the experience in **Austria** and **Germany**. The French Natura 2000 management plans are very similar in that they are drafted vaguely and are even voluntary for forest and landowners. The plans build on a basis of information, awareness raising and financial incentives. With active implementation this can become an effective strategy when forest owners are convinced to follow practical recommendations or to engage in conservation contracts. However, according to scientific studies, forest nature conservation standards are lower when compared to existing conservation biology knowledge and practice [84]. The tendency is also that only

minor measures are taken voluntarily, and only a few forest owners, who have specific conservation oriented attitudes and/or see some (financial) benefits, are willing to enter into the Natura 2000 contracts [80, 103, 104].

The example of France shows that *a clear picture is often difficult to get, even if several studies exist for the same country*. This is because the studies look at different cases, take different perspectives or ask different questions. For France, the positive examples refer to cases of voluntary engagement of forest owners, but when looking more critically from a biodiversity conservation perspective, the added value for nature conservation appears to be rather modest.

Although a comprehensive overview of all EU countries cannot be provided on the basis of the existing literature and available country cases, we can try to summarise the current situation in the Natura 2000 policy implementation. After different initial strategies, most of the EU Member States have taken a “softer” path of implementation. The frequently intense conflicts have led public authorities to make space for stakeholder participation even if they have not done so from the beginning. *The evidence seems to show that countries differ in how seriously they take such participatory approaches and whether stakeholder involvement remains symbolic, or not. The strong opposition of landowners, land users and other affected societal groups led public authorities to stop or slow down the active Natura 2000 policy implementation*. This resulted in missing regulations and/or vaguely defined management plans and in a lack of management measures applied on the ground. *Management of Natura 2000 sites in forests is furthermore lacking when no or only limited funding is made available* [26, 27, 29, 84].

Successful examples of Natura 2000 implementation in forests seem to be found in cases where active collaborative processes and structures are installed, funding is provided, and management guidance is in place (Chapter 4). These measures aim to encourage the acceptance and participation of landowners and land users during Natura 2000 implementation. Sometimes, they also seek to build mutual trust and cooperation between landowners and users on one side, and environmental authorities and civil society groups on the other. However, with regard to stakeholder involvement, scholars offer a more complex picture: *while participatory processes can increase Natura 2000 policy acceptance, they may also water down conservation goals and practical management as a result of negotiating with the land users’ interests* [27, 84]. Although more knowledge is needed on the real effects of land use and forest management on biodiversity conservation (Chapter 2 and Chapter 5), a rough picture can be drawn from the case study-based implementation analyses which exist to date. These studies and assessments paint a rather critical picture of the Natura 2000 implementation processes so far.

Overall, the available scientific and expert knowledge indicates that Member States have progressed to very different degrees and with varied pace in establishing Natura 2000 management regimes, including management plans, on-the-ground measures, funding and legal/administrative orders. In many cases, severe problems in the organisation of Natura 2000 site management are reported, including poor institutional solutions as well as unresolved funding problems. *Cases of effective enforcement where intensive land and water use practices, and infrastructure development projects (e.g., building of motorways, industrial parks, tourism facilities, wind turbine parks), with potentially negative impacts on habitats and animal and plant species, had been stopped are only known when environmental NGOs actively engaged through lawsuits and were supported by environmentally inclined public authorities* [81, 92]. Little is known about the domestic implementation of Natura 2000 policy and its effectiveness in restricting intensive land use practices and economic development projects with potentially negative effects on biodiversity (Chapter 5).

Issues and challenges for implementing Natura 2000 in forests

3.3.1 Supporters and opponents of Natura 2000 policy

The **main actors** in the implementation of Natura 2000 are the authorities in charge, involved scientists, the affected landowners and users and non-governmental organisations from both the environmental and the landowners' and users' side. The responsible authorities are the European Commission, DG Environment and the ECJ at the EU-level and the environmental or nature conservation authorities on a national level or – in the case of many countries with a federal system – on a sub-national level. In many countries, the lowest administrative level for the implementation (i.e., tasks of direct site management) rests with local governments. Usually, the whole Natura 2000 implementation, including forests, is in the hands of environmental protection authorities. Only in rare cases are forest authorities responsible for implementing Natura 2000 in forests (e.g., Greece). However, for the provision of EU's Rural Development funds for Natura 2000, the responsibility normally lies in the hands of the agricultural and forestry administration.

According to the literature, it is often observed that the environmental and forestry authorities are in opposition regarding how Natura 2000 policy should be implemented. The main actors can be grouped into supporters (nature conservationists' side) and opponents (land users' side). At the EU level, Natura 2000 supporters include the responsible DG Environment, environmentally minded members of the European Parliament, European and national environmental NGOs, biological scientists, and the national conservation authorities of the Member States. On the environmental side, close collaboration between national-level environmental groups and EU institutions is often documented in the literature. These collaborations are often supported by scientific experts and consultants. *This pro-Natura 2000 policy advocacy coalition often criticises the substantial deficits in domestic implementation and seeks to defend the stability of the EU nature protection regime based on the EU's Nature Directives* [105]. In their rulings on Natura 2000 issues, national and European courts have played a supporting role in Natura 2000 policy implementation [8].

In contrast, DG Agriculture of the European Commission, farmers' and forest owners' associations, and primary industries' interest groups take opposing or critical positions [1, 2, 5, 6, 9, 106]. In some countries, landowners formed organised coalitions to fight the implementation of Natura 2000. In France, for instance, the influential Group 9 coalition of agricultural, forestry, hunting and fishing interest groups was successful in its aim for a more participatory policy implementation, although the group seems not to be very active any more [16, 83]. In Austria, several landowner groups were formed on

a local level to fight against Natura 2000 and defend their property rights. According to the literature, opponents also included forest-based industries, hunters and other natural resource-based industries such as mining. Mayors and local residents also appear as opposing actors in certain cases. These policy actors and interest groups can be described as forming rival contra-Natura 2000 policy advocacy coalitions through which they work together [105]. They have often criticised *the top-down implementation, the lack of information and involvement, restrictions for the current land uses or future land development, or lack of financial compensation*.

This kind of conflict between competing nature conservation and commodity/land use policy advocacy coalitions are described in the literature for Germany, France and the UK [7, 8, 106], Hungary and Poland [99], Czech Republic and Slovakia [100] as well as for Bulgaria and Croatia [26] and more indirectly in many other studies. Many studies provide evidence that both types of policy advocacy coalitions fought for or against the extension of the Natura 2000 network and stronger enforcement in many European countries. *The pro and contra coalitions thus seem to exist in most EU Member States.*

3.3.2 Stakeholder involvement

EU Member States differ greatly in their implementation styles with regard to stakeholder involvement, including at what stage stakeholders were informed or involved (before or after site designation), the level of involvement (only information or negotiation of site designation and planning measures) but also which interest groups were consulted most (nature conservation and/or landowners and users). Although a number of national level studies on public and stakeholder participation have been done, these aspects have not been systematically analysed and reviewed yet.

However, the overall impression is that, in the beginning of the domestic implementation process, public authorities in most EU countries did not involve landowners whereas conservation experts were involved to provide their substantive technical knowledge and information about habitats and species which administrations were partially lacking. This can be largely explained by the fact that the designation of Natura 2000 sites had to be based solely on scientific criteria rooted in conservation biology as stipulated in the EU's Habitats and Birds Directives. Site designation was mostly done without any consultation with, or informing of, landowners. *Fewer countries practiced stakeholder involvement in informal ways.* The degree of participation varied among countries and even from one Natura 2000 site to another [29, 51]. An interesting insight is that socio-economic interests were involved in the domestic implementation even if this was not foreseen in the EU's Nature Directives.

The initial top-down conservation science based approach that was practiced in most countries caused conflicts with land users who felt excluded [11, 60]. *Only later, and mainly in response to the need to manage these substantial conflicts, did the implementation approach shift to more socially inclusive and participatory bottom-up approaches.* This "participatory" turn occurred as a (rational) reaction to the strong opposition built by land users' groups during the implementation of Natura 2000. As described earlier, some countries took this new participatory policy approach more seriously whereas others did it symbolically or only "on paper".

With the progression from site designation to the current phase of management planning and practical measures, there is growing evidence of more dialogue and cooperation

between nature conservation authorities and environmental groups on the one side, and agricultural and forestry authorities and land users' groups on the other side (Chapter 4). This seems to be a process that cuts across EU, national and local levels [27, 32, 105]. Nevertheless, studies on participation approaches usually focus more on the (lack of) involvement of affected land users rather than the involvement of conservationists or the public. A few studies draw attention to the *need for a balanced involvement of all parties* [27, 51, 52] and the *need to connect participation with co-responsibility* [107].

3.3.3 Challenges for the implementation of Natura 2000 policy in forests

On the most abstract level, the basic challenge for implementing Natura 2000 lies in the interdisciplinary and cross-sectoral nature of the problem of achieving biodiversity conservation in managed (forest) landscapes, which include the different interests and values of involved policy actors, landowners, land users, stakeholders and societal groups. Different authors have tried to categorise the challenges connected with the implementation of Natura 2000, for instance, from a literature review [32], from a survey [92], or from a comprehensive comparative study [27] (Box 3).

Building on Winkel et al., who categorise the main conflicts into four main types - procedural, interest-based/material, political-institutional, and idea and knowledge-based conflicts - we suggest clustering the Natura 2000 implementation challenges into three larger social science dimensions. These clusters of ideological and knowledge-based, interest-related, and institutional challenges are summarised below.

1. Ideological and knowledge-based challenges

In this perspective, conflicts between nature conservation and the economic use of natural resources can be seen to be rooted in either distinct core values and beliefs or, more simply, in a lack of good knowledge. According to the literature, both aspects are relevant in the case of Natura 2000 implementation. The **conflicting value and belief systems** have been portrayed as typical urban v rural views on nature where urban amenity values are at odds with rural commodity values [5, 78]. Such ideological or paradigmatic conflicts relate to the core beliefs of actors in the different sectors [8]. Competing core values and policy beliefs can explain why the implementation of Natura 2000 in forests and other land uses (e.g., agriculture, hunting, fisheries) has often been marked by polarised debates between environmental and land users' groups. They can also explain why national nature conservation authorities have been pitted against agriculture and forestry authorities. These ideological conflicts relate to the actors' fundamental worldviews and also involve professionals, consultants and scientists. Communication between the opposing parties is often difficult and characterised by a deep lack of understanding and distrust [83]. Conflict resolution in such highly controversial situations needs the *self-reflection of all involved parties, which can lead to insight on their different worldviews and to mutual respect and accommodation* [108]. Another promising conflict resolution strategy is *policy-oriented learning across sectors and actors' coalitions based on exchange of knowledge and experience, and skillful facilitation and de-escalation oriented dialogue processes* [105].

In addition to the basic ideological division between nature conservation and economic land-use actors, there have been **difficulties in understanding the specific conservation approach** of Natura 2000 on both sides. For landowners and users it was sometimes

Box 3. Different ways to categorise the key challenges of Natura 2000 policy implementation.

Starting from the core conflict between nature conservation and different land uses (e.g., agriculture, fishing, forestry, industrial and infrastructure development, ship navigation), a review of the literature [32] lists a number of key conflicts and challenges in Natura 2000 implementation:

- Questions around the legitimacy of the implementation process.
- Low capacity of state authorities on various levels.
- Scientific weaknesses.
- A lack of proper participatory approaches.
- A lack of clear policy goals.
- A lack of intersectoral coordination and involvement of local actors.
- The need for sufficient funding for compensation or for awareness raising.
- The need for a flexible local planning and a space for deliberation of interests in the implementation process.

In a survey of conservation experts across Europe [92], seven key drivers for successfully implementing Natura 2000 were identified. They can be understood as important strengths of the Natura 2000 policy but also as priority areas where improvements are needed. These drivers, and the connected weaknesses, are:

- Network design: a need to update the Natura 2000 network with growing scientific knowledge and with respect to dynamic developments such as climate change.
- External resources: a need for an independent funding mechanism for Natura 2000.
- Legal and policy framework: a need to strengthen control and enforcement mechanisms.
- Scientific input: a need for a better use of existing scientific knowledge in the actual site management planning and implementation.
- Procedural framework: a need to improve the quality of monitoring schemes.
- Social input: an imbalance of interest consideration in participatory processes.
- National and local policy: a lack of political will and effective implementation mechanisms.

On the basis of expert interviews and intensive interdisciplinary research on the implementation of Natura 2000 in forests in six EU Member States, and their interplay with the EU level, as well as an extensive inter- and transdisciplinary discussion process with ecological and social science researchers and European, national and local stakeholders [27], the following five important challenges for the implementation of Natura 2000 in forests are derived:

- How to balance biodiversity conservation and timber production.
- How to integrate nature conservation and local stakeholders' demands.
- How to consider changing environmental conditions due to climate change in Natura 2000 conservation regimes in forests.
- How to develop an effective and accepted funding scheme for the implementation of Natura 2000 in forests.
- How to integrate nature conservation policies (EU's Nature Directives and national nature conservation law) with forest policy and other land use sector policies.

difficult to understand that the integrative approach of Natura 2000 reflects a growing public interest in conserving biodiversity in agricultural or forest lands that can include **both** active and non-intervention management of natural resources. However, this was often not communicated clearly by the implementing agencies or it was not understood comprehensively by the target groups. This lack of communication is often mentioned as a major drawback in Natura 2000 implementation, particularly in its early phase. This *calls for targeted information measures for landowners and other affected groups* [27, 32].

Studies also report a **lack of knowledge of the Natura 2000** policy regime, even within the responsible public authorities [19, 27, 32, 92]. A lack of nature conservation knowledge is particularly highlighted for the implementing and/or managing agencies at a local level [32, 92] and in the Natura 2000 management plans themselves [84]. Apparently, quite different views emerged on the extent to which Natura 2000 should allow for traditional land uses (such as agriculture, forestry) and/or how static or dynamic its conservation goals should be understood. For example, EU Member States interpreted how to meet Natura 2000 policy goals quite differently, ranging from strict protection or non-intervention-management in forests [94, 109] to business-as-usual timber production and/or multi-purpose oriented forestry [7, 17, 84]. The interpretation of the integrative conservation approach in practice is the source of most informational conflicts related to Natura 2000 implementation in forests [27, 110]. There is thus a *need for better training within the implementation agencies*.

At the larger scale, the potential for Natura 2000 sites to **form a functioning European ecological network** remains poorly developed. A lack of communication between stakeholders both within and between Member States leads to insufficient functional connectivity and spatial connectedness between Natura 2000 sites at the bio-geographical level [64]. At the Member States level, factors such as the Natura 2000 network's unclear conservation goals, politically motivated site selection (such as biases toward selecting sites removed from human activity to minimise economic impact), and a low prioritisation of conservation as compared to economic objectives contribute to trade-offs in site selection and management. For example, there are large discrepancies in the representation of different habitats in the Mediterranean region; highland areas are overrepresented while more heavily populated lowland areas are underrepresented. This *calls for better ways to ensure more consistent development and implementation of management planning processes across EU Member States and bio-geographical regions*.

In addition, local level **trade-offs and contradictions between conservation goals** themselves are also reported. This includes contradictory conservation objectives for protected but competing species. For example, in Germany a protected cormorant species benefited from the banning/restricting of hunting activities but, due to its population growth, it started threatening protected fish species [63]. Another crucial aspect is trade-offs in the appropriate protection of complex and dynamic ecosystems [10]. In forest ecosystems, conservation goals need to be linked to certain development phases of the forest stands that in turn can indicate different management practices. For instance, in an old-growth phase, the establishment of an appropriate Natura 2000 management regime for the protection of certain habitat types and species is not trivial and often requires non-intervention measures (e.g., forest set asides, old trees, deadwood), particularly in managed forests [27]. At the same time, implementing conservation goals favouring certain (bird) species that depend on younger forests and/or more open forest habitats often necessitates active forest management, including sustainable timber felling [105].

Appropriate conservation planning would *need to secure the continuous availability of all forest development phases, not a conservation of one phase.*

Climate change poses a further specific problem for the designation of the Natura 2000 sites, the definition of conservation goals, the application of conservation measures and monitoring [59, 111]. *Managed ecosystems (e.g., forests) are likely to change in reaction to the changing climatic environments and so might need more flexible management.* This necessitates not only more monitoring and information on ecosystem change processes, but also poses thorny questions of whether and how the network of Natura 2000 sites, conservation goals and measures need to be adapted. *However, allowing for more management flexibility can pose the risk of compromising Natura 2000 integrity and conservation goals* given the substantial beliefs and interests in the economic use of forests and other land resources as a strategy to mitigate and/or adapt to climate change [27].

Complex forest ecosystem dynamics have often not been adequately considered in Natura 2000 planning and implementation, which needs to be adaptive in nature. With the given ongoing changes in global climate, plus the legacy effects of any past changes in management, it becomes essential to evaluate and revise the goals and measures of management plans to meet Natura 2000. *The complex and long-term dynamics of forest ecosystems, as well as changing climatic conditions, require integrated and adaptive conservation approaches within a robust management framework that includes both the best available ecological expertise and a balanced stakeholder involvement.*

2. Interest-related challenges

In the interest perspective, the issues at stake relate to costs and benefits, property rights and compensation measures. The fundamentally different interests in using or conserving forests usually imply the need to address distributional **trade-offs between these different goals** in the management of Natura 2000 forests. While synergistic relations can exist between these forest policy and management goals to a certain extent (“win-win”), the selection and/or prioritisation of a single goal often means a reduced fulfilment of the other goals (“win-lose”). This means that in more timber-oriented forest management practices - such as plantation forestry, clear-cut forestry or even-aged forestry - nature conservation goals are compromised. In strict protection regimes such as forest set-asides, timber production goals are neglected. If more multifunctional, integrative or close-to-nature forest management schemes are applied, those forest sites are more likely to contribute to meeting both conservation and timber production goals. *The Natura 2000 regime may hence allow retaining those close-to-nature and integrative forestry practices.* However, no maximisation of economic and ecological goals can be achieved at the same time. If forest management practices are intensified this might lead to a deterioration of the biodiversity conservation values which Natura 2000 aims to avoid.

In situations where the conservation status of habitats and/or species needs improvement and a change of the forest management regime is needed for this, **costs for the lost revenues or for costly conservation measures** might incur. *Such situations might call for the use of compensation payments* (Chapter 6).

In addition to costs, a Natura 2000 protection regime may also **restrict the decision-making freedom** of (non-state) landowners. *Forest owners may not only oppose having to bear direct and indirect costs, they may oppose the restriction of their property rights and management freedom even without regard to specific costs.* It remains an open question whether this objection also applies to public landowners or for ecologically oriented non-state

landowners who are willing to integrate conservation goals in their actual management due to regulations and/or on a voluntary basis [103, 104]

The motivations for opposition to Natura 2000 in intensively managed European forest landscapes were sometimes related more to reduction of property rights and sometimes more to real costs. The literature gives examples where the conflicts are assigned either to the perceived or real reduction of ownership and land use rights due to nature conservation objectives [5, 21, 76, 79, 94, 112], or to the perceived or real substantive material costs for land and forest owners, including consumption and production, management and investment costs [13, 78, 81, 99, 106]. Costs can also relate to the exclusion of future use options (such as intensification of commodity production or land development) or the fear of decreasing land value due to such limitations. Sometimes, conflicts arose specifically about compensation payments [5, 11, 80] or a lack of long-term and adequate funding [19, 21, 33, 76, 81].

The implementation of Natura 2000 policy started without specific **compensation of costs** for the landowners, either on an EU or national level (Chapter 6). The neglect of this issue is often said to be the cause, or at least one of the major causes, of landowners' resistance to Natura 2000. In policy debates, the "lack of funding" argument played a decisive role in arguments about lack of legitimacy and acceptance [113, 114]. At the same time, this policy narrative fails to recognise all the reasons for resistance and all of the aforementioned cost types – namely the restriction of property rights. While compensation payments would only cover incurred direct and maybe indirect costs and option values, the limitation of full management rights would not be fully compensated. However, landowners are often not willing to accept any nature protection schemes, even if compensation payments are offered, and others apply conservation-oriented management voluntarily, without compensation [85]. In an analysis of the use of EU Rural Development funds for Natura 2000 in the programming period 2017–2014, the paradoxical result is found that, in EU Member States with a higher need for compensation payments, EU funds were actually not used at all or used much less [86] (Chapter 6). The interplay between funding and landowners' motivations as well as its impact on the uptake or neglect of funding instruments is an important issue that needs further research and knowledge. It can be hypothesised that in EU Member States with a higher coverage of Natura 2000 sites in (economically managed) forests, the level of (psychological and pragmatic) resistance by (private) forest owners is higher, which results in a lower level of the use of EU/national public funds in those countries. *For a compensation regime, several steps seem to be necessary, including clear responsibilities for funding (EU/national level), clear regulations for landowners, awareness raising and information, and sufficient funding.*

3. Institutional challenges

Institutional issues in the implementation of Natura 2000 in forests and other land uses are manifold and relate to questions of policy design including the (in)formal rules and procedures in place, distribution of political authority, administrative responsibilities and cross-sectoral coordination.

The original **conservation science-based approach** of Natura 2000 neglects the social aspects of conservation policy. This includes questions of who owns the protected areas, what are their goals, how do they manage their land, and how should they be involved in and motivated for Natura 2000. The policy implicitly assumes that the sustainable

use of natural resources and nature conservation goals can be reconciled. However, the process of exploring and achieving “win-win” situations was neglected at the EU and Member States levels during the first implementation phase of legal transposition and establishment of the Natura 2000 network. In most documented cases, a top-down approach of implementation was taken, even if the involvement of landowners would have been usual practice in the domestic political culture [29]. The issue of how and to what extent to **involve stakeholders and/or the public** in the implementation process (section 3.3.2) was a major institutional challenge for the authorities [27, 32]. This question is in fact one of the prominent research topics in the recent studies related to Natura 2000 implementation [37, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57]. *The question of how to reconcile the contradiction between conservation goals and voluntary implementation approaches is still an open issue in relation to Natura 2000 management.*

A further interesting insight is that Natura 2000 apparently changed the institutional framework for nature conservation in that an **additional decision-making level** (the EU level) was added over nature protection and management of natural resources (e.g., agriculture, forests, water) in the countries. The traditional national policy networks were thus enlarged. This helped not only European Union and Member States institutions to gain influence but environmental groups also got new entry points to bring their views and expertise into the policymaking process even beyond national states’ authorities [26, 99].

Looking at **legal aspects** of Natura 2000 implementation, studies reached different results with regard to the quality and timeliness of legal transposition and enforcement as well as the policy effectiveness [32]. Many studies document that Natura 2000 site designation and related implementation measures were subject to substantial delays, insufficient coverage and inappropriate or incomplete national transposition. Infringement proceedings and lawsuits in national and European courts followed. They accused the EU Member States of implementation deficits and enforced fuller legal compliance and enlargement of the coverage of Natura 2000 sites [7, 8, 26, 27].

In addition, severe conflicts between public administrations over institutional issues of **multi-level and cross-sectoral coordination** are documented in the literature. They include conflicts between EU and national authorities as well as between national and local administrative bodies [7, 26, 27, 32, 100]. It is often reported that Natura 2000 policy implementation deficits resulted from institutional issues, including a lack of political support and/or power asymmetries between land use and nature conservation policy sectors and/or a lack of administrative capacities on national and/or local levels [8, 32, 92]. For a number of EU Member States, studies document implementation challenges within the environmental administration itself since the Natura 2000 policy introduced a new or stricter conservation rationale compared to the traditional nature protection regimes in place [27].

A major **policy and institutional gap** was evident in that Natura 2000 policy was designed at the EU level as a regulatory policy but no corresponding EU funding instrument was provided to address re-distributional issues in cases where restrictions caused by the Natura 2000 conservation regime implied costs for the landowners [27]. Cross-sectoral coordination problems between the agricultural and environmental administrations add further complexity to the institutional challenges. This path-dependency of institutional conflicts seems to explain well the current funding problems (section 6.2). That is, an institutional mismatch exists between Natura 2000, that originates from the environmental policy sector (EU’s Nature Directives), and its funding that should mainly come from the agricultural policy sector (EU’s Rural Development Regulation) [85].

As a result, rural development funding is often not, or not fully, used for Natura 2000 or used for the support of the economic use of natural resources which can potentially compromise the nature conservation goals [43, 92]. In summary, it seems that *the implementation of Natura 2000 suffers from mismatches in the institutional set-up with regard to the division of responsibilities between EU and Member States levels and between nature conservation and land-use public authorities.*

Policy coordination or **policy integration problems** were often documented and were not restricted to the financing issue [8, 27, 32, 100, 115]. There is a specific need for better integration between Natura 2000 policy and climate change policies [59, 116]. According to interviews and surveys, nature conservation experts are satisfied with cross-compliance issues in the Common Agriculture Policy, but are of different opinions regarding the quality and implementation of Environmental Impact Assessments (EIA) [92].

Summarising conclusions

What are the challenges? How are they managed by the involved administrations and stakeholders?

The present study finds a variety of challenges that public and private actors in the EU Member States and at the EU level have faced so far. Our analysis shows that, while the degree of conflict and timelines vary significantly, similar categories of *ideological and informational, interest-related and institutional challenges* evolved across the EU Member States.

The study finds *a wide diversity of Natura 2000 implementation strategies* both across the EU Member States and within countries with federal political systems. These domestic strategies have developed as a means to manage the aforementioned challenges. The strategies range from (i) timely legal transposition to substantial delays in domestic policy implementation; (ii) from top-down, command-and-control conservation science-based implementation to flexible approaches based on participation and negotiation with affected land users and stakeholders; (iii) from designation of few, smaller, or pre-existing Natura 2000 sites to designation of many, larger, new Natura 2000 sites; and (iv) from formal policy and legal shifts resulting in (some) changes in on-the-ground practices to formal policy and legal shifts without changes in the management practices, both with positive or negative effects on biodiversity conservation or forest land use.

The historical development and current state of affairs point to *substantial multi-level Natura 2000 policy implementation issues*. This situation is characterised by two defining features. First, a common policy and institutional framework for nature conservation has been established at the EU level. Even after substantial conflicts and delays, the Natura 2000 network of protected areas now covers almost 18% of the EU's territory or 25% of forest area in the EU-28. Both policy settings can be used to trigger coherent nature conservation activities across all Member States. Second, the Natura 2000 policy has not been fully enforced in all EU Member States in a manner consistent with its goals. This is mainly because appropriate practical management of Natura 2000 in forests in many EU Member States is still hampered and/or at very early stage. This is despite the fact that 25 years have passed since the adoption of the EU's Habitats Directive that introduced the network. The main reasons seem to be *a lack of funding, resistance from land users, deficits in knowledge and administrative capacities, and a lack of political will and/or other policy priorities*.

References:

- [1] Fairbrass, J., Jordan, A., 2001. Protecting biodiversity in the European Union: national barriers and European opportunities? *Journal of European Public Policy*, 8 (4), 499–518.
- [2] Weber, N., Christophersen, T., 2002. The influence of non-governmental organisations on the creation of Natura 2000 during the European Policy process. *Forest Policy and Economics*, 4, 1–12.
- [3] Fernandez, S.A., 2003. Spanish Coordination in the European Union: The Case of the Habitats Directive. *Administration & Society*, 34 (6), 678–699.
- [4] Rosa, H. D., Da Silva, J. M., 2005. From Environmental Ethics to Nature Conservation Policy: Natura 2000 and the Burden of Proof. *J Agric Environ Ethics*, 18 (2), 107–130.
- [5] Keulartz, J., 2009. European Nature Conservation and Restoration Policy-Problems and Perspectives. *Restoration Ecology*, 17 (4), 446–450.
- [6] Castro, P., Mouro, C., 2011. Psycho-Social Processes in Dealing with Legal Innovation in the Community: Insights from Biodiversity Conservation. *Am J Community Psychol.*, 47 (3-4), 362–373.
- [7] Borrass, L., Sotirov, M., Winkel, G., 2015. Policy change and Europeanization: Implementing the European Union's Habitats Directive in Germany and the United Kingdom. *Environmental Politics*, 24(5), 788–809.
- [8] Sotirov, M., Borrass, L., Winkel, G., 2011. Dem Wandel auf der Spur - Theoretische Ansätze zur Analyse von Politikwandel und -stabilität mit Fokus auf das Beispiel waldbezogener EU-Naturschutzpolitik. *Allgemeine Forst- und Jagdzeitung*, 182 (11/12): 215–230.
- [9] Chilla, T., 2007. The political relevance of discourses on space. *Erdkunde*, 61 (1), 13–25.
- [10] Ledoux, L., Crooks, S., Jordan, A., Kerry Turner R., 2000. Implementing EU biodiversity policy: UK experiences. *Land Use Policy*, 17, 257–268.
- [11] Alphandery, P., Fortier, A., 2001. Can a Territorial Policy be Based on Science Alone? The System for Creating the Natura 2000 Network in France. *Sociologia Ruralis*, 41 (3), 311–328.
- [12] Hiedanpää, J., 2005. The edges of conflict and consensus: a case for creativity in regional forest policy in Southwest Finland. *Ecological Economics*, 55 (4), 485–498.
- [13] Haaren, C. V., Reich, M., 2006. The German way to greenways and habitat networks. *Land-scape and Urban Planning*, 76 (1-4), 7–22.
- [14] Gibbs, D., While, A., Jonas, A.E.G., 2007. Governing nature conservation: the European Union Habitats Directive and conflict around estuary management. *Environ. Plann. A.*, 39 (2), 339–358.
- [15] Visser, M., Moran, J., Regan, E., Gormally, M., Sheehy Skeffington, M., 2007. The Irish agri-environment: How turlough users and non-users view converging EU agendas of Natura 2000 and CAP. *Land Use Policy*, 24 (2), 362–373.
- [16] McCauley, D., 2008. Sustainable development and the 'governance challenge': the French experience with Natura 2000. *Eur. Env.*, 18 (3), 152–167.
- [17] Apostolopoulou, E., Pantis, J. D., 2009. Conceptual gaps in the national strategy for the implementation of the European Natura 2000 conservation policy in Greece. *Biological Conservation.*, 142 (1), 221–237.
- [18] Sumares, D., Fidelis, T., 2011. Natura 2000 and the narrative nature of nature: a case for critical discourse analysis. *J. of Integrative Env. Sc.*, 8 (1), 53–68.
- [19] Ferranti, F., Beunen, R., Speranza, M., 2010. Natura 2000 Network: A Comparison of the Italian and Dutch Implementation Experiences. *Journal of Environmental Policy & Planning*, 12 (3), 293–314.
- [20] Dimitrakopoulos, P.G., Jones, N., Iosifides, T., Florokapi, I., Lasda, O., Paliouras, F., Evangelinos, K.I., 2010. Local attitudes on protected areas: Evidence from three Natura 2000 wetland sites in Greece. *Journal of Environmental Management*, 91 (9), 1847–1854.
- [21] Grodzinska-Jurczak, M., Cent, J., 2011. Expansion of Nature Conservation Areas: Problems with Natura 2000 Implementation in Poland? *Environmental Management*, 47 (1), 11–27.
- [22] Beunen, R., Van Assche, K. & Duineveld, M., 2013. Performing failure in conservation policy: The implementation of European Union directives in the Netherlands. *Land Use Policy*, 31, 280–288.

- [23] Beunen, R., van Assche, K., 2013. Contested delineations: planning, law, and the governance of protected areas. *Environment and Planning A*, 45, 1285-1301.
- [24] Borrass, L., 2014. Varying practices of implementing the Habitats Directive in German and British forests. *Forest Policy and Economics*, 38, 151-160.
- [25] Kati, V., Hovardas, T., Dieterich, M., Ibisch, P. L., Mihok, B. & Selva, N., 2015. The challenge of implementing the European network of protected areas Natura 2000. *Conservation Biology*, 29(1), 260-270.
- [26] Sotirov, M., Lovric, M. & Winkel, G., 2015. Symbolic transformation of environmental governance: implementation of EU biodiversity policy in Bulgaria and Croatia between Europeanization and domestic politics. *Environment and Planning C: Government and Policy*, 33(5), 986-1004.
- [27] Winkel, G., Blondet, M., Borrass, L., Frei, T., Geitzenauer, M., Gruppe, A. & Winter, S., 2015. The implementation of Natura 2000 in forests: A trans-and interdisciplinary assessment of challenges and choices. *Environmental Science & Policy*, 52, 23-32.
- [28] Bouwma, I., Liefverink, D., Van Apeldoorn, R. & Arts, B., 2016. Following Old Paths or Shaping New Ones in Natura 2000 Implementation? Mapping Path Dependency in Instrument Choice. *Journal of Environmental Policy & Planning*, 18(2), 214-233.
- [29] Geitzenauer, M., Hogl, K. & Weiss, G., 2016. The implementation of Natura 2000 in Austria—A European policy in a federal system. *Land Use Policy*, 52, 120-135.
- [30] Marta-Costa, A., Torres-Manso, F., Pinto, R., Tibério, L. & Carneiro, I., 2016. Stakeholders' perception of forest management: a Portuguese mountain case study. *Forest Systems*, 25(1), 052.
- [31] Young, J. C., Searle, K., Butler, A., Simmons, P., Watt, A. D. & Jordan, A., 2016. The role of trust in the resolution of conservation conflicts. *Biological Conservation*, 195, 196-202.
- [32] Blicharska, M., Orlikowska, E. H., Roberge, J.-M., Grodzinska-Jurczak, M., 2016. Contribution of social science to large scale biodiversity conservation: A review of research about the Natura 2000 network. *Biological Conservation*, 199, 110-122.
- [33] Iojă, I. C., Hossu, C. A., Niță, M. R., Onose, D. A., Badiu, D. L. & Manolache, S., 2016. Indicators for Environmental Conflict Monitoring in Natura 2000 Sites. *Procedia Environmental Sciences*, 32, 4-11.
- [34] Stancioiu, P. T., Abrudan, I. V. & Dutca, I., 2010. The Natura 2000 ecological network and forests in Romania: implications on management and administration. *International forestry review*, 12(1), 106-113.
- [35] Nastran, M. & Pirnat, J., 2012. Stakeholder participation in planning of the protected natural areas: Slovenia. *Sociologija i prostor*, 50(2 (193)), 141-164.
- [36] Mikulcak, F., Newig, J., Milcu, A. I., Hartel, T. & Fischer, J., 2013. Integrating rural development and biodiversity conservation in Central Romania. *Environmental Conservation*, 40(2), 129-137.
- [37] Cent, J., Mertens, C. & Niedziałkowski, K., 2013. Roles and impacts of non-governmental organizations in Natura 2000 implementation in Hungary and Poland. *Environmental Conservation*, 40(02), 119-128.
- [38] Sarvašová, Z., Šálka, J. & Dobšínská, Z., 2013. Mechanism of cross-sectoral coordination between nature protection and forestry in the Natura 2000 formulation process in Slovakia. *Journal of environmental management*, 127, S65-S72.
- [39] Mertens, C., 2013. Playing at multiple levels in biodiversity governance: The case of Hungarian NGOs in Natura 2000. *Society and Economy*, 35(2), 187-208.
- [40] Niedziałkowski, K., Paavola, J. & Jędrzejewska, B., 2013. Governance of biodiversity in Poland before and after the accession to the EU: the tale of two roads. *Environmental Conservation*, 40(02), 108-118.
- [41] Kolarič, Š., Golobič, M. & Marot, N., 2013. Slovenia as the natural park of Europe? Territorial impact assessment in the case of Natura 2000. *Acta Geographica Slovenica*, 53(1).
- [42] Chmielewski, W. & Głogowska, M., 2015. Implementation of the Natura 2000 Network in Poland—an Opportunity or a Threat to Sustainable Development of Rural Areas? Study on Local Stakeholders' Perception. *Eastern European Countryside*, 21(1), 153-169.
- [43] Křenová, Z. & Kindlmann, P., 2015. Natura 2000—Solution for Eastern Europe or just a good start? The Šumava National Park as a test case. *Biological Conservation*, 186, 268-275.

- [44] Niedziałkowski, K., Pietrzyk-Kaszyńska, A., Pietruczuk, M. & Grodzińska-Jurczak, M., 2015. Assessing participatory and multi-level characteristics of biodiversity and landscape protection legislation: the case of Poland. *Journal of Environmental Planning and Management*, 1-21.
- [45] Kubacka, M. & Macias, A., 2016. The Functioning of Natura 2000 Areas in the Opinion of Different Groups From the Local Community: A Case Study From Poland. *Society & Natural Resources*, 1-12.
- [46] Jones-Walters, L., Çil, A., 2011. Biodiversity and stakeholder participation. *J. Nat. Conserv.*, 19, 327-329.
- [47] Apostolopoulou, E., Drakou, E.G., Padiadi, K., 2012. Participation in the management of Greek Natura 2000 sites: evidence from a cross-level analysis. *J. Environ. Manage.* 113, 308-318.
- [48] Young, J. C., Jordan, A., Searle, K. R., Butler, A., Chapman, D. S., Simmons, P. & Watt, A. D., 2013. Does stakeholder involvement really benefit biodiversity conservation?. *Biological Conservation*, 158, 359-370.
- [49] Stringer, L. C. & Paavola, J., 2013. Participation in environmental conservation and protected area management in Romania: a review of three case studies. *Environmental Conservation*, 40(02), 138-146.
- [50] Cent, J., Grodzińska-Jurczak, M. & Pietrzyk-Kaszyńska, A., 2014. Emerging multilevel environmental governance—a case of public participation in Poland. *Journal for Nature Conservation*, 22(2), 93-102.
- [51] Ferranti, F., Turnhout, E., Beunen, R. & Behagel, J. H., 2014. Shifting nature conservation approaches in Natura 2000 and the implications for the roles of stakeholders. *Journal of Environmental Planning and Management*, 57(11), 1642-1657.
- [52] Enengel, B., Penker, M. & Muhar, A., 2014. Landscape co-management in Austria: The stakeholder's perspective on efforts, benefits and risks. *Journal of Rural Studies*, 34, 223-234.
- [53] Jones, N., Filos, E., Fates, E. & Dimitrakopoulos, P. G., 2015. Exploring perceptions on participatory management of NATURA 2000 forest sites in Greece. *Forest Policy and Economics*, 56, 1-8.
- [54] Díez, M. A., Etxano, I. & Garmendia, E., 2015. Evaluating participatory processes in conservation policy and governance: lessons from a Natura 2000 pilot case study. *Environmental Policy and Governance*, 25(2), 125-138.
- [55] Paloniemi, R., Apostolopoulou, E., Cent, J., Bormpoudakis, D., Scott, A., Grodzińska-Jurczak, M. & Pantis, J. D., 2015. Public participation and environmental justice in biodiversity governance in Finland, Greece, Poland and the UK. *Environmental Policy and Governance*, 25(5), 330-342.
- [56] Mueller, A. & Maes, J., 2015. Arguments for biodiversity conservation in Natura 2000 sites: An analysis based on LIFE projects. *Nature Conservation*, 12, 1.
- [57] Castro, P., Mouro, C., 2011. Psycho-Social Processes in Dealing with Legal Innovation in the Community: Insights from Biodiversity Conservation. *Am J Community Psychol.*, 47 (3-4), 362-373.
- [58] Suškevičs, M., 2012. Legitimacy Analysis of Multi-Level Governance of Biodiversity: Evidence from 11 Case Studies across the EU. *Environmental Policy and Governance*, 22(4), 217-237.
- [59] De Koning, J., Winkel, G., Sotirov, M., Blondet, M., Borrás, L., Ferranti, F. & Geitzenauer, M., 2014. Natura 2000 and climate change—Polarisation, uncertainty, and pragmatism in discourses on forest conservation and management in Europe. *Environmental Science & Policy*, 39, 129-138.
- [60] Turnhout, E., Behagel, J., Ferranti, F. & Beunen, R., 2015. The construction of legitimacy in European nature policy: expertise and participation in the service of cost-effectiveness. *Environmental Politics*, 24(3), 461-480.
- [61] Ferranti, F., Vericat, P., & de Koning, J., 2017. Discourses on sustainable forest management and effects of Natura 2000: a case study of Catalonia, NE Spain. *Journal of Environmental Planning and Management*. DOI: 10.1080/09640568.2016.1274254
- [62] Slepčević, R., 2009. The judicial enforcement of EU law through national courts: possibilities and limits. *Journal of European Public Policy*, 16 (3), 378-394.
- [63] Rauschmayer, F., van den Hove, S., Koetz, T., 2009. Participation in EU biodiversity governance: how far beyond rhetoric? *Environ. Plann. C.*, 27 (1), 42-58.

- [64] Beunen, R. & Duineveld, M., 2010. Divergence and convergence in policy meanings of European environmental policies: the case of the birds and habitats directives. *International Planning Studies*, 15(4), 321-333.
- [65] Bryan, S., 2012. Contested boundaries, contested places: The Natura 2000 network in Ireland. *Journal of Rural Studies*, 28, 80-94.
- [66] Pecurul-Botines, M., Di Gregorio, M., Paavola, J., 2014. Discourses of conflict and collaboration and institutional context in the implementation of forest conservation policies in Soria, Spain. *Biodivers. Conserv.*, 23, 3483-3499.
- [67] Young, J. C., Jordan, A., Searle, K. R., Butler, A., Simmons, P. & Watt, A. D., 2013. Framing scale in participatory biodiversity management may contribute to more sustainable solutions. *Conservation Letters*, 6(5), 333-340.
- [68] Papageorgiou, K., Vogiatzakis, I.N., 2006. Nature protection in Greece: an appraisal of the factors shaping integrative conservation and policy effectiveness. *Environmental Science & Policy*, 9 (5), 476-486.
- [69] Edwards, D., Jensen, F.S., Marzano, M., Mason, B., Pizzirani, S., Schelhaas, M.-J., 2011. A theoretical framework to assess the impacts of forest management on the recreational value of European forests. *Ecological Indicators*, 11 (1), 81-89.
- [70] Opdam, P., Broekmeyer, M., Kistenkas, F., 2009. Identifying uncertainties in judging the significance of human impacts on Natura 2000 sites. *Environmental Science & Policy*, 12 (7), 912-921.
- [71] Pullin, A.S., Báldi, A., Can, O.E., Dieterich, M., Kati, V., Livoreil, B., Lövei, G., Mihók, B., Nevin, O., Selva, N. & Sousa-Pinto I., 2009. Conservation Focus on Europe: Major Conservation Policy Issues That Need to Be Informed by Conservation Science. *Conservation Biology*, 23 (4), 818-824.
- [72] Cogalniceanu, D., Cogalniceanu, G.C., 2010. An enlarged European Union challenges priority settings in conservation. *Biodiversity and Conservation*, 19 (5), 1471-1483.
- [73] Iojă, C.I., Pătroescu, M., Rozyłowicz, L., Popescu, V.D., Verghet, M., Zotta, M.I., Felciuc, M., 2010. The efficacy of Romania's protected areas network in conserving biodiversity. *Biological Conservation*, 143 (11), 2468-2476.
- [74] Velázquez, J., Tejera, R., Hernando, A., Núñez, M.V., 2010. Environmental diagnosis: Integrating biodiversity conservation in management of Natura 2000 forest spaces. *Journal for Nature Conservation*, 18 (4), 309-317.
- [75] Louette, G., Adriaens, D., Adriaens, P., Anselin, A., Devos, K., Sannen, K., Van Landuyt, W., Paelinckx, D., Hoffmann, M., 2011. Bridging the gap between the Natura 2000 regional conservation status and local conservation objectives. *Journal for Nature Conservation*, 19 (4), 224-235.
- [76] Rojas-Briales, E., 2000. Socio-economics of nature protection policies in the perspective of the implementation of Natura 2000 Network: the Spanish case. *Forestry*, 73 (2), 199-207.
- [77] Getzner, M., Jungmeier, M., 2002. Conservation policy and the regional economy: the regional economic impact of Natura 2000 conservation sites in Austria. *Journal for Nature Conservation*, 10 (1), 25-34.
- [78] Wätzold, F., Schwerdtner, K., 2005. Why be wasteful when preserving a valuable resource? A review article on the cost-effectiveness of European biodiversity conservation policy. *Biological Conservation*, 123, 327-338.
- [79] Strange, N., Jacobsen, J.B., Thorsen, B.J., Tarp, P., 2007. Value for Money: Protecting Endangered Species on Danish Heathland. *Environmental Management*, 40 (5), 761-774.
- [80] Anthon, S., Garcia, S., Stenger, A., 2010. Incentive Contracts for Natura 2000 Implementation in Forest Areas. *Environ Resource Econ*, 46(3), 281-302.
- [81] Wätzold, F., Mewes, M., van Apeldoorn, R., Varjopuro, R., Chmielewski, T. J., Veeneklaas, F., Kosola, M.-L., 2010. Cost-effectiveness of managing Natura 2000 sites: an exploratory study for Finland, Germany, the Netherlands and Poland. *Biodiversity Conservation*, 2053-2069.
- [82] Hily, E., Garcia, S., Stenger, A., Tu, G., 2015. Assessing the cost-effectiveness of a biodiversity conservation policy - A bio-econometric analysis of Natura 2000 contracts in forests. *Ecological Economics*, 197-208.
- [83] Alphandery, P., Fortier, A., 2010. Local Settings and Biodiversity: A Sociological Approach to the Implementation of the EC Habitats Directive in France. *Current Sociology*, 58 (5), 755-776.

- [84] Winter, S., Borrass, L., Geitzenauer, M., Blondet, M., Breibeck, R., Weiss, G. & Winkel, G., 2014. The impact of Natura 2000 on forest management: a socio-ecological analysis in the continental region of the European Union. *Biodiversity and Conservation*, 23(14), 3451-3482.
- [85] Geitzenauer, M., Blondet, M., de Koning, J., Ferranti, F., Sotirov, M., Weiss, G. & Winkel, G., (forthcoming). The Challenge of Financing the Implementation of Natura 2000 - Empirical Evidence from Six European Union Member States. *Forest Policy and Economics* (accepted).
- [86] Sarvašová, Z., Quiroga, S., Suárez, C., Ali, T., Lukmine, D., Djordjevic, I., Hrib, M. (forthcoming, b). Understanding the drivers for Natura 2000 payments in forests: a Heckman selection analysis. *JNC* (submitted)
- [87] Rusu, M. & Bodescu, F., 2013. Supporting Natura 2000 Network through Rural Development Policy, in Romania. *Lucrări Științifice Management Agricol*, 15(1), 283.
- [88] Hermoso, V., Clavero, M., Villero, D., Brotons, L., 2016. EU's Conservation Efforts Need More Strategic Investment to Meet Continental Commitments. *Conservation Letters*, March 2016: 1-7.
- [89] Anthon, S., Garcia, S., Stenger, A., 2010. Incentive Contracts for Natura 2000 Implementation in Forest Areas. *Environ Resource Econ.* 46 (3), 281-302.
- [90] Lung, T., Meller, L., Teeffelen, A. J., Thuiller, W., & Cabeza, M., 2014. Biodiversity funds and conservation needs in the EU under climate change. *Conservation letters*, 7(4), 390-400.
- [91] Nita, A., Rozyłowicz, L., Manolache, S., CiocĂnea, C. M., Miu, I. V. & Dan Popescu, V., 2016. Collaboration networks in applied conservation projects across Europe. *PLoS ONE*, 11(10)
- [92] Kati, V., Hovardas, T., Dieterich, M., Ibisch, P. L., Mihok, B. & Selva, N., 2014. The challenge of implementing the European network of protected areas Natura 2000. *Conservation Biology*, 29(1), 260-270.
- [93] Popescu, V. D., Rozyłowicz, L., Niculae, I. M., Cucu, A. L. & Hartel, T., 2014. Species, habitats, society: An evaluation of research supporting EU's Natura 2000 network. *PLoS ONE*, 9(11). doi: 10.1371/journal.pone.0113648
- [94] Sumares, D., Fidelis, T., 2009. Local perceptions and postures towards the SPA "Ria de Aveiro". *Journal of Integrative Environmental Sciences*, 6, 121-137.
- [95] Fairbrass, J., Jordan, A., 2001. Protecting biodiversity in the European Union: national barriers and European opportunities? *Journal of European Public Policy*, 8 (4), 499-518.
- [96] Young, J., Pichards, C., Fischer, A., Halada, L., Kull, T., Kuzniar, A., Tartes, U., Uzunov, Y., Watt, A., 2007. Conflicts between Biodiversity conservation and human activities in the central and eastern European countries. *Journal of the Human Environment*, 36 (7), 545-550.
- [97] Cherp, A., 2001. "Environmental assessment in countries in transition: Evolution in a changing context." *Journal of Environmental Management*, 62(4): 357-374.
- [98] Kľuvánková-Oravská, T., Chobotová, V., Banaszak, I., Slavikova, L., Trifunovova, S., 2009. From government to governance for biodiversity: the perspective of central and Eastern European transition countries. *Environ. Policy Gov.*, 19, 186-196.
- [99] Börzel, T.A., Buzogány, A., 2010. Governing EU accession in transition countries: The role of non-state actors. *Acta Polit.*, 45 (1-2), 158-182.
- [100] Sarvašová, Z.; Salka, J.; Dobsinska, Z., 2013. Mechanism of cross-sectoral coordination between nature protection and forestry in the Natura 2000 formulation process in Slovakia. *Journal of Environmental Management*, 127, 65-72
- [101] Bonsu, N. O., Dhubháin, Á. N., O'Connor, D., 2015. *Understanding forest resource conflicts in Ireland: A case study approach*. *Land Use Policy* (in press, corrected proof available online 19 November 2015).
- [102] Blondet, M., Koning, J.D., Borrass, L., Ferranti, F., Geitzenauer, M., Weiss, G., Turnhout, E., Winkel, G., 2017. Participation in the implementation of Natura 2000: A comparative study of six EU Member States. *Land Use Policy*, 66, July 2017, 346-355. doi.org/10.1016/j.landusepol.2017.04.004
- [103] Sotirov, M., Deuffic, P., 2015. United in diversity? Typology, objectives and socio-economic characteristics of public and private forest owners in Europe. In: Živojinović, I., Lidestav, G., Feliciano, D., Hujala, T., Lawrence, A., Weiss, G. eds. *Concepts, methods and findings in forest ownership research in Europe*. EFCEEC-EFISEE Online Research Report. University of Natural Resources and Life Sciences (BOKU). Vienna, Austria, 25-36. [http://www.ipoles.sk/vy-nales/publikacie/space/2015/Mid-term%20PROCEEDINGS%20of%20the%20COST%20Action%20FP1201%20FACESMAP.pdf]

- [104] Deuffic, P., Sotirov, M., Arts, B., 2016. "Your policy, my rationale". How individual and structural drivers influence European forest owners' decisions. *Land Use Policy* (accepted, in press).
- [105] Sotirov, M., Cappellmann, L., Riemer, A., Eriksson O., 2013. *Implementing the vision of sustainable forestry through integrated forest management?* INTEGRAL First Policy Brief. www.integral-project.eu
- [106] Paavola, J., 2004. Protected Areas Governance and Justice: Theory and the European Union's Habitats Directive. *Environmental Sciences*, 1 (1), 59–77.
- [107] Gil, A., Calado, H., Costa, A.C., Bentz, J., Fonseca, C., Lobo, A., Vergilio, M., Benedicto, J., 2011. A methodological proposal for the development of Natura 2000 sites management plans. *J. Coast. Res.*, 64, 1326–1330.
- [108] Visser, M., Moran, J., Regan, E., Gormally, M., Skeffington, M.S., 2007. The Irish agri-environment: how turlough users and non-users view converging EU agendas of Natura 2000 and CAP. *Land Use Policy*, 24, 362–373.
- [109] Cavin, L., Mountford, E., Peterken, G., Jump, A.S., 2013. Extreme drought alters relative competitive dominance within and between species in a mixed forest stand. *Funct. Ecol.* 27, 1424–1435.
- [110] Winkel, G., Jump, A., 2014. Perspectives on forest conservation. Building evidence at the frontier between policy and conservation science. *Biodivers. Conserv.*, 23 (14) 3359–3372.
- [111] Alagador, D., Cerdeira, J.O., Araujo, M.B., 2014. Shifting protected areas: scheduling spatial priorities under climate change. *J. Appl. Ecol.*, 51, 703–713.
- [112] Young, J., Pichards, C., Fischer, A., Halada, L., Kull, T., Kuzniar, A., Tartes, U., Uzunov, Y., Watt, A., 2007. Conflicts between Biodiversity conservation and human activities in the central and eastern European countries. *Journal of the Human Environment*, 36 (7), 545–550.
- [113] EC, 2004. *Financing Natura 2000. Communication from the Commission to the Council and the European Parliament*. 15.7.2004 COM (2004) 431. Brussels: European Commission.
- [114] EC, 2011. *Investing in Natura 2000: Delivering benefits for nature and people*. Commission staff working paper – Financing Natura 2000. Brussels: European Commission.
- [115] Votsi, N.E.P., Kallimanis, A.S., Mazaris, A.D., Pantis, J.D., 2014. Integrating environmental policies towards a network of protected and quiet areas. *Environ. Conserv.*, 41, 321–329.
- [116] Roggema, R., 2009. *Ecology, In Adaptation to climate change: a spatial challenge*. Springer: Netherlands, 211–251.

Best practice in Natura 2000 implementation in forests

Lead author: Metodi Sotirov

Contributing authors: Mareike Blum, Andreas Schabel, Carol Grossmann, Sebastian Schmack

4.1 Best practice examples of Natura 2000 implementation in forests in EU-28

4.1.1 Introduction

The main aim of this section is to identify and review best practice examples of Natura 2000 implementation in forests across the EU-28. First, we provide an EU overview of implementation experiences, including many specific examples from a variety of countries. This broad and exemplary overview is based on a systematic search, coding and analysis of 63 best practice cases from 18 different EU countries as found in three policy reports (Table 6). Underlying these best practice cases are regional or national regulations and guidelines enacting the EU Nature Directives as well as local scientific studies which are usually published in national languages. It goes beyond the scope of the report to review all available knowledge in national languages.

This EU overview and the short country examples are complemented by a compact but in-depth description of the policy and management approach of the German federal state of Baden-Württemberg to implementing Natura 2000 in forests. This approach has often been reported to be an example of best practice. The narrative of this case study deals with policy, legal and economic aspects of domestic implementation as well as with the designation and management of forest habitats and species. As such, it addresses most topics that the present report deals with. Further details about other case studies can be found in the three policy reports or elsewhere throughout this chapter and the whole report.

Table 6. Policy reports describing best practice examples of Natura 2000 implementation in forests.

Title Data Source	Author, Year	Number of relevant case studies	Main contents
LIFE and European forests [1]	European Commission 2006	12	Case studies of forest and forestry projects co-financed by the EU's funding instrument LIFE-Nature aiming to restore, preserve or halt the decline of forest biodiversity in Europe in the context of Natura 2000.
NATURA 2000 management in European State Forests [2]	EUSTAFOR 2013	21	Cases of best practice where State Forest Management Organisations implemented Natura 2000 in forests.
Natura 2000 and Forests. Part III – Case studies [3]	European Commission 2015	30	Good practice experiences and examples from different Member States in managing forests in Natura 2000.

4.1.2 Best practice examples: an EU-28 overview

Around 60% of the 63 case studies under review originate from five EU countries: the UK (N=9), Germany (N=8), France (N=7), Austria (N=6), and Sweden (N=6). Each of them provide between six and nine cases of best practice. The reported cases largely reflect experiences with domestic implementation of Natura 2000 in these particular EU countries. Ireland presented four cases of best practice whereas Belgium is covered by three, Denmark and Finland each by two. Almost 10% of the cases originate from Southern European countries: three from Spain, two from Italy and one from Greece. The same holds for Eastern European countries: three cases originate from Latvia, two from the Czech Republic and from Slovenia respectively, and one from Bulgaria, Poland and Slovakia each (Figure 2). The reported best practice experiences from these 18 EU Member States cover almost all terrestrial bio-geographical regions. This reflects their relevance for the topic of Natura 2000 in forests.

No best practice examples in the three main data sources are reported for the remaining 10 EU Member States: Croatia, Cyprus, Estonia, Hungary, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, and Romania. The reasons for this are largely unknown.

Three case studies have been described twice in two of the three documents. They include the case of old trees and deadwood management in South-Western Germany (2013 and 2015), the Ecoforest case study in Latvia (2013 and 2015), and the Bosco Fontana case study in Italy (2006 and 2015).

It is interesting to note that three case studies from Ireland, Slovakia and the UK explicitly contain narratives about conflicts during the implementation of Natura 2000 in forests (Box 4).

Only 15% (10 out of 66) of the reviewed case studies report good examples in the **formal implementation** of Natura 2000 in forests (including legal aspects and the designation of Natura 2000 sites). Almost 85% of the cases (56 out of 66) refer to experiences with **practical implementation**.

As such, the majority of case studies mostly refer to *procedural measures* of practical implementation such as developing guidelines, collecting information and preparing management plans for Natura 2000 in forests. In a few cases (Denmark, Ireland, UK), guidance and procedures relating to appropriate assessments of the ecological impacts

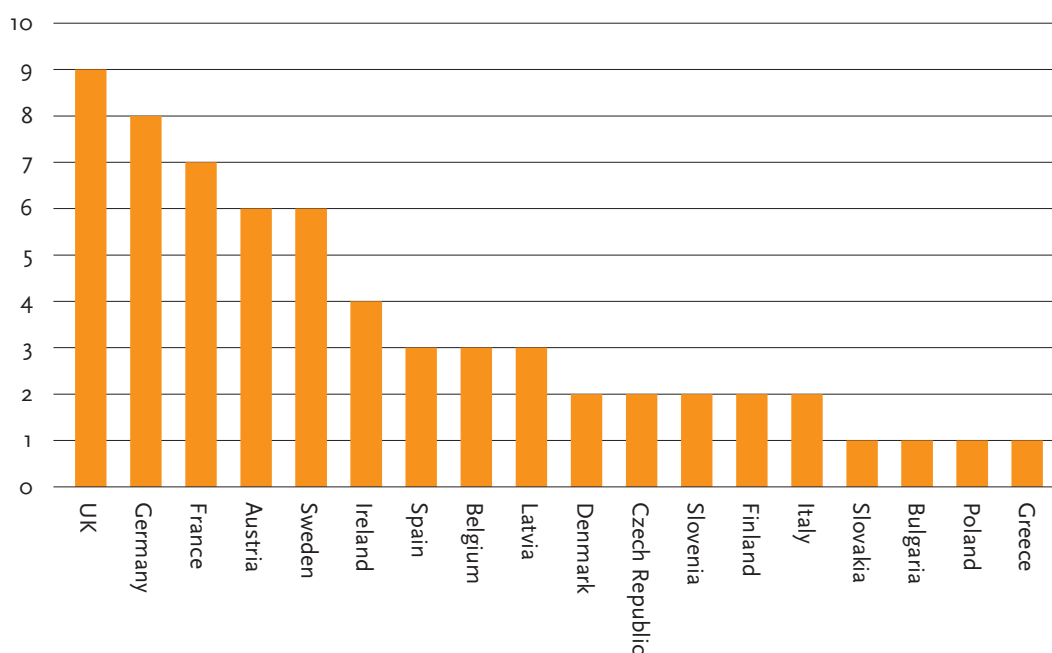


Figure 2: Implementation of Natura 2000 in forests: number of best practice cases by country

(e.g., protection of the hen harrier and the freshwater pearl mussel) by land use and forestry projects are also highlighted as best practice examples. Fewer cases summarise the experience with *substantive measures* of practical implementation through *on-the-ground management* of Natura 2000 in forests. These measures include restoration and conservation of habitats and species as well as sustainable forest management practices. 8% (5 out of 66) of all reported cases first explain the planning and management approach and then provide examples of practical measures for application. This category is referred to as “theory applied to practice” (Figure 3). Accordingly, the relevant cases outline two basic decisions: (i) integration of Natura 2000 in specific forest management planning; or (ii) preparation of general Natura 2000 management plans that contain sections referring to forests.

The case studies mainly describe best practices in relation to Natura 2000 **forest habitats**. 28% (18 out of 63) of all cases report management planning for forest habitats and 20% (13 out of 63) deal with **on-the-ground practices for forest habitats**. About 17% (11 out of 63) of all cases refer to **management planning** and 3% (two out of 63) to **practical management for both forest habitats and species**. In contrast, **management planning for forest species** is reported in only 5% (3 out of 63) of all cases. Similarly, only 6% (four out of 63) of all cases deal with **on-the-ground management practices for forest species**. 8% of all cases do not fit into any of the aforementioned categories. Half of them relate to forest species and half of them relate to forest habitats.

Most of the cases on **forest habitat management planning** deal with the processes of setting Natura 2000 goals and *conservation objectives*. They highlight *the importance of the involvement of and cooperation with various stakeholders, landowners and forest owners as well as coordination between public agencies and other state organisations as main factors of success*. In some cases, other specific factors that facilitate the process are mentioned.

Box 4. Case studies with reported conflicts in the implementation of Natura 2000 in forests.

Slovakia

The national forest authorities and state forest company report a substantial conflict with different interest groups, especially after there were bark beetle attacks in spruce-dominated forests following damaging storms. The main issue was that timber harvesting through sanitary fellings, a traditional forestry practice applied to respond to and/or minimise the risk of damaging storms, was hindered by the strict nature conservation regime in the affected Natura 2000 forest sites. In contrast, nature conservation authorities and environmental NGOs viewed the storm events as opportunities for the spruce-dominated forests to become shaped by natural processes such as regeneration and succession dynamics towards beech and/or mixed forests. The latter was seen as benefitting both biological diversity in, and climate resilience of, Natura 2000 forests and surrounding forest stands.

Ireland

The Irish forest company criticised poor forest owner involvement and poor consultation processes during the domestic implementation of Natura 2000 and the species protection regime aimed at protecting a bird of prey (hen harrier, *Circus cyaneus*). The company claimed that forestry operations such as timber harvesting and afforestation were banned on very unclear and disputable grounds. On the other hand, environmental authorities and NGOs referred to scientific and expert information justifying the designation and protection measures.

Scotland, United Kingdom

The Glenmore Forest in Scotland, UK usually attracts many tourists. Conservation groups complained about possible disturbance of the capercaillie (*Tetrao urogallus*), a woodland grouse, as result of public access to the forest. According to Forestry Commission Scotland, conservation groups tried to use Natura 2000 to justify their request to contain public access to the forest. The Forestry Commission perceived this as a considerable management challenge and held on to its principle of public access. As a result of this controversy, Scottish Natural Heritage, the competent authority for managing forest recreation, suggested extending the Natura 2000 designation to the Inshirach forest, which is located in another region with similar bio-geographical conditions, but without large rural communities nearby and less popular among tourists. However, extending a Natura 2000 forest site would have required an appropriate assessment as well as additional consultation, planning and administration efforts, which the Forestry Commission Scotland sought to avoid.

These include *securing funding for professional forest habitat management (Slovenia) and the availability of compensation payments for non-state forest owners (France, Sweden)*. As for management planning for forest species, the development of a hermit beetle strategy (Sweden) is reported as a good practice example. Setting Natura 2000 objectives, a Green Annexes management tool (France) and contracts providing compensation payments (France) are highlighted as further good practice examples for management planning and practical measures for both forest habitats and species.

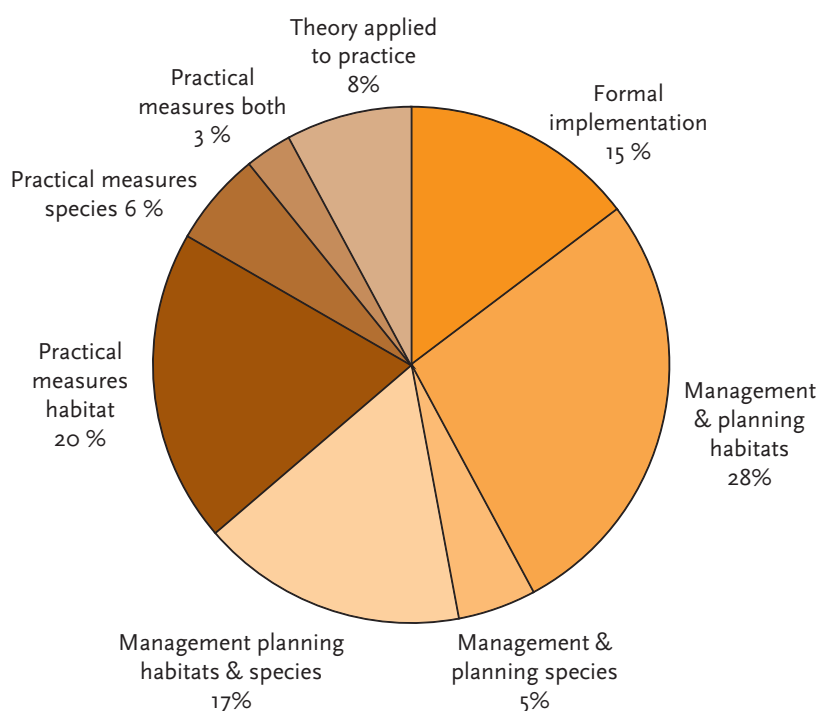


Figure 3: Best practice examples of Natura 2000 implementation in forests: by topic

Examples of good practice in on-the-ground **forest habitat conservation measures** include *leaving dead wood* (Austria, Finland, Germany, Italy, Poland, Sweden), *restoration of specific forest habitats* (Belgium, Greece, Italy, UK), *renaturation of bog woodland* (Germany), *controlled burning with the aim of opening up forests in order to promote more biodiversity in coniferous-dominated forests* (Sweden) and *removal of invasive tree species* (Italy, UK).

Almost half (12 out of 26) of the case studies of on-the-ground **forest species conservation measures** address forest-dwelling and/or forest-dependent birds (e.g., capercaillie, grouse, owls, woodpeckers and eagles). Bats and beetles are mentioned fewer times as main conservation targets. Some cases cover conservation activities benefiting single animal species such as lynx, bear, crayfish, newt, toad, and some plant species such as mosses. *Good practices to protect forest birds include installing nesting boxes, opening forest areas, creating resting places and running awareness raising programmes.* For example, in the Czech Republic, nature conservationists take care of around 2,000 nest boxes for forest birds financed by environmental NGOs. In the Black Forest, located in South-Western Germany, dense forest areas were opened through forestry to improve the habitat of the capercaillie and the hazel grouse (*Tetrastes bonasia*). While forest bird habitat restoration methods varied considerably depending on the individual forest managers, capercaillie habitat management and timber use seem to have been integrated in a synergistic way (“win-win”). In a similar way, *resting places for capercaillie were designated and/or suitable habitats created by opening forest areas through forestry in France.* These forest conservation activities are implemented through awareness raising and compensation payments that could help overcome possible trade-offs for forest owners (“win-lose”). *In Sweden, the hermit beetle is protected by establishing a nature reserve and large-scale restoration. In order to address trade-offs for forest owners (“win-lose”), compensation payments are made available.*

Table 7. Type and number of main initiators of best practice examples of Natura 2000 implementation in forests.

Main initiators (Types of lead actors)	Number of cases with a lead initiator	Number of cases with a lead initiator and partners	Examples of contributing partners	Total number of cases per main initiators
Nature conservation administration	16	4	State forest enterprise, private forest owners, industrial forest owner	20
Forestry administration	17	2	Park authority, nature conservation NGO, university	19
Nature and forestry administrations (<i>two initiators</i>)	1	1	National park and wildlife service	5
State forestry enterprise (state forest managers)	15	2	Environmental NGOs	17
Regional administration (eg county council)	n/a	2	Nature conservation NGOs, state forestry enterprise	2
Research organisation	n/a	1	Religious entity, state forest service	1
Environmental NGOs	0	0	n/a	0
Private forest owners	0	0	n/a	0
No information/unclear	n/a	n/a	n/a	1
			Total:	63

Another good example of on-the-ground measures that promote both **forest habitat and species conservation management** can be found in **Rothwald in Austria**. *This particular case study refers to the designation of a strict forest reserve for the main purpose of nature conservation in the context of Natura 2000. The establishment of this forest set-aside was enabled by addressing trade-offs (“win-lose”) for the private owners of this forest area through financial compensation.*

Good practice examples of “**theory applied to practice**” include a concept of *integrative forest management that guides the retention of some old trees and dead wood in managed forests in South-Western Germany*, as well as *the conservation of a newt habitat in Scotland, UK*. Further examples refer to *management plans and conservation measures to protect birds (black stork, kites, eagle, owls) in Poland through segregative measures such as the designation of protection zones around nesting sites or setting aside fallen trees within breeding sites*. A plan to protect birds and bats in Spain, a management approach towards forest use compatible with black vulture conservation in Spain, as well as a beetle protection management strategy in Austria are further examples of good practices.

Table 7 provides an overview of the **main initiators of best practice examples** of Natura 2000 implementation in forests. It is evident that it is *mainly state actors, such as nature conservation administrations, forestry administrations and state forestry enterprises, that have initiated and implemented most of the best practice*. In a few cases they have worked either with each other or with partners from environmental NGOs, nature conservation services, private forest owners or others (see also Box 5).

Table 7 shows evidence about the types of actors who have not been active initiators, at least not among the 66 case studies reviewed. The results show that private actors, such as environmental NGOs and private forest owners, were not among the main initiators of the best practice case studies reviewed in this study. Research organisations and regional/local governmental administrations are mentioned only a few times as

Box 5. Examples of good practices of Natura 2000 in forests in Ireland

There is strong engagement in Ireland between the Forest Service and the National Parks and Wildlife Service on Natura 2000 issues, and good examples of developed procedures on the ground. In this context there are several good examples relating to the management of forests within Natura 2000 sites, including both “qualifying interest” native woodlands and commercial forests.

Examples include the evolution of the *Forest Service Appropriate Assessment (AA) Procedure*, now embedded in the *licensing system* for afforestation, felling, forest roading and aerial fertilisation and setting out how AA Screening and Appropriate Assessment are both conducted. The *interaction between ecologists and foresters* and greater exposure of ecologists to forest management in Ireland is very strongly pursued under the auspices of the *Native Woodland Scheme*. Various related initiatives (see below) promote a higher level of *professional understanding and the integration of expertise* in relation to native woodland creation and management, with a highly beneficial knock-on impact on forest management in Ireland generally. The Native Woodland Scheme itself, which funds the creation of new native woodland and the restoration of existing native woodland (including conversion from conifer forest), has evolved since 1999 with *input from foresters and ecologists from key bodies within the public, private and environmental NGO spheres*. The scheme is underpinned by extensive *training delivered by a team of foresters and ecologists*, and this has trained over 800 practitioners - again, both foresters and ecologists – in native woodland ecology and management. Furthermore, a wide range of *publications* have been produced, again jointly aimed at foresters and ecologists, setting out expert guidance on a variety of issues. All of this represents a significant effort within Ireland towards promoting forest management practices among ecologists as well as ecological considerations among foresters. This would make a worthwhile example of good practice to consider in future work.

the main initiators of best practice examples. However, these findings have to be treated with caution given the possible geographic limitations and potential bias in the data sources reviewed.

Elsewhere in this report (Chapters 3 and 5), our results show that (private) forest owners, environmental NGOs and researchers have often been identified as the main stakeholders affected by, or interested in, Natura 2000 implementation. *Their active involvement and cooperation in the best cases might have been triggered by policy learning effects between them as former supporters and challengers of Natura 2000 in forests* (Box 5). This newer spirit of cooperation probably goes back to a mutual learning across the involved parties based on the recognition that cooperation between them can result in socio-economic acceptability of the ecological rationale and objectives of Natura 2000 in forests.

References

- [1] European Commission, 2006. LIFE and European forests. Office for Official Publications of the European Communities: Luxembourg.
- [2] European State Forest Association (EUSTAFOR), 2013. NATURA 2000 management in European State Forests. Brussels: Belgium.
- [3] European Commission, 2015. Natura 2000 and Forests. Part III – Case studies, Technical Report 2015 – 089. Office for Official Publications of the European Communities: Luxembourg.

Case study: Natura 2000 implementation in forests in Baden-Württemberg, Germany

Authors: Andreas Schabel, Sebastian Schmack, Carol Grossmann

4.2.1 Introduction

In Germany, nature conservation and forest management come under the responsibility of the federal states (*Bundesländer*). Accordingly, Natura 2000 implementation approaches differ substantially within the country. This case study describes the implementation of Natura 2000 in forests in Baden-Württemberg and addresses the central questions of the present report: relevant (domestic) framework conditions, the political and practical aspects of Natura 2000 implementation in forests (Chapter 3), its effectiveness (Chapter 5), economic aspects of Natura 2000 (Chapter 6) and, briefly, biodiversity monitoring issues (Chapter 2). This exemplary case of an integrative approach has been highlighted by the European Commission in its recent guideline document on Natura 2000 and forests [1]. Baden-Württemberg's implementation strategy should therefore be considered as a positive example within the European context, but not representative of Germany or the EU-28 as a whole.

After initial delays and additional efforts (Chapter 3), Baden-Württemberg only completed the nomination of its Natura 2000 sites in 2008. Since proposing them to the European Commission, Baden-Württemberg has made progress in preparing comprehensive Natura 2000 management plans. By 2020, detailed management plans are expected to be available for all its 302 Natura 2000 sites.

Managed ecosystems and cultural landscapes cover almost all of Baden-Württemberg. Agricultural lands and forests benefit from favourable natural and geographical conditions in South-West Germany. Natura 2000 sites are closely embedded into surrounding land use systems and are relatively small compared to the European average. 38% of Baden-Württemberg's territory is forested and 97% of these forests are actively managed, mainly for timber production, nature conservation and recreation. About 27% of all forest area is designated as Natura 2000 sites, while about 60% of the Natura 2000 sites are forested. 75% of all Natura 2000 forests are owned by the federal state and municipalities.

Public forests in Baden-Württemberg, i.e., 64% of all forest [2], follow the established general concept of “close-to-nature” forest management (*Naturnahe Waldwirtschaft*). This concept includes a variety of integrative management approaches aimed at providing multiple ecosystem goods and services such as timber production, nature protection and biodiversity conservation, and recreation opportunities within the same forest areas. The aim is to provide multifunctional and sustainable forests for society [3], and

facilitate reaching the Natura 2000 conservation targets. Nevertheless, *it took about 15 years to draft the majority of the Natura 2000 management plans, in coordination with the many individual and institutional stakeholders in a complex land-use system. Looking ahead, it will take yet more years to implement all the management measures.*

The most important forest habitats and species addressed by the EU's Habitats Directive in Baden-Württemberg are beech and oak forest stands, but also acidophilous montane spruce forests. Most sensitive are the bog woodlands and sarmatic steppe pine forests. The most important forest species addressed are bats, woodpeckers, hole-nesting and aerie-breeding birds, as well as xylobiotic beetles from about 60 protected species. Some of the species are endangered and occur only locally. Special efforts are needed to restore these rare species to a favourable conservation status.

4.2.2 Responsibilities

In Germany, the legal responsibility for the implementation of Natura 2000 lies with the federal states' nature conservation authority, relying on closely coordinated support by the state forest administration. The state forest administration in Baden-Württemberg is responsible for:

- Mapping (demarcation and description), evaluation, and appraisal of forest habitats.
- Formulating conservation measures.
- Monitoring of forest habitat types.
- Developing concepts for the implementation of forest-related management plans.
- Consulting private and municipal forest owners.
- Compensation of financial losses for private forest owners.

4.2.3 Strategy

Natura 2000 implementation in forests follows an integrative management planning approach where conservation objectives and measures are fully included in regular forest management plans. Wherever forest management plans are not mandatory (e.g., in small-scale private forests), forest enterprises are recommended to develop individual conservation concepts. Thus, forest owners have the opportunity to participate in the formulation of implementation measures. Since some forest owners still have reservations about nature protection, it will need more efforts and incentives to convince them of the benefits of Natura 2000. The aim is to implement Natura 2000 management plans in concordance with all other forest management activities and thereby (i) to reach all conservation objectives; and (ii) to burden forest enterprises as little as possible. This implementation approach relies heavily on the individual responsibility of forest owners and is based on the political will to limit regulative measures to a minimum.

4.2.4 Conceptual implementation

Natura 2000 management plans describe and appraise relevant species and habitats occurring in the area. Necessary conservation objectives and measures are developed and depicted. Implementation details are entrusted to the forest managers. Natura 2000 conservation measures in forests are implemented within a "four pillar concept" summarised as follows.

Pillar 1: management of Flora Fauna Habitat (FFH) forest habitats

Management of Natura 2000 habitats in Baden-Württemberg's public forests follows the silvicultural guidelines "WET-RL" [3], which were fundamentally revised in 2014 to conform to the EU's Habitats Directive. Consequently, forest management following these guidelines does (in most cases) not contradict Natura 2000 conservation objectives: forest management measures may not diminish (i) the area of a specific forest biotope; (ii) the amount of deadwood and habitat trees; and (iii) the conservation status of the forest habitat. These general silvicultural guidelines apply especially to FFH beech and oak forests as they favour a dynamic management approach. *This is not a static condition to be maintained, like the conservation of a specific beech old-growth forest, but seeks to keep the percentage of beech-old growth in a certain forest area.*

Pillar 2: care for special habitats

All other "special habitat" types, such as alluvial forests, are *legally protected forest biotopes*. Conservation measures have to follow the biotope care guidelines [4]. These guidelines were also revised in accordance with Natura 2000 conservation objectives. Management measures in these biotopes, such as timber logging operations, also have to follow the *WET-RL guidelines*.

Pillar 3: management of species' habitats

Many forest species rely on *deadwood and (old) habitat trees with specific micro structures*. A specific Old Trees and Deadwood Concept [5] strives for permanent regional interconnectivity of these structural habitats. Groups of up to 15 (habitat) trees and whole forest stands (1 to 10 hectares in size) are taken out of management, inventoried and mapped in detail. The Old Trees and Deadwood Concept is subject to annual controlling. Condensed management guidelines for forest enterprises are available for all relevant species listing the conservation objectives, suitable conservation measures, as well as supportive or detrimental impacts of forest management measures.

Pillar 4: Care for specific species

Special care strategies are applied to all Natura 2000 species which occur in forests but do not rely on tree structures, such as the yellow-bellied toad or the nightjar. *Respective forest areas are defined by experts working with the forest enterprises*. Forest management planning then takes over the localised conservation measures.

4.2.5 Economic restrictions

Forest enterprises fulfilling Natura 2000 conservation objectives are experiencing **additional management expenditure and opportunity costs**.

Additional expenditure occurs primarily due to higher administrative efforts, such as planning timber logging operations and controlling compliance with Natura 2000 management plans.

Opportunity costs incur mainly as a consequence of non-utilisation obligations. The most relevant economic factor is the specification of silviculturally eligible tree species. In Baden-Württemberg, this usually implies a reduction in the number of conifers in beech forest habitats. *Restrictions are found in almost all Natura 2000 management plans*

and across all forest biotopes, even though the target tree species are already present in most of these forest areas. Since the economic impact of implementing Natura 2000 in forest enterprises is calculated against the status quo, the figures stated below do not reflect the opportunity costs of a potential forest conversion towards more market-oriented timber species. Other Natura 2000 management restrictions beyond Baden-Württemberg's regular close-to-nature management include e.g., forest set-asides (areas under total protection; locally the most severe restriction), the prolongation of timber harvest rotation periods, extensification of forestry towards permanent forest cover with multi-leveled forest structures, and maintaining individual (old) habitat trees and deadwood. The severity of these restrictions differs widely according to the tree species and their site index [6].

Average timber production in Baden-Württemberg's total forest area is 7.3 m³/hectares/year. Based on exemplary management plans and averaged non-utilisation obligations, timber production in Natura 2000 forests is *projected* to be reduced by 0.4 m³/hectares/year to an average of 6.1 m³/hectares/year. Taking into account lower forest growth increment, divergent assortment of timber products and varying timber prices for different tree species, the timber production value in Natura 2000 forests in Baden-Württemberg *would* be reduced, on average, by about 30% to 117€/hectares/year, equivalent to about 50€/hectares/year. For the state of Baden-Württemberg these figures *would* result in a difference of over €-11m per year or -3.9% of all revenues from forestry [6].

It can hence be concluded that *the economic consequences of implementing Natura 2000 are moderate for the forest sector in Baden-Württemberg and do not threaten the economic sustainability of forest management*. Nonetheless, the resulting opportunity costs reduce the economic potential of the forest sector. *The average reduction in timber production may reach a magnitude where individual forest enterprises with larger Natura 2000 conservation sites would be seriously and detrimentally affected*. Natura 2000 management plans therefore aim to reflect opportunity costs. These could be reduced substantially if economic considerations were incorporated in the designation of Natura 2000 areas and conservation measures. *The underlying question to address is whether conservation objectives can be achieved by limiting restrictions to less productive forest stands while retaining timber-productive forest sites with no, or at least less, severe nature conservation restrictions*.

4.2.6 Funding of Natura 2000 measures

In **state forests**, the habitat and species conservation measures are obligatory. Funding is provided by the state and opportunity costs are consciously accepted.

In **municipal forests**, conservation measures are also obligatory. Still to be resolved is the question of whether or not municipalities will be reimbursed for their losses and/or increased expenditures by the state.

Private forest owners are requested to adapt their forest management plans to Natura 2000 conservation policy and to cooperate, especially in maintaining habitats of species. They are offered financial compensation by the state at a lump sum of €50 per hectare a year to cover average direct expenditures and opportunity costs. Means to support specific conservation measures for Natura 2000 species also exist, but the financial incentive and uptake is currently rather low.

4.2.7 Performance monitoring

The Forest Research Institute of Baden-Württemberg (FVA) systematically collects data concerning the condition and development of forest habitats, maintaining a specific sampling grid. Every six years a report on the conservation status of forest habitats and respective development prognoses is provided to the Institute for Environment, Monitoring and Nature Conservation of Baden-Württemberg (LUBW).

4.2.8 Challenges

The bio-geographic, forest policy and economic starting conditions in Baden-Württemberg are generally favourable for an effective implementation of Natura 2000. It is believed that by using the integrative approach detailed here to implement Natura 2000 it is possible to achieve a high level of acceptance by landowners and to minimise conflicts. However, the participatory aspects and effectiveness of this approach appeal to the good will of the stakeholders and require the building up and mobilisation of their capacities. Much effort is required to communicate effectively with all stakeholders.

More appropriate financial incentives for selected target groups, especially private forest owners, need to be developed as such incentives are considered indispensable to encourage engagement in Natura 2000. On a local management level, those responsible still often lack an understanding of how Natura 2000 should work and what to actually do to support its implementation. More training services need to be developed and applied. Currently, the staff of the state forest administration and the nature conservation service in Baden-Württemberg does not have the necessary capacity to cope with all these challenges. More employees, especially in forest enterprises, are necessary to boost the implementation of Natura 2000 in forests. The main conclusion – and this may be true for most EU Member States – is that *an appropriate implementation of Natura 2000 in forests in Baden-Württemberg is progressing but it needs more capacity and resources in terms of better communication, more staff, more money and more time.*

References:

- [1] European Union, 2015. Guidance document “Natura 2000 and Forests Part I - III”. S. Leiner und F. Kremer, European Commission, DG Environment Ubit B.3 – Nature. EC: Brussels.
- [2] Kaendler, G., Cullmann, D., 2014. *Der Wald in Baden-Württemberg - Ausgewählte Ergebnisse der dritten Bundeswaldinventur*. Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg. www.forstbw.de/...pdf/wald/Bundeswaldinventur_3_Auswertung_BW_Gesamt.pdf
- [3] ForstBW, 2014. *Richtlinie Landesweiter Waldentwicklungstypen*. G. Wicht-Lueckge, Fachbereich Waldbau, Waldschutz und Klimawandel: Stuttgart.
- [4] ForstBW, 2017. *Kartierung Schutz und Pflege von Waldbiotopen, 4. Pflegehinweise zu einzelnen Biotoptypen*. MLR: Stuttgart. (in preparation)
- [5] ForstBW, 2015. *Alt- und Tothholzkzept Baden-Württemberg*. Landesbetrieb ForstBW: Stuttgart.
- [6] Schmack, S., Aichholz, R., Hartebrodt, C., 2013. *Naturschutzfachliche Einschränkungen der Forstwirtschaft - Ökonomische Katastrophe oder Bagatelle?* Schriftenreihe Freiburger Forstliche Forschung, Heft 97. <http://fva-bw.de/publikationen/index3.html>

Summarising conclusions

What are the best examples of good practice?

Our review finds several good examples of Natura 2000 management practices in forests. Their basic elements are summarised here, together with a somewhat critical discussion in view of the implementation processes described earlier.

- *Scientifically supported work towards Natura 2000 management planning and setting of conservation goals:* this can be implemented either through integrating Natura 2000 objectives into forest management planning or integrating forest management aspects into overall Natura 2000 management plans.
 - The fact that this planning phase is still work in progress 25 years since the adoption of the Habitats Directive, and after 15 years of practical implementation of Natura 2000, testifies to the need to take sufficient time for designation, planning, and putting goals into action.
- *Administrative coordination as well as cooperation between public agencies with forest owners, land users, and stakeholders:* main elements include cross-sectoral participation and active involvement of both regulatory agencies and target groups in professional forums.
 - This experience shows that lessons have been and have to be learned from the evidence of the initial resistance of landowners and forest users. It indicates the need to consider socio-economic aspects when implementing the ecological scientific rationale of Natura 2000 in forests and other land uses.
- *Design and provision of compensation measures:* they can include compensation payments or property valuations and swaps.
 - This experience tells us that Natura 2000 implementation in forests is perceived as a win-lose situation from the socio-economic point of view of forest owners and land users (biodiversity conservation/rights of nature v timber production/property rights). It suggests that Natura 2000 needs to be managed by addressing and/or changing the incentive structure (cost-benefits-calculations and/or cognition) of forest owners and land users through funding and/or public recognition, for example.
- *Implementation of Natura 2000 in forests can be done either through integrative forest management (e.g., close-to-nature forestry; selective cutting; retention forestry) and/or segregative forest management (setting forest set-asides).*
 - This experience tells us that solutions for Natura 2000 implementation in forests largely depend on the natural, socio-economic and policy/management contexts and traditions in which the specific cases are located, as well as the conditionality of forest management practices on the conservation objectives of the Natura 2000 sites. It also tells us that neither approach can be regarded as “right” or “wrong” in general. On the contrary, each can be regarded and implemented as “appropriate”, or not, in any given local/cross-national/national context.

Further summarising conclusions from the EU-28 review of best practice examples can be drawn with a reference to the key words used. For **forest habitats**, these include oak trees, deadwood, and restoration. This evidence is telling us that *the most successful examples of Natura 2000 forest habitat management do not take place in commercially managed forests (which are coniferous or mixed forests), but may be in ecologically degraded and/or valuable forests*. Still, it also tells us that *deadwood is increasingly considered by forestry*, maybe not least as a reaction to the pressure by EU institutions, domestic environmental agencies and groups. Still, it remains an open question as to how much and what type of wood is left as deadwood in what kinds of forests. Overall, it seems that *conservationists and forest managers have learned to work together*, mainly in public forests where the majority of best case studies can be found.

Key words of best practice examples for **forest species** include nesting trees for birds, controlled burning, capercaillie management, and conservation of bugs and bats. It seems that *good examples of forest species management under Natura 2000 have mainly been driven by conservationists' interests and/or by "win-win" co-existence of species conservation and timber production* depending/contributing to more open habitats and/or supported by payments. This evidence can also signal the *increasing interest of forestry to integrate biodiversity conservation*. Still, the lower number of species-related best practice case studies might tell us that this topic remains a challenge across the EU-28.

Formal implementation as well as impacts and evaluations are among the topics that are represented the least in the EU-28 review of best case examples. This can be probably attributed to the history of Natura 2000 designation conflicts, as well as the still nascent state of Natura 2000 monitoring. This might also explain *the lack of strong evidence about the effects of Natura 2000 in forests*. The latter can be seen also in view of the still *very early stages of practical actions on-the-ground*.

The review is showing that the **main initiators of best practices** are state authorities responsible for nature conservation and forestry, together with state forestry enterprises. Private forest owners and environmental NGOs are only mentioned as partners in a few cases, but not as main initiators. It remains an open question whether this evidence is telling us that there is little implementation in private forests due to lack of interest and/or capacity to do so or whether this is just an artefact of the lack of information and coverage. This evidence shows that environmental NGOs are mainly involved in conservation projects related to other land uses (e.g., agriculture, water). The explanation might be that environmental NGOs have often little access to forest policy and forest lands due to the dominance of state and non-state forestry actors. This situation reflects the *early stage of practical implementation, and the ongoing focus on guidelines and procedures that are mainly driven by state actors*.

Further conclusions can be drawn from the best practice case study of the development and implementation of Natura 2000 in forests in Baden-Württemberg. It can be seen to possess a great fit to the European Commission's guidance and be exemplary in Europe for its **integrative approach**. On the one hand, the *approach incorporates administrative and supportive measures*, on the other hand it *combines production and recreation aspects with nature conservation management targets in forest ecosystems largely shaped by anthropogenic impacts and land use*. The applicability and success of this integrative approach depends on several favourable background conditions: a high percentage of public forests; a tradition of practicing close-to-nature silviculture; and the political decision to co-operate with forest owners and provide incentives, coupled with the need to address the challenges of achieving nature conservation in a very densely populated and intensively managed cultural landscapes.

The best practice case of Baden-Württemberg promises transferability only for countries and European regions with similar background conditions. Still, specific incentives and funding models developed in this context could also be seen as appropriate and exemplary for other regions dominated by private forests. Last but not least, *the integrative approach with its link to multifunctional forest management could be a promising model for other European countries to achieve their nature conservation targets in managed forests.*

Effectiveness of Natura 2000 in forests in EU-28

Lead authors: Sarah Greenwood and Alistair Jump

Contributing authors: Metodi Sotirov, Marco Marchetti, Grzegorz Mikusiński, Annemarie Bastrup-Birk, Lluís Brotons, Virgilio Hermoso, Jari Parviainen

5.1 Effects of Natura 2000 policy on forest biodiversity and ecosystem services

More than half of the sites covered by the Natura 2000 framework are forests [1]. It is therefore extremely important that we have a well-developed understanding of the impact of Natura 2000 policy and management on forest biodiversity and ecosystem services. It is equally important that the impact of Natura 2000 on forest management is well understood.

5.1.1 Measurement of Natura 2000 policy effectiveness

A central goal of Natura 2000 is to maintain or restore the favourable conservation status of the habitats and species for which the areas are designated. This means that if the status of the species or habitats is favourable in a designated Natura 2000 area, existing conditions need to be maintained and negative impacts on the site avoided or mitigated to levels compatible with the maintenance of those species and habitats. If the prevailing conditions are unfavourable for the designated habitats and species, these conditions need to be improved. The effectiveness of Natura 2000 policy can be hence defined as the extent to which its goals have been met and the conservation values of the network maintained.

The definition and methods of assessment of conservation status under Natura 2000 are summarised in Chapter 2. However, given that assessment of conservation status is a key tool by which policy success can be measured, it is important to understand that to assess effectiveness we must be able to assess change – e.g., has Natura 2000

led to improved conservation status by its own measures, or at least halted any decline overall? Two main approaches are used to investigate the ecological effectiveness of the Natura 2000 framework: “gap analysis” and “conservation status” [2]. As defined by the Convention on Biological Diversity, a gap analysis in this context is an assessment of the extent to which a protected area system meets the protection goals set by a nation or region to represent its biological diversity. It thus seeks to determine whether an ecological site network provides the necessary requirements for a species/habitat to achieve a favourable conservation status in the long term. “Conservation status” analysis is the examination of ecological conditions of habitats and species as defined in the Habitats Directive. Conservation status analysis specifically looks at whether a protected area or system of protected areas ensure favourable conservation status for given species and habitats.

Chapter 2 provides a useful assessment of the status of and trends in the conservation status of forest habitats and species under Natura 2000. This information can be used to assess the ecological effectiveness of the network. Still, limitations in the analysis of ecological effectiveness involve a lack of available and reliable data and the spatial resolution necessary to understand the impact of many small Natura 2000 sites. Limiting factors in biodiversity monitoring include a lack of knowledge and difficulties in properly assessing reference baselines [3], practical constraints such as financial resources and the inconsistency of criteria used for analysis [4]. Natura 2000 effectiveness in forest systems can be difficult to assess from an ecological perspective because succession in forests occurs over timescales that make it difficult for the effectiveness of relatively recent policy measures to be gauged. Unequal levels of research into the impact of Natura 2000 on different bio-geographical regions, Member States, habitats and taxonomic groups [4, 5] also reduces the degree to which effectiveness can be measured – despite the apparently clear framework for assessment of conservation status set out within Natura 2000 (Chapter 2). Measurement of the effectiveness of Natura 2000 as a policy is therefore limited by three key challenges: 1) *the consistency with which the impact of Natura 2000 is reported and investigated across the EU*; 2) *the consistency with which conservation status is assessed by Member States*; and 3) *the limited period for which Natura 2000 has so far been implemented*.

5.1.2 Expected and identified impacts on biodiversity

Conservation in a changing environment

Biological communities are groups of species that inhabit a particular area at a particular time due to a suite of environmental conditions, such as soil, climate and plant and animal competitors. Communities are, therefore, subject to changes in their composition and distribution as their environment changes. We have a continually improving understanding of the links between environmental conditions and the species that inhabit an area, thereby enabling us to predict how changes in habitat structure, such as those caused by adaptation to climate change impacts (e.g., species migration), reducing timber extraction or increasing deadwood volume might favour certain groups of species. However, Natura 2000 is implemented with a rather static vision of ecosystems and so the degree to which it will be able to meet its conservation objectives under changing conditions in the future remains a major question [6, 7]. Furthermore, Natura 2000 is not a system of strict nature reserves where all human activities are excluded; it is influenced by activities occurring in the areas surrounding the sites. Therefore, an

outstanding challenge for Natura 2000 planning is to integrate this complexity better in order to come up with management objectives that build on the dynamics of ecosystems in a global change context. For this, a key insight is that *we need a better understanding of the interactions between changes in climate, forest management and other direct, human-induced drivers and their effects on biodiversity.*

As an example of the challenges ahead, we can turn to the effect of wildfires and changes in fire regimes that have severe practical implications for biodiversity management in fire-prone ecosystems such as Natura 2000 sites across the Mediterranean region [8, 9]. Changes in fire suppression policies, forest management practices and vegetation encroachment in previously cultivated but now abandoned areas are key driving forces changing fire regimes and land cover dynamics. A recent assessment of the future effectiveness of current protected areas for the conservation of bird species targeted by Natura 2000 under different combinations of climate and novel fire regime scenarios in a Mediterranean region showed that the amount of suitable habitat will decrease considerably both inside and outside Natura 2000 sites. This is because of land-use change, vegetation encroachment and increases in fire occurrence and intensity and the effects of associated fire suppression management [10]. However, this decrease is expected to be lower within Natura 2000 sites, enhancing the relative importance of Natura 2000 for the protection of these conservation-interest bird species. The current Natura 2000 network across fire-prone, highly dynamic Mediterranean ecosystems will, therefore, play a key role in maintaining suitable habitats for open-habitat and forest bird species of European conservation interest. However, as the climate changes, this effectiveness may be considerably improved through the implementation of novel fire management strategies (i.e., such as relaxing criteria for fire suppression in particular conditions) that are not necessarily in line with those that have been typically implemented so far. This emphasises the key challenge of *the need for an explicit consideration of landscape-scale, long-term environmental changes when assessing Natura 2000 effectiveness in the context of global change.*

On a broader, Europe-wide scale, the effectiveness of the protected framework will also depend on it being adaptable in the face of changing climate. Model-based assessment of the stability of other protected site networks to climate changes shows that, in the future, many protected sites will lose some of the species on which the framework is based [11]. This highlights the dynamic nature of Natura 2000 sites, and the importance of a flexible and connected network that allows for the designation of new sites, and for site designation to be reassessed based on species migrations. This is, understandably, difficult to achieve, especially on private land, but by creating more Natura 2000 sites that are better connected at a landscape scale as an enabling green infrastructure, some adaptability can be built into the system [12]. A key challenge is *to build sufficient flexibility and connectivity into Natura 2000 site designation and planning processes so that habitats and species can remain sufficiently represented as species distributions change, but without undermining the protections that site designation confers.*

Direction of vegetation change within Natura 2000 sites

All forest ecosystems are subject to directional change such as continuous successional changes or non-directional changes linked to ecological processes like ageing and death of trees, competition or presence/absence of different disturbances (both natural and anthropogenic). Therefore, it is inevitable that Natura 2000 sites undergo changes in time and the direction of this change may be relevant to the conservation status of

species and habitats within those sites [13]. For example, the long-term absence of natural fires inside sites oriented to conserve habitat type western taiga may, in the long-term, wipe out fire-dependent species and lead to large structural and compositional changes in this habitat. In small, isolated Natura 2000 sites, the influence of the surrounding landscape may, in some cases, be negative for maintaining favourable conservation status due to encroachment of invasive species or edge effects (e.g., from clear-cuts or other land uses). In both cases, a larger landscape-scale approach to conservation must be attained to secure the favourable conservation status of species and habitats. A lack of anthropogenic disturbances, like grazing by domestic stock or coppicing, may lead to undesired changes (from a conservation perspective) in protected forest if these disturbances have been a fundamental component of the historic management regime that led to the present-day conservation value of the site [14].

The assessment of change in Natura 2000 sites is not easy since, on an ecological timescale, designation of these sites is recent and forest successional changes are generally rather slow. However, forest area is expanding faster within Natura 2000 sites than outside them and this expansion is more extensive in the Member States that joined the EU more recently in 2004 and 2007 [15]. This difference can be attributed to more recently abandoned open land (e.g., former arable fields) being subject to natural forest succession in these Member States in Eastern and South-Eastern Europe. In Natura 2000 sites without active management to keep the landscape open (e.g., through grazing, browsing or active removal of trees) the increase of forest area is expected to continue since forests are the major natural vegetation type of much of Europe. How these changes influence the conservation status of species and habitats may be a complex issue [16, 17], and a key challenge is, therefore, *to understand how natural forest successional processes contribute to measured changes in conservation status of Natura 2000 sites*. However, the impact of land-use change varies regionally [18], so that in some areas, instead of issues of land abandonment and associated succession, intensification of forest management creates challenges for Natura 2000 conservation [19]. For example, in the Mediterranean regions a mixture of land abandonment and intensification is occurring [18] and throughout much of Northern and Central Europe the main trend has been towards intensification of forest management [20]. *Understanding and recognising the importance of regional differences in land-use change in driving changes in vegetation is, therefore, another key task.*

The state of non-Natura 2000 forest areas within Natura 2000 sites

Many forested Natura 2000 sites incorporate some forest areas that are not designated as Natura 2000 habitat. This situation concerns mostly larger designated sites, where nationally protected forests are interspersed with undesignated intensively managed forests or early successional phases of forest resulting from previous large-scale disturbance. There is no consistency in how such areas are considered in management plans. In Sweden, for example, such forest stands are treated as Natura 2000 yet they are not included in any management plan. Given that such forests might make a significant contribution to the Natura 2000 network, their conservation status should be assessed alongside that of their neighbours, since they still provide habitat for forest-dwelling species targeted by the site conservation objectives, and may, therefore, influence population sizes in Natura 2000 sites. To our knowledge, however, there are no studies addressing the role that these forests may play in contributing to the conservation status of designated forest habitats and species.

Unequal representation of taxonomic groups

The number of Natura 2000 publications addressing different taxonomic groups is not proportional to their representation in the EU's Birds and Habitats Directives. Animal species, birds, reptiles and amphibians are clearly underrepresented, whereas insects are the most overrepresented taxonomic group. Lichens and fungi have hardly been studied from the Natura 2000 perspective and are very poorly represented in the Habitats Directive. The most commonly represented taxonomic group in the Habitats Directive, vascular plants, are also the most commonly represented research subjects. For example, out of 164 articles concerning forest environments that we assessed, 52% focused on plants, 18% on insects, 13% on birds, 5% on mammals and another 5% on amphibians and reptiles together [3].

While in some cases we can use the conservation status of one species or taxonomic group as a proxy for the conservation status of others, the validity of this approach must be based on data derived from appropriate habitats and regions [60]. Under Natura 2000, the unequal representation of different taxonomic groups, and even entire biological kingdoms of organisms, presents significant challenges to measuring effectiveness. Given that we currently lack data on many groups of organisms, a key challenge is to *identify the consequences of these data gaps for our understanding of changes in forest biodiversity and to assess the validity of proxy variables for use in conservation status assessment.*

5.1.3 Effects on conservation status of forest habitats and species according to scientific studies and expert knowledge

The first assessment report on the conservation status of habitat types and species found that only a small proportion of the habitats and species of interest were in a favourable conservation status [21]. Similarly, in the most recent State of Nature report published in 2015, the status of forest habitats and species was generally not good [22] (Chapter 2). It is challenging to establish a direct link between conservation policies and conservation status of forest species and habitats. Forest species have a general tendency to remain stable or increase in most of Europe and especially so in the Mediterranean region [23]. This positive trend has been associated with expansion of forests after large-scale land abandonment of less productive regions [24], it is general and affects areas both inside and outside of Natura 2000.

In some cases, where the effectiveness of Natura 2000 on species diversity has been recently investigated, it has been found that designated sites are no better than undesignated forest, for example for beetle diversity [25] or for bat diversity in commercially managed beech forests in Atlantic, Continental and Mediterranean Europe [26]. These studies describe multiple reasons why Natura 2000 sites are ineffective; these include inadequate coverage, poor scientific basis of management plans, a lack of effective monitoring, the short timescale of implementation; and inflexibility under changing climate and land-use conditions. However, we do have evidence in relation to birds that species included in the annexes of the EU's Nature Directives appear to be doing better than species not included, suggesting a positive effect of conservation policies on biodiversity [27, 59]. More specifically, in the last 25 years, Annex I species had more positive trends than non-Annex I species, particularly in countries that joined the EU earlier. However, within Annex I species, long-distance migrants fared significantly worse than other species, suggesting that enhanced protection for the breeding grounds alone may be insufficient for these species.

Even though we now have some evidence that species specifically targeted by the EU's Nature Directives tend to do better than other species, it is difficult to attribute these increases to a better performance of these species within Natura 2000.

The lack of evidence for an increase in biodiversity in Natura 2000 sites is likely to be partly due to the timescales involved and the lagged nature of the response of biodiversity to conservation actions. However, substantial evidence for the importance of the key indicators of habitat quality and the management implementations of Natura 2000 does exist. The established links between these indicators and biodiversity show that the concepts behind Natura 2000 are robust and mean that it is likely that, given time, the impact of Natura 2000 implementation in terms of protection and management on biodiversity will be positive [59]. For example, the abundance of deadwood, the presence of old trees and diverse forest structure are important indicators of forest habitat quality that are recognised by the Natura 2000 policy regime and are managed for in the protected areas. Deadwood is a key factor for forest biodiversity in temperate European forests [28]. Deadwood provides an important habitat for a variety of organisms such as fungi [29], birds, mammals and beetles. Forests with abundant deadwood, that varies in decomposition rate and size, have higher biodiversity [30] and are important for endangered saproxylic species [31]. As these organisms are an integral part of food webs, increasing their abundance and diversity has wider implications for forest biodiversity and function. The retention of large old trees in forested landscapes is another factor recognised by Natura 2000 designation for biodiversity conservation. As the largest living structural components of ecosystems, and also being long-lived, large trees provide necessary habitat for high numbers of species and are local biodiversity hotspots, of crucial importance [32].

Challenges from contrasting requirements of species for favourable conservation status.

Many larger Natura 2000 sites consist of a mixture of different habitats so that many species are considered in the management plans. Since the ecological niches of these species are, in the best case, only partially overlapping, in the ideal situation the management of a site should aim at finding the most optimal trade-off allowing maintenance or improvement of favourable conservation status of habitats and species. In reality, both passive management allowing natural succession, and active conservation measures, will favour some habitats or species and simultaneously harm others to a certain degree (Box 6). However, it seems that there are no clear mechanisms in overall Natura 2000 management strategy to deal with trade-offs between species requirements within a site and to allow for more explicit criteria to prioritise management of particular species in particular situations.

Different countries currently approach the problem of prioritisation in different ways. In Poland, for example, Natura 2000 standard data forms will be used to build a hierarchical system to rank all the sites from the perspective of all relevant species and habitats covered by both EU's Nature Directives (*J. Balcerzak – pers. comm.*). While this system is still in development, it aims to assist in the allocation of scarce resources available for the management of Natura 2000 sites and to assist in resolving prioritisation conflicts among species and habitats. However, ongoing problems of data quality and questions of how to integrate priorities from European, country and bio-geographic regional levels remain. In Sweden, it is expected that each site should have clearly prioritised species and habitats and that this information should be explicit in Natura 2000 management plans (*M. Lindberg – pers. comm.*). Decisions about which species and habitats should

Box 6. Trade-offs between passive and active conservation management of Natura 2000 forests

In Natura 2000 sites encompassing the Białowieża forest in Poland, there is ongoing conflict concerning the management of the part of this forest that is not covered by the national system of nature protection [33, 34]. Whereas one side of the conflict opts for mimicking (by silviculture) the natural disturbance regime in this forest (gap-phase dynamics based on ageing and death of trees forming a fine-scale mosaic of different tree ages, sizes and species composition), the other side argues for creating larger areas with forest succession (through clear-cutting). Different species (all included in Annex 2 of the Habitats Directive or Annex 1 of the Birds Directive) can be used to support the claims of both sides; some threatened thermophilic species of wood-living insect would profit from the creation of larger open areas (clear-cuts) as would birds such as woodlark (*Lullula arborea*) or European nightjar (*Caprimulgus europaeus*). On the other hand, birds such as the three-toed woodpecker (*Picoides tridactylus*) or white-backed woodpecker (*Dendrocopos leucotos*) would be much better off if the fine-scale forest management with high tree retention level were applied.

be prioritised is based on expert knowledge and opinions. While the development of an explicit framework is an advance, such prioritisation was already incorporated implicitly during the development of Sweden's Natura 2000 network.

The need for a functioning ecological network

The implementation of Natura 2000 in different EU Member States, even if done with a common goal, has been approached in a variety of ways (Chapter 3) mainly because of different natural and anthropogenic settings (e.g., land use cover, existing national level conservation areas, conservation traditions, political decisions etc) [35, 36]. This has led to a high variation in the size distribution, spatial shapes and resulting ecological connectivity of the network in the different countries [37]. In addition, many Natura 2000 sites include protected areas designated within national protection regimes with their own conservation goals and management plans. Since the management and conservation of forests may be performed in many ways depending on the conservation goals, there is a potential for conflicts between Natura 2000 sites and other designated areas. A key challenge for Natura 2000 in the future is *how to manage Natura 2000 sites across Europe as a functioning ecological network*.

Given that different types of management and natural disturbance, alongside ongoing changes in climate and land use pressure, will favour different species, the greatest efficiency and effectiveness of Natura 2000 will come through the conservation of habitats and species at the bio-geographical scale, irrespective of geopolitical boundaries. Such an approach does not require a radical rethink of the Natura 2000 policy but more coordinated and standardised monitoring with improved policy coordination and practice to ensure greater consistency in data collection, which will allow more detailed analyses of land use changes across countries and at EU scale (Box 7). Such data will also allow identification of hotspots where designation of new Natura 2000 sites and better connectivity between old and new sites will bring maximum benefit when species distributions move as our climate continues to change.

Box 7. Added value of the Natura 2000 network in a changing environment.

- The broad spatial scale of the Natura 2000 network has provided valuable and unprecedented information on species and habitats across their whole range in Europe.
- The network allows for broad understanding of various forest management options and the trade-offs between management, conservation of habitats and species and maintenance of ecosystem services.
- This scale of information can be especially useful in the face of land use and climate change as it allows for “space for time” substitutions and helps us to better predict future impacts on species, habitats and ecosystem services.
- However, inconsistency of data collection across countries and taxonomic groups currently restricts our ability to evaluate the effectiveness of Natura 2000 and to target new sites to create a functioning ecological network.

5.1.4 Effects of Natura 2000 policy on forest ecosystem services

The emergence of the concept of ecosystem services (ES) in the Natura 2000 context follows the publication of the Millennium Ecosystem Assessment Reports and mirrors a trend towards the policy and economic valuation of nature and its services fostered by the Potsdam Initiative [38, 39]. A central principle is that ES derive from ecosystem functions that depend on biodiversity, thereby necessitating the preservation or enhancement of biodiversity in order to maintain ES supply [61]. It is important to note that ES are not fully covered by the Natura 2000 network, which is mainly designed to maintain the diversity of species and habitats. However, a change in land use from a non-Natura 2000 forest to a Natura 2000 forest is likely to cause a change in service supply, for specific services as well as the complete bundle of services provided by these forest ecosystems, including trade-offs where increasing the supply of one service is linked to a decrease in supply of another.

Forest ecosystem services

Before exploring the possible trade-offs between the Natura 2000 areas and forest ES, a short conceptual introduction is given. ES are defined as the societal benefits provided by ecosystems. These can be broken down into provisioning, regulating, cultural and supporting services. Each of these is described below in the context of forests.

Provisioning Services: timber production in forest ecosystems is the basis for many economic activities and has a clear market value. Other timber-related products (fuelwood, cork, resin) are also marketed and used for economic activity. Non-timber forest products (such as game, berries, mushrooms, fruits, wild honey, medicinal plants, drinking water) are also important in many forest regions. Regulating Services: in addition to wood and non-wood products, forest ecosystems provide water and soil protection, avalanche and flood control, carbon storage, climate regulation, and control of diseases and waste. Cultural Services: forest and nature-based tourism play an important role in the EU because of their importance for regional economies and employment. Forests

attract many visitors who appreciate recreation, nature, biodiversity, scenery and peaceful surroundings. As such, forests contribute to human health and societal wellbeing. Forests are often integral parts of historical, cultural and spiritual heritage. Supporting Services are the underlying bio-physical factors and ecosystem processes that are essential for the provision of all other ES. They include nutrient cycling, soil function, primary production, habitat structures and functions and species. All services are all strongly interrelated and, in many cases, are underpinned by a vast array of physical, chemical and biological interactions. The importance of supporting ES on human wellbeing may not be as clear for the other ES, but these are the basis for the continued provision of the other services.

The benefits of Natura 2000 sites in forests, therefore, include the supply of tangible resources such as water and timber (“provisioning services”), and processes that regulate water and air quality, prevent natural hazards (flooding, soil erosion), and mitigate climate change through storing and sequestering carbon (“regulating services”). Protected areas can also provide “cultural services”, for example by supporting recreation and tourism, and maintaining cultural identity and common sense of place. These services are underpinned by the role that Natura 2000 forest sites play in supporting the preservation of basic ecological processes (e.g., nutrient cycling), fundamental in maintaining the overall functioning of natural systems (“supporting services”). Healthy and well-functioning ecosystems sustained within and beyond Natura 2000 protected areas can increase not only the range of ES, but also the resilience of ecosystems to resist and adapt to disturbances (e.g., climate change) beyond the site level [40, 41].

Species abundance, level of biomass, quality and structure of natural habitats, and level of genetic diversity are all factors that influence ecosystem resilience and the likely extent and rate of changes to ES. Diverse forests e.g., those with high tree species richness and diverse structures are known to deliver more ES than plantations, monocultures and even aged forests managed primarily for timber production [42]. Some services are directly linked to community composition and diversity (e.g., pollination, many cultural services). Others, like flood regulation, depend on the role of physical structures and processes at the ecosystem scale. Valuation of ES is critical for the maintenance and improvement of the delivery of the beneficial services and helps to assist in the assessment of trade-offs. Forest ecosystems both inside and outside the Natura 2000 sites are often managed ecosystems. The cumulative impacts of these human uses must be determined to avoid degradation of these forest ecosystems and the services they provide.

Trade-offs and synergies between forest ecosystem services

Conservation management is increasingly required to support both the provision of ES and maintenance of biodiversity. Now central to sustainable forest management is the concept of “multifunctional forestry” which should allow for forest goods and services to be provided sustainably at the same time and in the same place [43]. However, research has documented that trade-offs often occur between biodiversity and provisioning and regulating ecosystem services [44]. A trade-off occurs whenever the simultaneous provision of ES is not possible, initiate a conflict or inhibit each other. Forest ecosystems produce multiple services and these interact in complex ways, different services being interlinked, both negatively and positively. Delivery of many services will therefore vary in a correlated manner, but when a forest ecosystem is managed principally for the delivery of a single service (e.g., timber production) other services (e.g., biodiversity) are nearly always affected negatively.

While trade-offs and synergies are discussed in more detail in Chapter 6, we emphasise here that most of the current Natura 2000 forests have long been used by their owners to produce multiple benefits for society. The fact that these forests have been included in the Natura 2000 network as areas with high present or potential biodiversity value shows that, in most cases, sustainable forest management is compatible with biodiversity conservation and can contribute to this objective. An unmanaged forest ecosystem will develop to the natural limit of productivity given the natural disturbance regime to which it is subjected. The habitat and species composition of the unmanaged system is likely to remain largely unaltered and the manipulation of the system is minimal. However, local populations and forest owners will not gain from provisioning services since no forest resources are extracted. An intensively managed forest is likewise expected to have a reduced cultural and supporting service supply resulting from the simplification of habitat structure.

The management of sites under a “multifunctional forestry” perspective, and with habitat and species conservation at the centre can provide sustainable provision of services. It is important to communicate the value of ES with managers of Natura 2000 sites, and with the people who use the areas. A wealth of services are provided by the network but people are often unaware of this, and do not know how ES can be linked to conservation and management of a forest [34]. In improving management planning for Natura 2000 forests to incorporate the ES concept, a key challenge is *to develop a better understanding and quantification of the relationships between Natura 2000 management and ecosystem services and how they respond to environmental changes*.

Effects of Natura 2000 policy on sustainable development and forest management

5.2.1 Management of Natura 2000 habitats and species

The Natura 2000 network aims to protect vulnerable and/or typical habitats and species in Europe, but this does not mean that human activities need to be systematically excluded from these areas. Forests within Natura 2000 are often managed to fulfil multiple functions, including ecosystem services and nature protection. The ecological requirements of species and habitats can vary significantly from one site to another and proposed management options must also take account of the economic, social and cultural requirements of the area concerned as well as their territorial characteristics and ownership regime. Where a Natura 2000 site overlaps with a national nature reserve or a national park, forests are generally managed mainly for conservation purposes in accordance with the relevant national legislation. In multifunctional forests, the economic, social and ecological aspects need to be balanced to support management actions required for Natura 2000 habitats and species. Effective management of Natura 2000 sites requires both the initial identification of competing interests likely to impact forest development and then close cooperation between managers and stakeholders to minimise conflict in pursuing Natura 2000 aims at the site level. It is also necessary to consider bio-geographic boundaries and so to work beyond national and administrative boundaries [45].

5.2.2 Constraints on forestry

The designation of a site under Natura 2000 does not necessarily require modifications of existing forestry activities. In fact, traditional forestry activities have often created the conservation status of habitat and species. For example, in wood-pasture habitats like the Spanish “dehesas” or their equivalents in EU Nordic countries and the UK, traditional management practices have shaped these habitats and should therefore be maintained or favoured. In such cases, it will be important to ensure that these practices are continued, and possibly even extended to other similar areas. However, modifications of forest management practices may still be necessary to improve the conservation status of threatened/degraded habitat types.

In some cases, the implementation of Natura 2000 is reported to have limited regular forest management. For example, in the Netherlands, restrictions include short timber harvesting periods and obligations on forest owners to avoid disturbing nesting birds and to maintain static forest types instead of managing the dynamic nature of forests

[46]. Similarly, in Slovenia, Slovakia [47] and Lithuania [48], forest managers report restrictions on timber-oriented forest management and economic burdens due to the implementation of Natura 2000. In Ireland, species protection regimes in designated red zone hen harrier sites (SPAs for bird protection under the EU's Birds Directive) and appropriate assessment (according to the EU's Habitats Directive) put restrictions on afforestation and timber harvesting in the forest landscape. There is also a general ban on aerial fertilisation of afforestation on peat soils and restrictions on the time of timber harvesting in Ireland to avoid negative impacts on animal species such as salmonid fish and the fresh water pearl mussel according to the Habitats Directive [49].

Common land use restrictions on forest sites include not clearing large areas, not changing the form of land use or not replacing existing indigenous tree species with other exotic tree species. Article 6 of the EU's Habitats Directive states that operations or plans which are not directly connected with or necessary for the management of Natura 2000 sites but which are likely to have a significant effect on them, either individually or in combination with other plans and projects, must undergo an appropriate assessment of the effects on the sites. For example, a forest management activity like timber logging, track construction or soil drainage could fall under this provision, which would mean that it must form part of a management plan or be decided on a case-by-case basis. In practice, management priorities differ between sites and decisions or options depend on different factors, such as site ownership, intensity of economic use, occurrence of priority species and habitats, the relative rarity and sensitivity of the habitats or species concerned and traditional rules on natural resource use.

If an existing activity in a Natura 2000 site causes deterioration of the habitats or disturbance of the species for which the site has been designated, it must either be addressed by appropriate measures to halt the deterioration and/or by proactive conservation measures. This may require, as appropriate, bringing the negative impact to an end either by stopping the activity or by taking mitigating measures. For example, the ecological condition of open woodland habitats in five large Natura 2000 sites in the Czech Republic has been reported to be compromised because of an intensification of forestry activities (excessive infilling of open canopy areas for timber logging) [50]. Although the intensity of timber logging was reported as technically in accordance with the applicable forest law, it is unlikely to meet conservation objectives in these Natura 2000 forest sites. Some economic incentives or compensation can be foreseen where the efforts imposed on forest owners go beyond normal sustainable forest management practice. For instance, it may be the case that some bird species nesting in the area require an adaptation of the timing of forestry operations to avoid disturbance to the species during sensitive periods or a restriction in certain forestry activities in particularly sensitive areas to avoid deterioration of specific habitats or natural features present on the site.

5.2.3 Adverse effects of site designation

The potential for significant changes to economic return from a site because of Natura 2000 designation can impose perverse incentives on forest managers to decrease site conservation value. For example, when faced with an impending conservation designation that might restrict or prevent timber harvesting, a manager might choose to "preemptively harvest" as much resource as possible from the site before designation becomes effective, thereby minimising immediate economic impact and simultaneously destroying

the conservation value of the site. Cases where this has happened have been reported in Finland [51], France, Germany [52] and Romania [53]. In Lithuania, some forest owners purposively destroyed nests of protected bird species before they were known to the authorities to avoid restrictions in commercially managed forests [48]. In Bulgaria and Croatia, potentially harmful land use projects (e.g., constructing hotels, golf courses, ski runs, wind turbine parks and hydropower plants) and intensive timber logging were deliberately authorised in ecologically valuable forest landscapes, including nature and national parks when they were being mapped and designated as Natura 2000 sites [54]. Such perverse incentives cannot be ignored in the site designation and management process and their avoidance requires that stakeholders are meaningfully engaged when sites are designated and managed as Natura 2000. As the evidence for these effects is fairly limited, it is not possible to determine the overall impact on Natura 2000 sites.

5.2.4 Overview of effects on forestry

In many cases Natura 2000 has had little impact on regular forest management. This is due to a variety of reasons, for example the objectives for management under Natura 2000 are often quite vague or are not yet properly defined, and this can lead to them being ignored by forest managers [52]. In addition, many managers can be reluctant to believe the ecological science, and feel that it may not be relevant for their particular area [12]. In some cases, Natura 2000 management plans have themselves not fully taken scientific recommendations into account, for example levels of deadwood required are much lower than those suggested by conservationists and levels vary by Member States [52]. It is also common for management procedures to avoid the inclusion of clear requirements related to Natura 2000 conservation objectives to minimise conflicts between nature conservation and timber production, leading to little change in management practices due to Natura 2000 designation. For example, in Austria, Germany and France only vague non-binding advice concerning the number and quality of habitat trees and deadwood are outlined as managers' responsibilities [55]. Minimal change can also occur because sites may have been managed for conservation before Natura 2000 designation. This is the case in the UK, the Netherlands and in Spain, where no impacts on forest management were found since the few Natura 2000 forests were already designated and managed for nature conservation [55,56]. The degree to which Natura 2000 management plans are binding or enforceable also differs between Member States, and it is not uncommon for plans to be non-binding, especially on private land [55]. In many cases, however, lack of discernible effects of Natura 2000 designation on forestry result from the fact that, where site conservation value is associated with existing forestry practices, land-use practices do not change post-designation. Experts often find it difficult to assess the effects of Natura 2000 on forestry practices and many state that it is too early to assess any effect since management plans are sometimes not ready - such as in sites in Austria, France and Germany. There is a frequently encountered perception that Natura 2000 will have little direct effect on forest management and this can cause frustration to those working in the environmental sector, although many are aware that the main conservation aims of Natura 2000 mean that it will often be necessary to avoid further intensification of land use management in the future [55]. In other countries, such as Bulgaria for example, no specific Natura 2000 management plans have been delivered yet, but traditional forest management plans undergo a compliance assessment

with the rules of the Habitats and Birds Directives and may include general recommendations towards conservation objectives [54]. Given diverse management histories and forestry practices across different countries and bio-geographical regions of Europe, determining the impacts of Natura 2000 designation on forestry is not straightforward.

In summary, it is important to recognise that uncertainty regarding the effects of Natura 2000 on forests stems substantially from the disparate implementation of the policy at the national and local level and the varied “pre-designation” condition and management history of Natura 2000 sites, not from weakness in the conservation biology science underpinning the policy. Key challenges remain *to develop better monitoring and a greater understanding of the impact of previous land management on the conservation value of Natura 2000 sites and how site management changes post-designation.*

5.2.5 Overview of main synergies with forestry

The need for forest managers to consider ecological conditions and conservation can also lead to benefits for forestry. Multifunctional forestry can achieve economic, recreational and ecological forest benefits [57]. Consequently, changes in management activity under Natura 2000 that lead to reduced harvest frequency or intensity do not necessarily lead to negative economic outcomes for forest owners, if simultaneous increases in revenue from other forest values can be exploited (but see Chapter 4, section 4.2.6 and Chapter 6). In some cases, direct subsidy may offset reduction in timber revenue following site designation. However, in other cases revenue can be generated from alternative forest uses, such as recreation, tourism and harvesting of non-timber forest products. Close-to-nature forestry, compatible with the conservation of habitats and species under Natura 2000, can lead to short-term economic losses, but can offer long-term economic benefits by creating forests that are more adaptable and resilient to threats such as forest fires, storm damage and pathogen outbreaks [58]. It is important to recognise, however, that differences in forest ownership and the potential for long-term planning can constrain the potential for multifunctional forestry. For example, state forest services can be better able to offset short-term economic losses against long-term diversification of revenue streams than the private sector, while larger forestry companies may be better practiced at exploiting available subsidies to offset economic impacts than their smaller counterparts.

Overall, a key task is *to promote cooperation between local policy and decision makers, stakeholders and land managers to find practical solutions that regulate trade-offs and conflicts of interest to promote conservation objectives.*

Summarising conclusions

What do we know about the effects of Natura 2000 policy on biodiversity?

Our review suggests that *we need to improve our understanding of the effects of climate change on biodiversity and on Natura 2000 management effectiveness* in order to better understand the full impact of Natura 2000 on biodiversity. We stress that while early indications suggest that *Natura 2000 policy is having a positive effect on biodiversity*, this can be hard to determine due to the recent implementation of policy, compared to the long ecological timescales associated with changes in biodiversity. The evidence for the effectiveness of the management interventions associated with Natura 2000 (e.g., deadwood and large tree retention) is high and we therefore have confidence that, given time, the impact of Natura 2000 on biodiversity will be positive.

What do we know about effects of Natura 2000 on forest management and sustainable development?

It is difficult to determine the effects of Natura 2000 on land management due to diverse management histories and practices. Our review discusses evidence for *positive, neutral and negative impacts on forest management* and finds evidence for all three situations occurring in certain contexts.

Required changes in management with negative economic impacts are not necessarily associated with Natura 2000 designation and, where these occur, they may in some cases be offset by alternative uses more compatible with Natura 2000 policy. Changes to a close-to-nature forestry management can have short-term negative economic implications but often *create long-term benefits by producing more resilient forests*, although we note that state forest services and larger private companies may be better able to deal with the short-term losses compared to smaller private forest owners.

We also discuss a small number of cases where imminent designation has created perverse incentives for forest managers, and has led to the conservation value of certain sites being damaged. Better *involvement of forest managers* from the outset could help to alleviate this rare but serious issue.

We found in our review that, in many cases, Natura 2000 policy has had little or no effect on land management practices and that this can be for several reasons, including: the importance of current management practices for maintaining conservation status, vague management plans that forest managers cannot implement and the fact that many sites are already managed for conservation pre-Natura designation. We stress the need for *better monitoring to develop a greater understanding of the changes in the management of sites after designation*, and the impact that changes in management have on conservation status.

How is policy effectiveness monitored?

To monitor and assess the effectiveness of Natura 2000 we must be able to assess change in conservation status of habitats and species over time. Our review described how *effectiveness can be assessed through gap analysis and conservation status approaches*. We find several limitations in the assessment of effectiveness, related to data limitations and inconsistencies in reporting and implementation. *The limited period over which Natura 2000 has been implemented also makes it difficult to assess its effectiveness.*

References:

- [1] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.
- [2] Davis, M., Naumann, S., McFarland, K., Graf, A. & Evans, D., 2014. *Literature Review, the ecological effectiveness of the Natura 2000 Network*. ETC/BD report to the EEA.
- [3] Mihoub, J.-B., Henle, K., Titeux, N., Brotons, L., Brummitt, N. A. & Schmeller, D. S., 2017. Setting temporal baselines for biodiversity: the limits of available monitoring data for capturing the full impact of anthropogenic pressures. *Scientific Reports*, 7, 41591.
- [4] Orlikowska, E., Roberge, J.-M., Blicharska, M. & Mikusiński, G., 2016. Gaps in ecological research on the world's largest internationally coordinated network of protected areas: A review of Natura 2000. *Biological Conservation*, 200, 216–227.
- [5] Popescu, V.D., Rozyłowicz, L., Niculae, I.M., Cucu, A.L., Hartel, T., 2014. Species, habitats, society: an evaluation of research supporting EU's Natura 2000 network. *PLoS One*, 9, e113648.
- [6] Trouwborst, A., 2011. Conserving European Biodiversity in a Changing Climate: The Bern Convention, the EU Birds and Habitats Directives and the Adaptation of Nature to Climate Change. *Review of European Community and International Environmental Law*, 20, 62–77.
- [7] Van Teeffelen, A., Meller, L., van Minnen, J., Vermaat, J., & Cabeza, M., 2014. How climate proof is the European Union's biodiversity policy? *Regional Environmental Change*, <http://dx.doi.org/10.1007/s10113-014-0647-3>
- [8] Vallecillo, S., Hermoso, V., Possingham, H.P. & Brotons, L., 2013. Conservation planning in a fire-prone Mediterranean region: threats and opportunities for bird species. *Landscape Ecology*, 28, 1517–1528.
- [9] Kelly, L. T., Bennett, A. F., Clarke, M. F. and McCarthy, M. A., 2015. Optimal fire histories for biodiversity conservation. *Conservation Biology*, 29, 473–481.
- [10] Regos, A., D'Amen, M., Titeux, N., Herrando, S., Guisan, A. & Brotons, L., 2016. Predicting the future effectiveness of protected areas for bird conservation in Mediterranean ecosystems under climate change and novel fire regime scenarios. *Diversity and Distributions*, 22, 83–96.
- [11] Johnston, A et al., 2013. Observed and predicted effects of climate change on species abundance in protected areas. *Nature Climate Change*. DOI: 10.1038/NCLIMATE2035
- [12] de Koning, J., Turnhout, E., Winkel, G., Blondet, M., Borrás, L., Ferranti, F., Geitzenauner, M., Sotirov, M. & Jump, A. S., 2014. Managing climate change in conservation practice: an exploration of the science-management interface in beech forest management. *Biodiversity and Conservation*, 23, 3657–3671.
- [13] Timmermann A., Damgaard C., Strandberg M.T., Svenning J.-C., 2015. Pervasive early 21st-century vegetation changes across Danish semi-natural ecosystems: More losers than winners and a shift towards competitive, tall-growing species. *Journal of Applied Ecology*, 52, 21–30.
- [14] Hédil R., Kopecky M., Komarek J., 2010. Half a century of succession in a temperate oakwood: From species-rich community to mesic forest. *Diversity and Distributions*, 16, 267–276.
- [15] Kallimanis, S. A., Touloumis, K., Tzanopoulos, J., Mazaris, A. D., Apostolopoulou, E., Stefanidou, S., Scott, A. V., Potts, S. G. & Pantis, J. D., 2015. Vegetation coverage change in the EU: patterns inside and outside Natura 2000 protected areas. *Biodiversity and Conservation*, 24, 579–591.

- [16] Brzeziecki, B., Pommerening, A., Mścicki, S., Drozdowski, S. & Żybura, H., 2016. A common lack of demographic equilibrium among tree species in Białowieża National Park (NE Poland): evidence from long-term plots. *Journal of Vegetation Science*, 27, 460-467.
- [17] Jaroszewicz, B., Bobiec, A. and Eycott, A. E. In press. Lack of demographic equilibrium indicates natural, large-scale forest dynamics, not a problematic forest conservation policy – a reply to Brzeziecki et al. *Journal of Vegetation Science*. DOI: 10.1111/jvs.12458
- [18] Gerard, F., Petit, S., Smith, G., Thomson, A., Brown, N., Manchester, S. et al., 2010. Land cover change between 1950 and 2000 determined employing aerial photography. *Progress in Physical Geography*, 34, 183-205.
- [19] Miklín, J and Čížek, L., 2014. Erasing a European Biodiversity hotspot: Open woodlands, veteran trees and mature forests succumb to forestry intensification, succession and logging in a UNESCO Biosphere Reserve. *Journal for Nature Conservation*, 22, 35-41.
- [20] Levers, C., Verker, P. J., Müller, D., Verburg, P. H., Butsic, V., Leitão, P. J., Linder, M. and Kuemmerle, T., 2014. Drivers of forestry intensification practices in Europe. *Forest Ecology and Management*, 315, 160-172.
- [21] European Commission, 2009. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0358:FIN:EN:PDF>
- [22] Forest Europe, 2015. *State of Europe's Forests Report 2015*. Madrid: Spain.
- [23] Sirami, C., Brotons, L., Burfield, I., Fonderflick, J. & Martin, J. L., 2008. Is land abandonment having an impact on biodiversity? A meta-analytical approach to bird distribution changes in the north-western Mediterranean. *Biological Conservation*, 141, 450-459.
- [24] Giltena, A. S. S. U., Brotons, L., Santiago, S., 2009. Mediterranean forest dynamics and forest bird distribution changes in the late 20th century. *Global Change Biology*, 15, 474-485.
- [25] Zehetmair T., Muller J., Zharov A., Gruppe, A., 2015. Effects of Natura 2000 and habitat variables used for habitat assessment on beetle assemblages in European beech forests. *Insect Conservation and Diversity*, 8, 193-204.
- [26] Zehetmair, T., Muller, J., Runkel, V., Stahlschmidt, P., Winter, S., Zharov, A., Gruppe, A., 2015. Poor effectiveness of Natura 2000 beech forests in protecting forest-dwelling bats. *Journal for Nature Conservation*, 23, 53-60.
- [27] Sanderson, F. J., Pople, R. G., Ieronymidou, C., Burfield, I. J., Gregory, R. D., Willis, S. G. & Donald, P. F., 2016. Assessing the performance of EU nature legislation in protecting target bird species in an era of climate change. *Conservation Letters*, 9, 172-180.
- [28] Paillet, Y., Berges, L., Hjalten, J., Odor, P., Avon, C. et al., 2010. Biodiversity differences between managed and unmanaged forests: a meta-analysis of species richness in Europe. *Conservation Biology*, 24, 101-112.
- [29] Junninen, K., Komonen, A., 2011. Conservation ecology of boreal polypores: a review. *Biological Conservation*, 144, 11-20.
- [30] Müller, J. & Büttler, R., 2010. A review of habitat thresholds for dead wood: a baseline for management recommendations in European forests. *European Journal of Forest Research*, 129, 981-992.
- [31] Müller, J., Bussler, H., Kneib, T., 2008. Saproxylic beetle assemblages related to silvicultural management intensity and stand structures in a beech forest in Southern Germany. *Journal of Insect Conservation*, 12, 107-124.
- [32] Lindenmayer D.B., Laurance W.F., Franklin J.F., 2012. Ecology: Global decline in large old trees. *Science*, 338, 1305-1306.
- [33] Blicharska M., Angelstam P., 2010. Conservation at risk: Conflict analysis in the Białowieża forest, a European biodiversity hotspot. *International Journal of Biodiversity Science, Ecosystems Services and Management*, (1-2) 68-74.
- [34] Niedziałkowski K., Blicharska M., Mikusiński G., Jędrzejewska B., 2014. Why is it difficult to enlarge a protected area? Ecosystem services perspective on the conflict around the extension of the Białowieża National Park in Poland. *Land Use Policy*, 38, 314-329.
- [35] Ferranti F., Beunen R., Speranza M., 2010. Natura 2000 network: A comparison of the Italian and Dutch implementation experiences. *Journal of Environmental Policy and Planning*, 12, 293-314.

- [36] Cent J., Mertens C., Niedziałkowski K., 2013. Roles and impacts of non-governmental organizations in Natura 2000 implementation in Hungary and Poland. *Environmental Conservation*, 40, 119-128.
- [37] Opermanis O., MacSharry B., Evans D., Sipkova Z., 2013. Is the connectivity of the Natura 2000 network better across internal or external administrative borders? *Biological Conservation*, 166, 170-174.
- [38] Spash, C. L., 2008. How much is that ecosystem in the window? The one with the bio-diverse trail. *Environmental Values*, 259-284.
- [39] Ferranti, F., Turnhout, E., Beunen, R. and Behagel, J. H., 2014. Shifting nature conservation approaches in Natura 2000 and the implications for the roles of stakeholders. *Journal of Environmental Planning and Management*, 57, 1642-1657.
- [40] Stolton, S., Dudley, N. & Randall, J., 2008. *Natural Security: Protected Areas and Hazard Mitigation*. WWF.
- [41] Dudley, N., Parrish, J. D., Redford, K. H. & Stolton, S., 2010. The revised IUCN protected area management categories: the debate and ways forward. *Oryx*, 44, 485-490.
- [42] Gamfeldt, L., Snäll, T., Bagchi, R., Jonsson, M., Gustafsson, L., Kjellander, P., Ruiz-Jaen, M. C., Fröberg, M., Stendahl, J., Philipson, C.D., Mikusiński, G. et al., 2013. Higher levels of multiple ecosystem services are found in more diverse forests. *Nature Communications*, 4, 1340
- [43] Winkel, G., Gleissner, J., Pistorius, T., Sotirov, M and Storch, S., 2011. The Sustainably Managed Forest Heats up – Discursive Struggles over Forest Management and Climate Change in Germany. *Critical Policy Studies*, 5, 361-390.
- [44] Howe, C., Suich, H., Vira, B. and Mace, G. M., 2014. Creating win-wins from trade-offs? Ecosystem services for human well-being: a meta-analysis of ecosystem service trade-offs and synergies in the real world. *Global Environmental Change*, 28, 263-275.
- [45] Gustafsson L., Felton A., Felton A.M., Brunet J., Caruso A., Hjalten J., Lindblad M. and Westli J., 2015. Natural Versus National Boundaries: The Importance of Considering Biogeographical Patterns in Forest Conservation Policy. *Conservation Letters*, 8, 50-57.
- [46] Sotirov, M., Storch, S., 2017. Resilience through forest policy integration in Europe? Domestic policy changes and institutional responses to absorb pressure to integrate biodiversity into forestry in France, Germany, the Netherlands and Sweden. *Land Use Policy* (accepted pending minor revisions).
- [47] Brodrechtova, Y., Navrátil, Sedmák, R., Tuček, J., 2016. Using the politicized IAD framework to assess integrated forest management decision-making in Slovakia. *Land Use Policy* (accepted, in press).
- [48] Brukas, V., Stanislovaite, A., Kavaliauskas, M., Gaižutis, A., 2016. Protecting or destructing? Local perceptions of environmental consideration in Lithuanian forestry. *Land Use Policy* (accepted, in press).
- [49] Bonsu, N., Dhubháin, A., O'Connor, D., 2015. Understanding forest resource conflicts in Ireland: A case study approach. *Land Use Policy* (in press, corrected proof).
- [50] Miklín, J, Cížek, L., 2014. Erasing a European biodiversity hot-spot: Open woodlands, veteran trees and mature forests succumb to forestry intensification, succession, and logging in a UNESCO Biosphere Reserve. *Journal for Nature Conservation*, 22, 35-41.
- [51] Hiedanpää, J., 2005. The edges of conflict and consensus: a case for creativity in regional forest policy in Southwest Finland. *Ecological Economics*, 55, 485-498.
- [52] Winter, S., Borrass, L., Geitzenauer, M., Blondet, M., Breibeck, R., Weiss, G., Winkel, G., 2014. The impact of Natura 2000 on forest management: a socioecological analysis in the continental region of the European Union. *Biodiversity Conservation*, 23, 3451-3482.
- [53] Iojă, C.I., Pătroescu, M., Rozyłowicz, L., Popescu, V.D., Vergheș, M., Zotta, M.I., Felciuc, M., 2010. The efficacy of Romania's protected areas network in conserving biodiversity. *Biological Conservation*, 143, 2468-2476.
- [54] Sotirov, M., Lovric, M., Winkel, G., 2015. Environmental governance between Europeanization and domestic politics: Analyzing the implementation of EU biodiversity conservation policy in Bulgaria and Croatia. *Environment and Planning C: Government and Policy*, 33, 986-1004.

- [55] Winkel, G., Blondet, M., Borrass, L., Frei, T., Geitzenauer, M., Gruppe, A., Jump, A., De Koning, J., Sotirov, M., Weiss, G., Winter, S., Turnhout, E., 2015. The implementation of Natura 2000 in forests: A trans- and interdisciplinary assessment of challenges and choices. *Environmental Science and Policy*, 52, 23-32.
- [56] Borrass, L., Sotirov, M., Winkel, G., 2015. Europeanization and policy change. Implementation of the European Union's Habitats Directive in Germany and the UK. *Environmental Politics*, 24, 788-809.
- [57] Naaburs, G.J., Paivinen, R., Schanz, H., 2001. Sustainable management regimes for Europe's forests- a projection with EFISCEN until 2050. *Forest Policy and Economics*, 3, 155-173.
- [58] Bauhus, J., Puettmann, K. and Kuhne, C., 2013. Close-to-nature forest management in Europe: Does it support complexity and adaptability of forest ecosystems. In: Messier, C., Klaus J., Puettmann, K. D. Coates (eds.) *Managing Forests as Complex Adaptive Systems: building resilience to the challenge of global change*. The Earthscan forest library. London: Routledge, 187-213.
- [59] European Commission, 2016. *Fitness Check of the EU Nature Legislation (Birds and Habitats Directives)*. EC: Brussels.
- [60] Caro, T., 2010. Conservation by proxy - indicator, umbrella, keystone, flagship and other surrogate species. Washington: Covelo; London: Island Press.
- [61] Mori, A. S., Lertzman, K. P. & Gustafsson, L., 2017. Biodiversity and ecosystem services in forest ecosystems: a research agenda for applied forest ecology *Journal of Applied Ecology*, 54, 12-27.

Economic effects and funding of Natura 2000 in forests

6.1 Costs and benefits of the implementation of Natura 2000 in forests

Lead authors: Louise Ecochard, Emeline Hily, Serge Garcia

Protected areas are usually seen as expensive, partly because the benefits they generate are not easily measurable and are not directly comparable to the costs they incur. This section gathers and analyses existing scientific knowledge on the costs and benefits of Natura 2000 in forests. We also explore the economic tools used by EU Member States to ensure biodiversity conservation on Natura 2000 sites.

6.1.1 Benefits related to Natura 2000 in forests

Assessing the benefits provided by Natura 2000 forest sites is important. The information can aid communication about the network, especially when facing social opposition. Moreover, knowing which forest goods and services are the most valuable can help maximise the social welfare provided by Natura 2000.

What are the benefits provided by Natura 2000 forest sites?

The Natura 2000 network is expected to “ensure the long-term survival of Europe’s most valuable and threatened species and habitats” [1]. More specifically, its aim is to reach or maintain a favourable conservation status for the targeted species and habitats defined in the Habitats and Birds Directives. Therefore, biodiversity conservation is the first benefit expected from Natura 2000. Other benefits can be generated both by the existence of forest ecosystems in a favourable conservation status, and by the specific management practices implemented in order to reach or maintain this status. Indeed, the ecological

Box 8. Definition of use and non-use values

- **Use value** refers to utility obtained from direct use (from consumption such as timber and food, and non-consumption such as recreation), and indirect use value (e.g., ecological functions and landscape).
- **Non-use value** reflects value which does not arise from usages. This concerns existence and bequest motivated by intra- and inter-generational altruism, but can also include (although it is sometimes considered to be distinct) option value, i.e., potential future use value for the current generation.

functioning of an ecosystem and its biodiversity are deeply related. Therefore, measures targeting biodiversity conservation also have side effects for the ecosystem services (ES) delivered by the protected sites [2] (see definition and classification in 5.1.4). The relationship between biodiversity conservation measures and the provision of forest ES is not trivial. There are a lot of scientific uncertainties about the link between biodiversity and the provision of ES, as well as about the link between the biodiversity of a site and the fact that it belongs to the Natura 2000 network. This leads to one of the main difficulties in assessing the benefits provided by Natura 2000 forests: knowing to what extent any benefits are actually due to Natura 2000 network and associated measures (see 5.2). Moreover, it also raises the question of trade-offs and synergies between forest ES (see 5.1.4). While biodiversity conservation under Natura 2000 policy may lead to an increase in the provision of many ES (including outside a site, due to spreading ecological processes), the delivery of some others can be reduced, such as timber production by restricting harvests or promoting open spaces. Furthermore, the recreational value of a Natura 2000 site could be improved by the presence of wildlife, the aesthetic value of a forest landscape by banning clear-cuts, or water purification could be enhanced by favouring broadleaves instead of coniferous stands. However, an increased recreational use of the forest may also have a negative impact on biodiversity, and consequently on related ES (see 4.1.2). Concerning climate change mitigation through storing and sequestering carbon, Natura 2000 could lead to a reduction in wood harvesting but higher storage on the site.

While some ES have a monetary and market value (e.g., wood), it is not possible to use a market price to value the benefits of some other ES (e.g., biodiversity, water protection). **In assessing the value provided by a given ecosystem an important distinction is made between use values and non-use values (Box 8).**

Who benefits from Natura 2000 in forests?

The concept of ES is deeply anthropocentric. Therefore, there is no ES without people who directly or indirectly benefit from it. **ES can only be defined with regards to their beneficiaries.** These beneficiaries can be classified following various approaches. We use a spatial classification (from local benefits, e.g., fuelwood, to global benefits, e.g., carbon storage) and a sector classification (e.g., tourism, timber industry, agriculture).

Spatial classification of the beneficiaries of the services provided by Natura 2000 in forests

Spatially explicit assessment of ES provision and beneficiaries can be useful for the design and implementation of conservation policies. Indeed, mapping both supply and demand sides could provide information on which areas to prioritise for protection, but also on the relevant scale for the management of these services. Some services, such as carbon sequestration by growing forests, generate global benefits. Others are more spatially limited. For example, the impact of trees on air quality is rather local. For recreational benefits, it depends on how far people are prepared to travel to visit a site. The literature highlights spatial heterogeneity in people's preferences. For example, a Finnish study found that a Natura 2000 conservation programme was more supported by urban households than by rural ones [3]. In Scotland, it was found that the protection of Natura 2000 sites is more valued by foreigners than by local inhabitants [4]. Others found that for provisioning and cultural services, beneficiaries were mostly located outside the protected area, whereas for regulating services, most of them were located within or very close to the area [5]. On the contrary, it was shown that local beneficiaries tend to value more provisioning services (timber, hunting, mushroom harvesting and bee-keeping) while non-local beneficiaries demanded more erosion control and nature tourism [6].

Classification of the beneficiaries of the services provided by Natura 2000 in forests by sectors

A 2011 report to the EC valued the benefits provided by Natura 2000 for the tourism, recreation and employment sectors [7]. It estimated that Natura 2000 sites were visited between 1.2 and 2.2 billion times per year, with an overall visitor spend of 50 to 90 billion US dollars. Natura 2000 sites were also found to support employment, with an estimated 4.5 to 8 million full time equivalent (FTE) jobs directly or indirectly generated by the network across the EU-27. However, this study does not provide detailed breakdowns by ecosystem and land use types. At site scale, for the well-known example of the Białowieża forest, cultural and recreational benefits were estimated around €4bn [8]. The designation of a site as Natura 2000 does not always have a positive impact on its touristic value. In certain cases, protecting some species requires restrictions on public access to their habitats at least during some periods of the year, thus having a negative impact on the recreational value. This can be the case in Natura 2000 forest sites hosting the western capercaillie where hiking is prohibited (see Chapter 4).

Forestry can also benefit from Natura 2000. For example, Natura 2000 funds can allow for expensive management operations to take place, such as the removal of introduced species, which would have been impossible otherwise. In the case of Natura 2000 conservation contracts, forest owners can undertake forest works that belong to reimbursable measures, thus saving the cost of the operation even if they would have done it anyway. This can lead to overcompensation of opportunistic forest owners [9].

A global monetary assessment of Natura 2000 benefits in forests

The monetary valuation of environmental assets is fundamentally anthropocentric, i.e., related to the utility people get from them. It doesn't mean that nature has no intrinsic value outside of human appreciation, but it means that this intrinsic value can hardly be estimated in monetary terms.

In a report to the EC [10], the overall value of all Natura 2000 habitats on terrestrial and marine sites was assessed on the basis of existing benefit valuation case studies across the EU-27. These site-specific results were then scaled-up to EU-level. The median and mean values for Natura 2000 forests were found to be €924 and €2,309/

hectares/year, respectively. This corresponds to a *global monetary value of Natura 2000 forests of approximately €27bn/year (median) and €68bn/year (mean)*. These economic values were calculated by aggregating site-based results using various valuation methods for a wide range of benefits (from provisioning to regulating services, and non-use values). The report listed some methodological issues, such as the lack of estimates of benefits of some habitats and the use of an amalgam of estimates using different methods.

The total monetary value can refer to a wide range of ES, including the value of the timber produced and of the CO₂ stored. The issue is to disentangle the effect of Natura 2000 in the production of these services. Indeed, a non-Natura 2000 forest also produces timber and stores CO₂. Therefore, this global assessment did not fully deal with the value added related to Natura 2000 in forests. It is not known if the benefits provided by forests could have been lower without Natura 2000. The lack of data for assessing the net benefits and the additionality of the Natura 2000 network was acknowledged in this study as a relevant question to address in future work.

For now, this report provides the only available assessment of the value of the benefits provided by Natura 2000 in forests at a European scale. Even if it does not fully answer the question of the value added by Natura 2000 in forests, it still provides interesting information, e.g., on the part of each habitat type in the global value. According to this study, *Natura 2000 forests represent 24% of the estimated benefits generated by the network (mean values)*. This is due to a higher surface of protected forest habitats, estimated to represent 32% of the total network in this study. In a more recent report [11], *forests in Natura 2000 were found to cover 49% of the network*¹¹ which might result in *higher values*.

Estimating the Europeans' willingness to pay for forest conservation in Natura 2000

Since public funding is used to implement Natura 2000, it is important to gather information about Europeans' preferences in terms of biodiversity conservation. Indeed, it has been clearly stated in several studies that social acceptance of the implementation of Natura 2000 was crucial for the success of the network. One way to learn about people's preferences is to determine their willingness to pay (WTP) for forest conservation, or willingness to accept (WTA) a decrease of protected area. Some available values of WTP are shown in Table 8.

Natura 2000 and biodiversity conservation valuation studies highlight the importance of non-use values in Europeans' WTP. In Scotland, non-use value was found to represent 99% of the total welfare benefits related to the protection of Natura 2000 sites [4]. Similar results were found in Norway [19]. This means that **people value nature conservation for its existence and amenity values related to biodiversity and habitat services and cultural services, and independently of the provisioning goods or recreational services it provides**. The biodiversity conservation is also likely to be positive for other ES such as regulating (e.g., water quality preservation) and supporting services (e.g., soils, pollination).

¹¹ This large difference is due to the different data sources used in the studies. IEPP (2001) [10] relies on data used in [12] sent by the 25 Member States to the EU by June 2005, whereas EU (2015) [11] relies on data from State of Europe's Forests (2011) for the EU-27, plus Croatia.

Table 8. Economic valuation studies of the WTP for forest conservation.

Reference	Region	Type of value	Mean WTP
[3]	Finnish Natura 2000 network (mostly forests)	Non-use and use values	€101/year/household for a 3% increase of the protected area
[12]	“	“	From €92 to €112/year/household for a 6% increase of the protected area
[14]	“	“	From €83 to €131/year/household if participatory planning is implemented
[15]	“	“	WTP for an increase of the protected area = €132/year/household; WTA for a decrease in protected area = €579/year/household
[16]	Southern Finland (not Natura 2000)	“	Contingent valuation (CV): €60/year/household for increasing forest conservation; Choice experiment (CE): €223/year/household for a higher level of conservation
[17]	North Karelia, Finland (not Natura 2000)	“	From €39.2 (local residents) to €48.6/year/household (outside visitors) for forest preservation
[4]	Natura 2000 network in Scotland, UK (not specific to forests)	Non-use	€81/household/year for the existence of the current Natura 2000 network
		Use	€5.25/visit/year for recreation
[18]	Natura 2000 Network in Galicia, Spain (not specific to forests)	Non-use and use values	€113/year/household for conserving 280,000 hectares rather than 36,000 hectares, €42.7/year/household to have more than 50% of the surface in forest
[19]	Norway (forest but not Natura 2000)	Non-use (inaccessible reserves)	€111/year/household for protecting 2.8% of forest areas instead of the current 1.4%, €133 for 4.5%, €139 for 10%
[20]	Denmark (nature-based forest management practices)	Use (recreation)	Changing from conifers to mixed forests: €130/year/household, from one to two tree heights: €28, to uneven stand: €116, leaving a few dead trees: €15

Several reasons can account for the variations across results, among which are the spatial scale, the valued environmental assets, and the methodologies. **Still, the main factors that influence people's WTP for Natura 2000 conservation programmes** were found to be (i) income (the higher the income, the higher the WTP); (ii) age (the younger, the more likely to support the programme); (iii) people's background (urban respondents tend to have a higher WTP than rural ones); (iv) gender (women are more willing to pay than men); (v) general attitude towards nature preservation; and (vi) the planning method (bureaucratic methods are less supported than participative ones).

Two studies [3, 13] found that after an initial 3% increase in the amount of protected areas, the marginal WTP for additional conservation was null. They also found no significant influence on people's preferences of the size of the additional protected area. This can mean that people do not perceive the difference between the types of protected areas when interviewed. Comparing WTP for an increase of the protected area v WTA for a decrease, the results are coherent with the literature: the amount to allocate to people for a decrease in the nature preservation area is far higher than the amount they want to receive for an equivalent increase. This means that *people are more sensitive to a loss than to a gain of environmental values and benefits, including biodiversity conservation*. Furthermore, another study [3] finds that the WTP of Finnish households for the same environmental assets was higher if they were presented as a general nature conservation programme than as a Natura 2000 project. This is explained by the general negative public opinion of Natura 2000 in Finland. This shows that *attitudes towards Natura*

2000 policy do not necessarily equate to attitudes towards traditional domestic nature conservation in some contexts.

Most existing Natura 2000 benefits valuation studies address national or regional scales while a few others focus on a site scale. At a European scale, a 2003 public opinion survey [21] reveals that for Europeans, the most important roles of forests were those related to the preservation of the natural environment, including biodiversity and protection against natural disasters. Recreation is considered to be their second most important role. Wood production is also recognised as a role of forests, but comes after. According to the latest Eurobarometer survey about attitudes towards biodiversity, *most Europeans (73%) have not heard about the Natura 2000 network*. 16% have heard of the Natura 2000 but they don't know what it is, while only 10% have heard of it and know what it is [22].

6.1.2 Costs of Natura 2000 in forests

Analysis of the costs of Natura 2000 implementation is crucial in order to assess the cost-effectiveness, viability, fairness, and social acceptability of EU nature conservation policy. We distinguish between **direct costs, which are monetary costs directly related to the implementation of Natura 2000 measures**, and **indirect costs including opportunity costs and transaction costs** (Box 9).

Box 9. Types of costs in the implementation of Natura 2000 policy.

Direct costs are all expenses (including operation costs and investments) directly related to the measures implemented for biodiversity conservation.

Opportunity costs refer to foregone economic benefits from alternative activities or uses of a resource on a particular Natura 2000 site.

Transaction costs are all costs related to the policy implementation (i.e., costs of gathering information, bargaining costs and enforcement costs) but that cannot be directly attributed to particular conservation activities on a Natura 2000 site.

What does Natura 2000 cost?

Direct costs

Forestry works that can be required for preserving habitats or species and hence can result in direct costs include:¹² creation of clearings (e.g., for the western capercaillie); fencing for regulating game pressure; removing invasive species; tree felling or thinning in favour of a particular species; transformation towards an uneven age structure; over expenditure related to more environmentally friendly but more costly skidding methods (wood harvesting).

These operations can come at a cost because they require the intervention of specialised forest workers and machines. Direct costs depend highly on the site's characteristics, such as its accessibility, its frequentation, the protected habitats or species and the

¹² Some of these measures for preserving biodiversity could generate monetary benefits if timber was sold. However, we consider only direct costs here. We can also note that in some countries, such as France, selling timber resulting from a Natura 2000 measure is illegal.

relevant conservation measures. They also depend on the country's average income: they tend to be higher in higher income countries, reflecting higher wages, and this has to be taken into account when comparing cost estimates from different countries. However, the cost of some operations can be compensated or even overcome, by timber sales (e.g., creation of clearings, or tree felling or thinning). Others might be compensated over time but they still represent a high initial investment (such as fencing, which allows for natural forest regeneration and more resilience).

Opportunity costs

Opportunity costs may be significant since they are estimated to be 35.8% of the total cost of the complete Natura 2000 network in 2011 [23]. Some biodiversity conservation measures in forests have an impact on forest management practices such as timber production and/or timber use. Examples of such measures are: forest land set aside for strict conservation (potential loss of productive area); trees set aside for natural decay and deadwood (as above); restrictions on the tree species that can be used (potential lower yields); maintaining mature forest stands and longer rotation periods (potential delays/losses in yields).

Opportunity costs depend on the forest's characteristics. For example, forest stands with a very low productivity or difficult access will have a null opportunity cost since they would have not been exploited anyway. For old trees with a low economic quality, the foregone timber income can be negligible; the opportunity cost comes from the surface occupied by the tree, which cannot be used for producing other wood. Contrary to direct costs, for which forest owners can be compensated for by public funds in most Member States, opportunity costs are often not taken into account when designing compensation schemes under the Natura 2000 framework. This is in contrast to agri-environmental compensation payments for Natura 2000 sites implemented through the EU Rural Development Policy. This makes it difficult to tailor financial compensation.

Transaction costs

Transaction costs include all costs related to the establishment and administrative management of the Natura 2000 network. They include the costs of gathering scientific knowledge, organising meetings to coordinate stakeholders and developing management plans for the sites. Administrative costs incurred by the management of contracts with the landowners also belong to this type of costs. Transaction costs also comprise costs related to monitoring management practices in Natura 2000 sites and, if necessary, the costs of enforcement. Monitoring compliance can be crucial to ensure the effectiveness of Natura 2000 as a regulatory approach and through voluntary schemes involving compensation payments. Monitoring costs encompass the costs for dedicated personnel and equipment. Enforcement measures are costly and can include administrative costs for collecting fines and lawsuits. Long-term monitoring can provide useful site-specific information about the actual level of enforcement and effectiveness of Natura 2000 measures. However, in several countries, the strict EU requirements for monitoring and enforcement, e.g., regarding the size of the protected area or detailed information on the exact location of nests, have been considered to act as a deterrent for voluntary participation in forest contracts. It is concluded that these administrative requirements led to unnecessarily high costs [24].

More monitoring or greater punishment can be used for increasing compliance. The latter is often more cost effective since stepping up monitoring activities is expensive

[25]. However, in terms of “political costs” (making decisions about what is acceptable and what will increase resistance), a more coherent monitoring system might be preferred (Chapter 5). Another softer approach for increasing compliance is to use informative tools, e.g., by installing information boards so that hikers understand why certain activities are prohibited in a Natura 2000 site, or by offering advice to forest owners. Finally, costs related to asymmetric information between the nature conservation and forestry authorities and the forest owners should be accounted for. The costs of conservation measures may involve a landowner’s private information and so may not be observable by the public authority. In the case of contracts, this can lead to over- or undercompensation of the landowner, resulting in a lack of cost effectiveness [24, 25].

Overall assessment of Natura 2000 costs at the EU level

An estimation of the costs of the Natura 2000 network was provided recently [24]. All Member States were sent a questionnaire to estimate how much the Natura 2000 network cost them. In the questionnaire, financial costs were divided between one-off expenses (e.g., inventories, land purchase, writing a management plan) and recurrent expenses (e.g., compensation for landowners, monitoring, ongoing management). The **overall costs of managing the Natura 2000 network** for both the terrestrial and marine sites were estimated at **€5,772bn per year** over the 2008–2014 period. For the terrestrial area of the network, this corresponds to an average cost of €63.4 per hectare per year. Estimating the costs of Natura 2000 in forests requires distinguishing expenses by ecosystem and/or land use type, which most countries were not able to do. Only 10 countries provided breakdowns of cost by land use type (Austria, Cyprus, Czech Republic, Hungary, Malta, Poland, Portugal, Slovakia, Slovenia and the UK). For these countries, it was found that **forests represent 33% of the total costs**. However, this percentage cannot be extrapolated to the EU-27. Using data about Natura 2000 forest area in these countries from the EC report [11], we found that the **average cost of implementing Natura 2000 in forests was €37 per hectare per year**. However, a range of methodological difficulties were encountered in the assessments. Some countries provided data on their actual expenses, while others estimated necessary levels of expenses to meet conservation targets, which would be desirable if there was no budget limit. Some countries based their answers on past expenses while others on projected future needs. Moreover, not all types of economic costs of Natura 2000 were taken into account in this assessment.

Who bears the Natura 2000 costs?

Table 9 summarises what kinds of cost are borne by which stakeholders under Natura 2000 in forests.

The available studies find that biodiversity conservation measures result in less harvested timber. This can have a direct impact on forest owners’ revenues. However, a Finnish study [26] found that a loss of available timber would result in higher timber prices, thus impacting forest industries instead of forest owners. At the same time, shortages of raw material for the forest industry and raw timber imports are less than expected. For the implementation of Natura 2000, different forest management strategies have been carried out ranging from strict protection to slightly modified to continuation of timber production-orientated forestry practices [27] (Chapter 3). Hence, the negative impact of Natura 2000 on the lack of raw material for the timber industry is far from certain.

It is important to bear in mind that whether forest owners should be compensated or not depends on the country-specific definitions of the property rights over forest goods

Table 9. Overview of the types of costs borne by different stakeholders.

Public authorities (national + EU funds)	Direct costs	Compensation for forest owners for conservation measures and/or foregone opportunities; land purchase or lease.
	Transaction costs	Administrative costs; management planning; stakeholders' information and meeting; gathering scientific information; monitoring and enforcement.
	Opportunity costs	Scarce financial and human resources that could be used for other purposes or developments.
Forest owners	Direct costs	Operation and investment costs.
	Transaction costs	Time and resources spent on gathering information, eg available contracts, stakeholder meetings, administrative management.
	Opportunity costs	Loss of timber revenue or foregone property rights.
Other stakeholders	Direct costs	Loss of available timber can result in higher wood prices impacting the final consumer.
	Opportunity costs	Potential restrictions on forest access for recreational use.

and services. If forest owners are assumed to have exclusive and comprehensive property rights over forests, they should be compensated for revenue losses incurred by the provision of public services for society. On the contrary, if it is considered that society owns the services produced by the forests, countries can legally hinder forest owners from degrading them. In Finland [28] for instance, sovereignty of forest owners is deeply rooted in culture and policy, and most citizens are attached to it. Finnish households' attitude towards nature conservation policy was found to be significantly influenced by their perception of the Natura 2000 programme's ability to take into account landowners' rights [3]. For public forests however, which represent about 40% of EU forests [11], the question of compensation is different. This is because public entities, state forest administrations or public forest companies often have to provide public goods such as biodiversity and other ES by adhering to principles of multifunctional forest management. As they are already paid through the state budget and/or are entrusted to manage public forests, one can argue that they should not get further compensation for implementing Natura 2000. However, this is not always the case in practice. In France, for example, a large part of forest Natura 2000 contracts concern state or other public forests. However, a study on the cost-effectiveness of Natura 2000 contracts in France [29] shows higher costs for public owners (i.e., municipalities, national office of forests). The following cost allocation principles can be outlined:

- i. Costs to the landowners: if forest management is restricted by legal regulations or specific measures prescribed for nature conservation purposes, the costs are incurred by the landowners. Restrictions or obligations such as limitations on clear cuts or the obligation to reforest are regularly included in forest laws and are a way to define the specific property rights of the owners. The purpose is to avoid negative externalities of forest management on the provision of public goods.
- ii. Costs to the beneficiaries: the costs of production could be assigned to those benefiting from them. This is only possible if the beneficiary groups can be clearly determined. As shown above, the benefits of nature conservation are very often non-use values. Benefits are frequently bundles of various ES, and thus are in-

direct and often apply to large groups. When looking at the example of tourism, we see that even single services may be very complex: the tourism value of forests is difficult to assess and it would be even more difficult to redirect the benefits from the group of beneficiaries (tourism companies) to the producers (landowners). Market-based instruments could be set up as they could relieve public budgets and seem to be more efficient than state subsidies.

- iii. Costs to the public: in some cases, the state may take over the costs. For improving efficiency, it is advisable to compensate not for the costs (inputs) but for the service (outputs). However, such contracts are rarely found in practice. This model is difficult to apply since a clear and objective measurement of biodiversity conservation or related ES is difficult. Furthermore, production is risky, which makes it less attractive for landowners to enter such contracts. As a consequence, result-based payment schemes are rarely found in reality.

The impact of Natura 2000 on forest owners' profit

Forest profits are defined as the difference between revenues (comprising those from harvested timber but also other revenues such as those from renting land for hunting) and financial costs. Several studies assess the impact of Natura 2000 on forest profits (Table 10). Most of these studies account for opportunity costs in addition to (financial) direct costs.

Table 10. Consequences of biodiversity conservation measures on timber revenue.

Reference Country	Measures studied	Effects on forest management*	Effects on forest income
[30], Germany	Designation of habitat trees and old trees for natural decay	Loss of production area; potential higher thinning and harvesting costs	Mean income loss: €31/ha/year when comparing Natura 2000 management with business as usual, and €39/ha/year when comparing Natura 2000 management with the forest owner's objectives.
	Conservation of habitat-typical woody species	Lower yield of beech compared to conifers: less timber harvested (long term)	
	Conservation of mature beech stands	Longer rotation periods, decreasing timber value; postponing harvest can also trigger liquidity difficulties	
[31], Denmark	Restrictions on regeneration intensity (no pesticides, limited soil preparation)	Prolonged rotation; restocking costs; higher costs due to longer fencing period; lower pesticide costs	The expectation value (EV), is lower for stands with restrictions. Relative losses in EV can be up to 10% but vary a lot.
	Old trees set-aside	Loss of production area	
[32], Germany	Conversion from an even to an uneven age structure (not specific Natura 2000)	Lower amount of harvested timber for the conversion strategy (-20%)	Total income higher for the even-aged stand, net present value higher for the transformed stand

Note: * direct costs are written in bold and opportunity costs in standard font.

These studies show that income losses due to Natura 2000 depend not only on the applied measures, but also on the forest's and the owner's characteristics.

Influence of the forest's characteristics

Different habitat types are targeted by the Habitats Directive. The **type of forest and of targeted species or habitats influences the measures** that are applied (e.g., when favouring habitat-typical tree species). The opportunity cost of foregone timber harvest is also related to the **age of the stands**. When assessing the net present value of a stand by actualising money flows, the nearest profits are given the most weight. Therefore, the closer the forest stand to economic maturity, the higher its opportunity cost. Another variable influencing the impact of Natura 2000 measures is the **yield class** of the forest. Natura 2000 measures are found to have more impact on forest stands with a higher yield class [30]. Moreover, high yield stands faced a higher absolute loss, but a lower relative loss than low yield stands [31].

Influence of the forest owner's characteristics

The forest owner's characteristics can influence the cost of Natura 2000 measures in several ways. **Current management practices have a direct impact**. Indeed, if the forest owner already fulfils the requirements of a Natura 2000 measure, implementing this measure will not trigger any cost and the compensation paid by the public authority will lack additionality. A payment is additional if it triggers a benefit that would not have existed without the payment. An example of non-additional payment is when a forest owner, who already leaves old trees for natural decay, engages in a contract that pays him a monetary compensation for what he is already doing. The corresponding money is not efficient because it doesn't improve the ecological situation compared to the "business as usual" management. Furthermore, opportunity costs of a forest stand depend on its productivity, which is not only determined by biological characteristics but also by forestry practices. **The objectives of the forest owner determine his/her management practices**, which have an impact on the cost of Natura 2000 for this particular forest [30]. Taking into account the influence of individual characteristics on the costs borne by a forest owner could be a way of adapting compensations and incentives to be more efficient. Indeed, some forest owners can reach conservation purposes at a lower cost than others. Targeting them is a way to minimise costs related to Natura 2000 (see below).

It has to be noted that previous studies focus on the costs of Natura 2000 for forest owners. They do not take into account the potential benefits generated by these measures. For example, lower-yield beech stands, which are supported by the Habitats Directive and Natura 2000, can be more resilient to storms than fast-growing conifers (e.g., spruce) which in turn can avoid economic damage. Moreover, these studies do not take into account potential (state) subsidies or compensation. Indeed, their aim is to assess the costs for forest owners in order to design adapted compensation payments. In practice, some of these measures can be partially or completely reimbursed by EU or national funds. For example, fencing against game pressure is a reimbursable measure in French contracts. In this case, the cost is borne by the state budget and the forest owner benefits from the positive impact on regeneration. Still, we must bear in mind that the benefits of such measures are often uncertain.

In short, a key task in Natura 2000 costs valuation is *to consider the total costs borne by forest owners (and the decrease in their revenue) for the calibration of monetary compensations but also those borne by other stakeholders such as public authorities, society and forest sector actors.*

6.1.3 Overview of the existing cost-benefit analyses of the Natura 2000 network

Cost-benefit analyses (CBAs) are useful tools for decision- and policy-makers. However, very few studies have conducted such an analysis in the case of Natura 2000 and none is specific to forests. The report “*Costs and socio-economic benefits associated with the Natura 2000 network*” [24] is, as far as we know, the only attempt at a CBA of Natura 2000 at a European scale (see details above).

To the best of our knowledge, only two studies have conducted CBAs of the Natura 2000 network at a national level so far. A CBA was undertaken on the Natura 2000 network in **Scotland, UK** based on seven site-scaled case studies [4], for which benefits and costs were assessed and the results extrapolated to the overall Scottish Natura 2000 network. Costs include direct (management), transaction (policy) and opportunity costs. Benefits were estimated through surveys of both use and non-use values. The authors found a Benefit Cost Ratio (BCR) of around seven over a 25-year period. This means that the **overall benefits of Natura 2000 are seven times greater than costs**.

Another report was drafted for Natura 2000 in **Spain** [33]. Aside from assessing costs related to the implementation of Natura 2000, this report identifies direct and indirect benefits delivered by the network. Authors find that **indirect revenues compensated and even overcame the related costs**. An interesting conclusion of this study is the existence of a flow of economic resource from the primary to the tertiary sector. Tourism benefits from Natura 2000, while for agriculture, fisheries and **forestry, costs overcome benefits**.

The above-mentioned results on costs and benefits are informative, but must not be considered to be comprehensive and fully accurate for Natura 2000 in forests. Major difficulties remain for evaluating both costs and benefits, and one in particular is to disentangle the effect of Natura 2000 from other site-dependent factors, such as ecological characteristics or forest management practices. The challenge is to compare the costs and benefits related to the existence or non-existence of sites.

The difficulty in evaluating the value that Natura 2000 designation adds to the benefits provided by a forest has already been highlighted [24]. The calculated figures do not clearly answer the question of whether designation as a Natura 2000 site brings an additional value to a forest. Another question concerning the impact of Natura 2000 concerns the fact that many sites were already protected under national conservation schemes before being designated as SACs or SPAs. In conclusion, while CBAs conclude that the benefits provided by Natura 2000 are far higher than the related costs, it is necessary to be aware of what is being valued and how, and a key challenge remains *to implement CBAs at different scales with accurate data on costs and benefits, based on economic indicators accounting for long-term perspective and uncertainty of results*.

6.1.4 Natura 2000 forest management instruments and cost-effectiveness

Overview of the existing instruments for Natura 2000

The European Commission strongly encourages Member States to set out Natura 2000 **management plans** in close cooperation with local stakeholders. The content and authors of these planning documents may vary across countries. Their aim is to describe

the site, the conservation objectives and the necessary measures to reach the objectives [34] (see Chapters 3 and 5).

Different types of conservation instruments can be used by the responsible public authorities to ensure biodiversity protection. These instruments usually belong to the categories of regulatory, informative or economic instruments. More detailed information on the use and effects of regulatory and informative instruments can be found in Chapter 3 and Chapter 5.

Economic instruments encompass all economic incentives such as contracts, land lease or purchase, or tax exemptions. Our review study finds several examples of economic instruments being used by Member States. For example, **voluntary contracts** are used in **France, Germany, Denmark and the UK**. Contracts are voluntary agreements between the forest owner or manager and the responsible public authority. The forest owner agrees to enact certain measures in exchange for monetary compensation. A main difference between contract types across countries is their duration (five years in France; permanent contracts in Denmark, including for future owners).

Tax exemption is another form of economic incentive. In **France**, for example, if forest owners sign a (hardly restrictive) “good practices” Natura 2000 charter, they are exempted from the property tax. **Land purchase** is used by **the Netherlands and Sweden**. It is a form of economic agreement with forest owners who forego their property rights for a one-off payment. This strategy represents a higher initial investment from the state, but has the advantage of securing biodiversity protection in the longer term.

In **Slovakia**, voluntary agreements include the possibility to **lease forest lands** for several decades, to **buy private properties**, or to **exchange them for state properties** outside protected areas. Lease costs are calculated in accordance with the possible profit from the land if it was outside protected areas and, subsequently, negotiated with the owners.

The approach to compensating forest owners for costs triggered by Natura 2000 designation differs between countries. In **Sweden**, for example, owners receive **full economic compensation** if they will suffer an economic loss due to the establishment of nature protection forms on their land (e.g., a ban on timber logging in the forest). In **Poland**, on the contrary, there is **no monetary compensation** provided to the landowners for the economic losses caused by the establishment of Natura 2000 sites.¹³ In **Denmark**, any economic loss that **the owner can prove** stems from the implementation of the EU Nature Directives is compensated at a net present value through a **lump-sum payment**.

Forest owners’ motivations for participating in voluntary Natura 2000 conservation

Voluntary contracts are increasingly used in order to ensure biodiversity conservation. This approach is considered to be more acceptable to forest owners and managers than regulations. Since the adoption of such programmes is voluntary, it is necessary to understand landowners’ motivations for participating - or not - in such programmes. Motives for adoption or non-adoption of a conservation programme can be economic (financial incentives), social (gaining a better social image, reputation, or belonging to a particular social group) or ethical (intrinsic motivations related to personal values, to opinions

¹³ In Poland, private forests represent 18% of the total forest area and are highly fragmented (with an average of one hectare). Natura 2000 sites represent approximately 20% of the land area of the country. Over 40% of forest area is under Natura 2000 and the vast majority of it (over 90%) is located in state forests [35].

about how a forest should be managed, or to attachment to the forest) [35]. Financial incentives have been found to be an important motivation for participating in voluntary schemes in several studies. At the same time, payments for environmental services (PES) have been criticised because they might lead to paying landowners for something they would have done anyway (i.e., lack of additionality). On this question, a study shows that most forest owners (64%) in **Denmark** declared increased willingness to set aside productive forest land when offered financial compensation [36]. This result is in favour of PES schemes. However, for some forest owners, financial compensation has the opposite effect: their willingness to set aside productive stands decreases when they are offered money to do so. This effect is described as a “crowding-out effect”: economic motivations can crowd-out non-economic ones. Being aware of such potential crowding-out effects is important for designing a voluntary scheme. Sociologists assume that economic incentives could crowd out social motives [37], since the volunteer’s involvement in the programme needs to be genuine in order to bring social benefits. However, a recent study finds no such crowding-out effect between social and economic motives for non-industrial private forest owners in **France** [35].

Forest owners’ willingness to accept Natura 2000 measures

Several studies assess forest owners’ WTA compensation for implementing biodiversity-friendly measures (Table 11). **Forest owner’s WTA for implementing Natura 2000 measures is not necessarily equal to their costs.** For example, a study of forest owners in Denmark [38] finds that compensation claims were lower than opportunity costs for setting aside forest stands and for maintaining a certain percentage of broadleaves. On the other hand, owners demanded very high compensation for allowing public access to their forests, even if it didn’t entail costs for them. This has two major implications: first, compensating in relation to the costs can lead to over- or undercompensation compared to the forest owner’s actual loss of utility. Moreover, other factors than the cost of implementation influence the WTA. Identifying these factors can hence help design the most attractive payment scheme at a lower cost for the public authority.

Table 11. Forest owners’ WTA compensation for different conservation measures.

Reference	Country	Method	Valuation of the WTA
[38]	Denmark	CE	€0.48/ha/year for the entire forest per percentage point of land set aside; €7.1/ha/year for having 75% of broadleaves; €32/ha/year for allowing unlimited public access to the forest
[28]	Finland	CE	€224/ha/year (higher than the average annual revenue per ha)
[19]	Norway	CV	€259/ha/year for strict forest reserve

Note: The Norwegian study relates to strict reserve possibly comparable to some Natura 2000 forest sites.
CV= Contingent valuation, CE= choice experiment

Compensation claims also depend on current management practices. A study shows that forest owners in **Denmark** who already had untouched forest areas or already allowed access to their forests had a mean WTA of 0 for implementing such measures [38]. Therefore, flat-rate payments could lead to overcompensation and to no additionality, since forest owners get paid for what they would have done anyway. However, more tailored payments could create a sense of unfairness and have a perverse effect on forest owners who are already managing their forest in a biodiversity-friendly way.

Overcompensation issues related to Natura 2000 in forests are identified in **Denmark** and **France** [9]. The difficulty is to target the forest owners with the highest conservation potential and the lowest opportunity cost. Indeed, there are several information asymmetry issues that can lead to non-optimal contracts. Another study [29] finds that the most used measure in Natura 2000 forest contracts in **France** was setting aside trees for natural senescence. This can be explained by the fact that this measure is the only one that takes into account opportunity costs for compensation, and not only direct costs. This result shows the need to account for opportunity costs in the definition of payments for Natura 2000 forest contracts in France in order to successfully trigger participation from private forest owners. Other factors found to influence forest owners' willingness to take part in incentive payment programmes are (i) age (younger people are more likely to accept a contract); (ii) gender (women are more likely to take part in incentive payment programmes); (iii) household income (it is positively correlated to the probability of taking part in a contract); (iv) general attitude towards nature conservation; (v) the flexibility of the contract (short-term contracts are preferred to long-term contracts); (vi) the importance of the restrictions on forest uses and the perceived impact of the contract on the forest owner's sovereignty; (vii) the cost of implementing the measures for the forest owner; and (viii) the ecological value of the forest area (implying a higher claimed compensation).

Cost-effectiveness of Natura 2000 policy

Cost-effectiveness can be defined in two ways. For a given budget, the most cost-effective strategy is the one that maximises the biodiversity output (also referred to as budget efficiency in the literature). For a given goal in terms of biodiversity protection, the most cost-effective strategy is the one that comes at the lowest cost. The cost-effectiveness of public policies, including the Natura 2000 network, has been increasingly studied.

Biodiversity benefits and the different costs of biodiversity measures

An integrated approach to designing areas for biodiversity protection, **accounting for both ecological and commercial values (i.e., opportunity costs) of the forest stands**, is often considered to be cost-effective. A study in **Finland** [39] showed that an integrated model leads to a nine to 19% higher conservation cost-efficiency than a model based only on ecological criteria or another based on low-cost sites. In **France** [29], the opportunity costs of timber production are not taken into account in the definition of payments for Natura 2000 forest contracts (except for a measure on development of senescent wood). These studies point to the value of relying on public forest owners when biodiversity needs to be conserved in areas characterised by a high land pressure. This is because multiple-objective public owners (state or municipalities) are willing to bear higher opportunity costs of land use than private owners. However, as described in an exploratory study of **Finland, Germany, the Netherlands and Poland** [24], the cost-effectiveness of a biodiversity conservation programme depends on the repartition between different types of costs. **A trade-off exists between minimising direct costs and non-monetary costs.** For instance, targeting the sites that will provide the most biodiversity at the lowest direct cost requires a higher decision-making budget to gather all necessary information. In **Finland**, it was found that coordination of the management of protected swamps over wider areas would be more effective. However, such coordination would also entail higher decision-making costs. Another example is involving more stakeholders in the decision, which can lead to better results and lower conflict costs, but comes at a higher decision-making cost.

One way to make biodiversity conservation more cost-effective in private forests could be the use of payments for conservation results, and not for measures themselves. In addition to targeting landowners who can provide biodiversity protection at a lower cost, it gives them an incentive to reach conservation goals with minimum costs. Due to the long-term and uncertain results of measures on biodiversity, forest owners in **France** are asked to implement some measures subject to a prepayment, and are given a bonus at the end of the contract if and when the expected state of biodiversity is achieved [9].

Cost-effective allocation of measures in space and time

The cost-effectiveness of a biodiversity conservation programme also depends on the **location of measures in space and time**. Relevant research and policy questions concern the choice between uniform or spatially differentiated payments. If conservation costs and benefits are heterogeneously distributed **in space**, the implementation of differentiated payments can bring significant cost-effectiveness gains. Ecological data on the likelihood of the presence of species on a forest parcel, together with data on the productivity of tree species (combined with price data on timber in order to estimate the forest owners' opportunity costs), would make it possible to design cost-effective and incentive-compatible payments for species conservation.

The allocation of measures **in time** also has an effect of their effectiveness. Indeed, preserving some species or habitats requires long-term actions, and results cannot be achieved in a short time. In such cases, money is wasted if not spent over a long enough period to achieve the conservation goals [24]. The currently applied short-term contracts for forest measures are widely criticised for not being appropriate for the slow and long-term developments in forest ecosystems [24, 40]. There are studies which show a waste of initial investments if the conservation contracts run out and owners apply regular forest management after the end of the contracts. On the other hand, short-term contracts are more likely to attract forest owners. In **France**, for example, contracts are concluded for a minimum duration of five years (except for the measure on senescent trees, which is 30 years). This could result in the implementation of measures on a wider area. But, at the end of this period, there is no guarantee of continuity of management practices, which runs the risk of cancelling out the benefits of the conservation action. The relevance of these very short contracts must be seriously questioned. In **Denmark**, on the other hand, the voluntary agreements negotiated between public authorities and the forest owner are permanent for all current and future owners and users. Time can also influence the cost-effectiveness of a forest conservation programme because of the evolution in timber prices, which has an impact on the opportunity cost of foregone timber harvest. However, this is not a lever policy-makers can directly influence.

A key task is to *define conservation incentives that can account for trade-offs and synergies between forest ecosystem goods and services as well as their variability in space and time (and accounting for climate change)*.

References:

- [1] European Commission, 2008. *Natura 2000: Protecting Europe's biodiversity*. Information Press, Oxford: United Kingdom.
- [2] TEEB, 2010. *The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations*. Earthscan, London and Washington: Pushpam Kumar.
- [3] Pouta, E., Rekola, M., Kuuluvainen, J., Tahvonen, O., Li, C.-Z., 2000. Contingent valuation of the Natura 2000 conservation programme in Finland. *Forestry*, 73(2), 119-128.

- [4] Jacobs, 2004. *An economic assessment of the costs and benefits of Natura 2000 sites in Scotland*. Final Report, Scottish Executive 2004, Environment Group Research Report 2004/05.
- [5] Schirpke, U., Scolozzi, R., Marco, C. D., Tappeiner, U., 2014. Mapping beneficiaries of ecosystem services flows from Natura 2000 site. *Ecosystem Services* 9, 170–179.
- [6] Garcia-Nieto, A., Garcia-Llorente, M., Iniesta-Arandia, I., Martin-Lopez, B., 2013. Mapping forest ecosystem services: From providing units to beneficiaries. *Ecosystem Services*, 4, 126–138.
- [7] Bio Intelligence Service, 2011. *Estimating the economic value of the benefits provided by the tourism/recreation and employment supported by Natura 2000*. Final Report prepared for European Commission – DG Environment.
- [8] Pabian O., Jaroszewicz B., 2009. *Assessing Socio-economic Benefits of Natura 2000 – a Case Study on the ecosystem service provided by Białowieża Forest*. Output of the project Financing Natura 2000: Cost estimate and benefits of Natura 2000 (Contract No.: 070307/2007/484403/MAR/B2), 69pp.
- [9] Anthon, S., Garcia, S., Stenger, A., 2010. Incentive Contracts for Natura 2000 Implementation in Forest Areas. *Environ Resource Econ*, 46(3), 281–302.
- [10] ten Brink P., Badura T., Bassi S., Daly, E., Dickie, I., Ding H., Gantioler S., Gerdes, H., Ketunen M., Lago, M., Lang, S., Markandya A., Nunes P.A.L.D., Pieterse, M., Rayment M., Tinch R., 2011. *Estimating the Overall Economic Value of the Benefits provided by the Natura 2000 Network*. Final Report to the European Commission, DG Environment on Contract ENV.B.2/SER/2008/0038. Institute for European Environmental Policy / GHK / Ecologic, Brussels.
- [11] European Commission, 2015. *Natura 2000 and Forests - Part I-II*. Technical Report - 2015 – 088. Luxembourg: Office for Official Publications of the European Commission.
- [12] Múcher, C.A., Hennekens, S.M., Bunce, R.G.H., Schaminee, J.H.J., and Schaepman, M.E., 2009. Modelling the spatial distribution of Natura 2000 habitats across Europe. *Landscape and Urban Planning*, 92, 148–159.
- [13] Rekola, M., Pouta, E., Kuuluvainen J., Tahvonen, O., Li, C.-Z., 2000. Incommensurable preferences in contingent valuation: The case of Natura 2000 Network in Finland. *Environmental Conservation*, 27(3), 260–268.
- [14] Pouta, E., Rekola, M., Kuuluvainen, J., Li, C.-Z., Tahvonen, O., 2002. Willingness to pay in different policy-planning methods: insights into respondents' decision-making processes. *Ecological Economics*, 40, 295–311.
- [15] Li, C.-Z., Kuuluvainen, J., Pouta, E., Rekola, M., Tahvonen, O., 2004. Using Choice Experiments to value the Natura 2000 Nature Conservation Programs in Finland. *Environmental and Resource Economics*, 29, 361–374.
- [16] Lehtonen, E., Kuuluvainen, J., Pouta, E., Rekola, M., Li, C.-Z., 2003. Non-market benefits of forest conservation in southern Finland. *Environmental Science & Policy*, 6, 195–204.
- [17] Kniivilä, M., Ovaskainen, V., Saastamoinen, O., 2002. Costs and benefits of forest conservation: regional and local comparisons in Eastern Finland. *Journal of Forest Economics*, 8, 131–150.
- [18] Prada Blanco, A., Vazquez Rodriguez, M. X., Solino Millan, M., 2005. Beneficios y costes sociales en la conservación de la Red Natura 2000. *Fundación Caixa Galicia*, 0.
- [19] Lindhjem, H., Grimsrud, K., Navrud, S., Kolle, S. O., 2015. The social benefits and costs of preserving forest biodiversity. *Journal of Environmental Economics and Policy*, 202–222.
- [20] Nielsen, A.B., Olsen, S.B., Lundhed, T., 2007. An economic valuation of the recreational benefits associated with nature-based forest management practices. *Landscape and Urban Planning*, 63–71.
- [21] Rametsteiner, E., Kraxner, F., 2003. *Europeans and Their Forests - What Do Europeans Think About Forests and Sustainable Forest Management? A Review of Representative Public Opinion Surveys in Europe*.
- [22] TNS opinion & social, 2015. *Special Eurobarometer 436 - Attitude of Europeans towards biodiversity*.
- [23] Kaphengst, T., Bassi, S., Davis, M., Gardner, S., Herbert, S., Mazza, L., Pieterse, M., Rayment, M., 2011. *Taking into account opportunity costs when assessing costs of biodiversity and ecosystem action*. Ecologic, IEEP, GHK.
- [24] Wätzold, F., Mewes, M., van Apeldoorn, R., Varjopuro, R., Chmielewski, T. J., Veeneklaas, F., Kosola, M.-L., 2010. Cost-effectiveness of managing Natura 2000 sites: an exploratory study for Finland, Germany, the Netherlands and Poland. *Biodiversity Conservation*, 2053–2069.

- [25] Wätzold, F., Schwerdtner, K., 2005. Why be wasteful when preserving a valuable resource? A review article on the cost-effectiveness of European biodiversity conservation policy. *Biological Conservation*, 123, 327-338.
- [26] Leppänen, J., Linden, M., Uusivuori, J., Pajuoja, H., 2005. The private cost and timber market implications of increasing strict forest conservation in Finland. *Forest Policy and Economics*, 7, 71-83.
- [27] Winkel, G., Blondet, M., Borrass, L., Frei, T., Geitzenauer, M., Gruppe, A., Jump, A., de Koning, J., Sotirov, M., Weiss, G., Winter, S., Turnhout, E., 2005. The implementation of Natura 2000 in forests: A trans- and interdisciplinary assessment of challenges and choices. *Environmental Science & Policy*, 52, 23-32.
- [28] Horne, P., 2006. Forest Owners' Acceptance of Incentive Based Policy Instruments in Forest Biodiversity Conservation – A Choice Experiment Based Approach. *Silva Fennica*, 169-178.
- [29] Hily, E., Garcia, S., Stenger, A., Tu, G., 2015. Assessing the cost-effectiveness of a biodiversity conservation policy - A bio-econometric analysis of Natura 2000 contracts in forests. *Ecological Economics*, 197-208.
- [30] Rosenkranz, L., Seintsch, B., Wippel, B., Dieter, M., 2014. Income losses due to the implementation of the Habitats Directive in forests - Conclusion from a case study in Germany. *Forest Policy and Economics*, 207-218.
- [31] Jacobsen, J. B., Vedel, S. E., Thorsen, B. J., 2013. Assessing costs of multifunctional Natura 2000 management restrictions in continuous cover beech forest management. *Forestry*, 575-582.
- [32] Knoke, T., Plusczyk, N., 2001. On economic consequences of transformation of a spruce (*Picea abies* (L.) Karst.) dominated stand from regular into irregular age structure. *Forest Ecology and Management*, 163-179.
- [33] Moreno, V.; Picazo, I.; Vázquez-Dodero, I. e Hidalgo, R. (Coords.), 2013. *Valoración de los costes de conservación de la Red Natura 2000 en España*. Ministerio de Agricultura, Alimentación y Medio Ambiente: Madrid.
- [34] European Commission, 2014. ANNEX 2 - Fact Sheets on Natura 2000 Management Planning in the Member States – Situation in 2011. In: *Establishing conservation measures for Natura 2000 Sites*.
- [35] Polomé, P., 2016. Forest Owners Motivations for Adopting Programs of Biodiversity Protection. *Journal of Environmental Management*, 183(1), 212-219.
- [36] Boon, T. E., Broch, S. W., Meilby, H., 2010. How financial compensation changes forest owners' willingness to set aside productive forest areas for nature conservation in Denmark. *Scandinavian Journal of Forest Research*, 25: 6, 564 - 573.
- [37] Bénabou, R., Tirole, J., 2006. Incentives and Prosocial Behavior. *The American economic review*, 1652-1678.
- [38] Vedel, S., Jacobsen, J. B., Thorsen, B. J., 2015. Forest owners' willingness to accept contracts for ecosystem service provision is sensitive to additionality. *Ecological Economics*, 113, 15-24.
- [39] Juutinen, A., Mäntymaa, E., Mönkkönen, M., Salmi, J., 2004. A cost-efficient approach to selecting forest stands for conserving species: A case study from Northern Fennoscandia. *Forest Science*, 527-539.
- [40] Geitzenauer, M., Blondet, M., de Koning, J., Ferranti, F., Sotirov, M., Weiss, G., Winkel, G., 2017. The Challenge of Financing the Implementation of Natura 2000 - Empirical Evidence from Six European Union Member States. *Forest Policy and Economics* (in press).

Funding of Natura 2000 in forests

Lead Author: Gerhard Weiss

Contributing authors: Zuzana Sarvašová, Virgilio Hermoso, Lluís Brotons, Metodi Sotirov

6.2.1 EU funding instruments for Natura 2000 in forests

The responsibility for implementing and financing EU environmental policy lies with the EU Member States (Maastricht Treaty, 1992). The Treaty, however, allows for EU contributions in exceptional cases when disproportionate costs for individual Member States occur. For the Habitats Directive, a co-financing by the EU was initially only foreseen as an exception. After years of political debates and a consultation of Member States and stakeholders, the European Commission eventually decided to offer EU funding opportunities for Natura 2000 but through a so-called “integrated approach”. This means the use of financing sources from different existing EU budgets and policy fields (e.g., environmental protection, structural funds for regional development, agriculture and rural development etc) [1]. However, no specific single instrument for Natura 2000 was created and a full coverage of costs is not foreseen. Available budgets are significantly lower than the implementation costs.

Currently, the implementation of Natura 2000 can be co-funded through several EU instruments, namely the European Agricultural Fund for Rural Development (EAFRD), the European Maritime and Fisheries fund (EMFF), the European Regional Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund, the Financial Instrument for the Environment (LIFE) and the Framework Programme for Research and Innovation (Horizon 2020). Private sources of funding play hardly any role. EAFRD and LIFE, as the most relevant for funding of Natura 2000, are specifically described and evaluated in the following section. After that, the main issues in the implementation of funding for Natura 2000 are analysed based on the available scientific literature and practical knowledge.

6.2.2 European Agricultural Fund for Rural Development (EAFRD)

Programme period 2007–2013

Established in the year 2000, the European Agricultural Fund for Rural Development (EAFRD) is the funding instrument for the EU’s Rural Development Policy (RDP). Natura 2000 payments were introduced and available for the RDP programming period 2007–2013 under Axis 2 - *Improving the environment and the countryside through land management*, through the new Measures 213 and 224, the former on agriculture, the latter on forestry land. The Natura 2000 payments in forests (M224) were defined as a

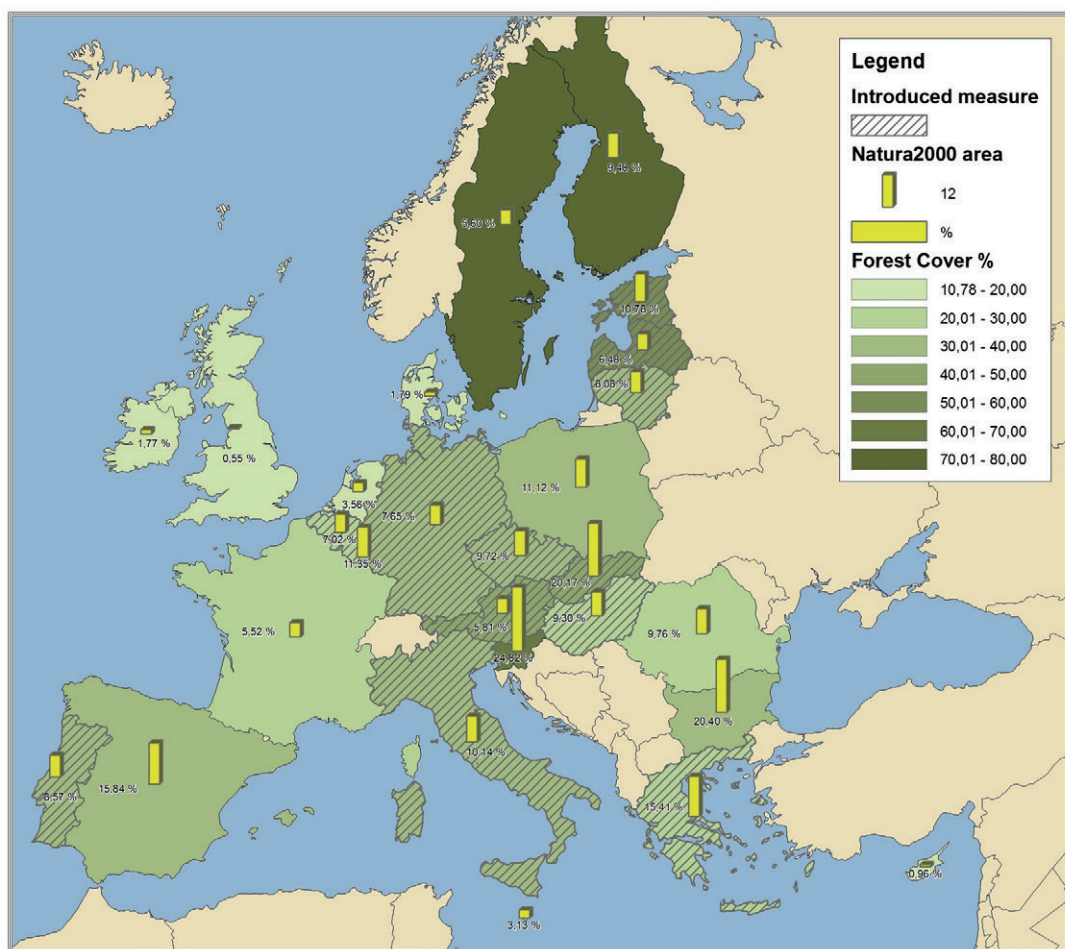


Figure 4: Planned distribution of RDP Measure 224 for Natura 2000 payments in forests across EU countries, programming period 2007-2013.

compensation mechanism “... for costs incurred and income foregone resulting from the restrictions on the use of forests and other wooded land due to the implementation of Directives 79/409/EEC and 92/43/EEC”.

This measure was designed to compensate private forest owners for disadvantages related to the forests in the Natura 2000 network. According to a preliminary estimation of DG Agriculture and Rural Development of the European Commission (DG AGRI), 60,000 private forest owners and 400,000 hectares of forest should have been supported through national Rural Development Programmes (RDPs) in the EU-27 during the programming period 2007–2013 [2].

Member States were free to choose any RDP measures to achieve their regional priorities. Measure 224 was programmed in 15 out of the 88 national or subnational RDPs (2007–2013). This means that only 12 Member States (Austria, Belgium, Czech Republic, Estonia, Germany, Greece, Italy, Latvia, Lithuania, Portugal, Hungary and Slovakia eventually introduced this measure by modifications in 2012) out of all 27 EU countries chose to implement the measure (Figure 4).

Table 12. Implementation of RDP Measure 224 for Natura 2000 payments in forests, 2007–2013. [3, 4].

Natura 2000 payments 2007-2013	Planned Expenditure (€'000) EAFRD	Planned number of supported forest holdings	Planned supported ha	Public Expenditure (€'000) EAFRD	Number of forest holdings supported	Forest land supported (ha)
12 member states from EU-27	72,068	47,199	509,161	61,894.06	14,391	278,974.6

The total public expenditure (EU+Member State) programmed for M224 during the period 2007–2013 was €95m (of which more than €72m was EAFRD contribution). During that period, more than 14,000 forest holdings in Natura 2000 areas and 278,900 hectares of forests received support (Table 12).

According to the data from DG AGRI (preliminary data, not finally validated, as of June 2016), Hungary has financially supported the largest area of forest land in Natura 2000 (around 115,494 hectares). A significant amount of forest land has also been supported in Estonia, Latvia, and Slovakia (72,981; 34,002 and 19,132 hectares respectively). Estonia was able to support 6,149 beneficiaries, Hungary supported 3,116 and Latvia 2,297 forest holdings. Italy supported only three forest holdings (52 hectares of forest land) and Greece had problems with implementation and therefore no financial aid to Natura 2000 forests through the Measure 224 was provided. The system of monitoring data collection is suitable for financial tracking of the overall budget for the programming period, but of very limited use in analysing the results and outputs for biodiversity.

Programme period 2014–2020

With the CAP reform in 2014, the financing of Natura 2000 areas changed. Several measures under the RDP may be applied in Natura 2000 areas but the shares of the budgets are not specified. Support for Natura 2000 sites may be covered by operations, and cooperation among various actors and multiple purposes, but they cannot be traced in terms of their amount. Such indirect opportunities provide for a range of activities, such as improving knowledge about rural biodiversity or drawing up Natura 2000 management plans. There is only one measure exclusively dedicated to supporting Natura 2000 – Measure 12 *Payments for Natura 2000 areas in combination with Water Framework Directive payments* which is aimed at activities on agricultural land (sub-measure 12.1), forests (12.2) and water/wetlands (12.3). Financial support can be granted annually per hectare to landowners in order to compensate for the additional costs and income foregone related to the constraints or restrictions, as long as they are specified in Natura 2000 management plans or equivalents (e.g., forest management plans).

Measure M12 is due to be implemented in 17 (Austria, Belgium, Bulgaria, Czech Republic, Cyprus, France, Germany, Greece, Hungary, Estonia, Italy, Latvia, Lithuania, Luxembourg, Portugal, Slovakia and Spain) out of the 28 EU Member States. Total planned public expenditure is around €745,565m (€505m from EAFRD). Figure 5 presents the planned budget distribution for M12 in these 17 Member States. However, only 10 are ready to apply sub-measure 12.2 in forests.

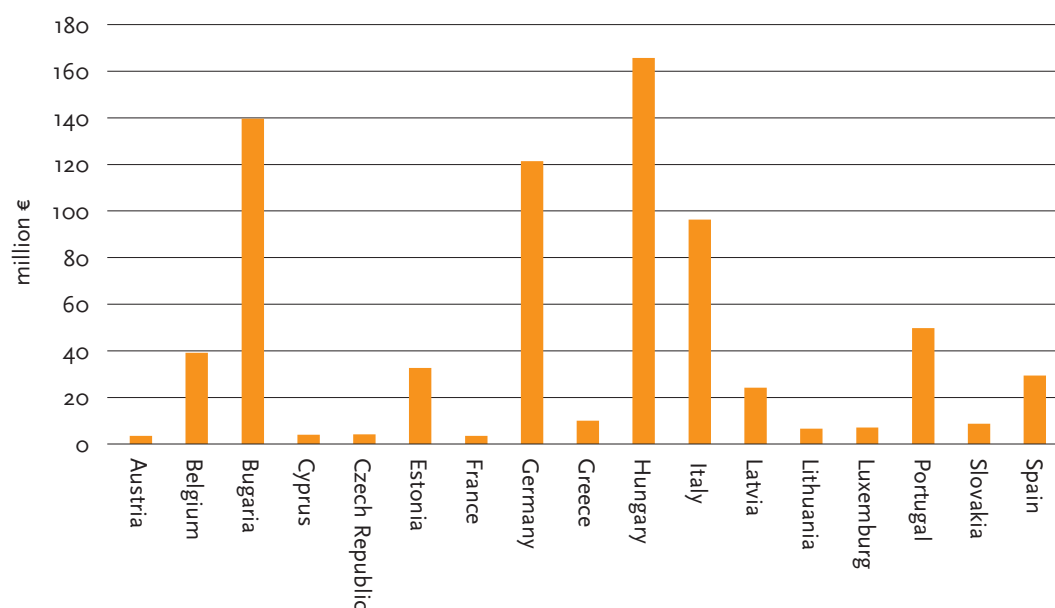


Figure 5: Indicative public support for Natura 2000 specific payment (M12) in RDP 2014-2020. [5]

Similar to the former measure 224 for Natura 2000 payments in forests (period 2007–2013), the specific sub-measure M12.2 *Payments Natura 2000 for forest areas* (new period 2014–2020) was designed to compensate private forest holders and their associations for the disadvantages they face as a result of any mandatory activities they carry out under the legal requirements set out by Natura 2000 under the EU's Habitats and Birds Directives, compared to the situation of forest owners in other areas not affected by these requirements. Non-intervention management, as well as necessary management activities, in Natura 2000 forest sites can be financed to support specific active conservation actions targeted at the relevant species and habitats for which the sites are designated. M12.2 is due to be used by the following Member States (and their regional RDPs) that had applied the similar Measure 224 in the former period: Belgium (Walloon), Estonia, Germany (Baden-Württemberg, Mecklenburg-Vorpommern), Greece, Hungary, Italy (Basilicata, Liguria, Marche, Piemonte, Umbria), Latvia, Lithuania, Portugal (Madeira) and Slovakia. There are three countries which newly programmed M12.2: Bulgaria (at a later stage and subject to resolving some issues), France (Basse-Normandie) and Spain (Castilla-Mancha, Murcia, Navarra). A few countries, such as the Czech Republic, do apply M12 but not in forests (no M12.2) [4].

Evaluating Natura 2000 payments in forests

An analysis of the use of Natura 2000 payments by the Member States shows severe deficiencies for their effective and efficient application. Their use seems to depend heavily on national political preferences. Although opportunities for an evaluation of their effectiveness are very limited, the use of EU funds in the Member States can be evaluated against some general indicators of funding needs. The main results of two recent studies [4, 6] on the use of Measure 224 for Natura 2000 payments on forest lands (2007–2013) are summarised in the following.

The preliminary data available shows that the funding of Natura 2000 sites in forests was used by less than half of the Member States, and that the expectations of the

European Commission with regard to the number of beneficiaries and forest area were not reached. Member States that implemented M224 spent 85% of their budgets on average. The financial support reached less than a third of the forest holdings and less than half of the forest land when compared to the plans.

According to one of the studies [6], the probability that countries implement M224 depended more on institutional factors (governance index) than environmental indicators (biodiversity index). There was no correlation with their economic situation (GDP) whereas the amounts of payments have an inverse relation to what could be assumed to be funding needs (e.g., the share of private forests in the country). The most striking result is that those countries with more forest areas under Natura 2000 do not use more EU payments but, on the contrary, they use less or no funds. The use of Natura 2000 payments apparently does not serve the goal of compensating for economic loss of forest owners. Furthermore, total payments were higher for countries that implemented CAP Axis 1 measures (competitiveness oriented measures) more strongly than Axes 2 or 3 (environmental and quality of life oriented measures). It can be hence concluded that *countries use the Natura 2000 payments much more for fostering the competitiveness of the agricultural and forest sectors than environmental sustainability and biological conservation.*

Since the use of EU funds seems to be hardly guided by the aim of compensating for the disadvantages of the Natura 2000 designation for landowners, their effectiveness and efficiency is questionable. A better understanding of the reasons behind this use of EU funds requires an in-depth analysis. It has been investigated through some case studies and the results are summarised and discussed below (see 6.2.4).

Outlook

The broader environmental-oriented outline of RDP measures, as defined in the programming period 2014–2020, aims to increase the overall availability of funding for restoring, preserving or enhancing the ecosystems of Natura 2000 sites in forests. *However, the Natura 2000 financing relevant for forests is still insufficient.* For example, the German federal states (Länder) identified new funding needs for the implementation of the EU's Nature Directives (cost estimation for Natura 2000) of about €1.416bn/year. This is approximately equivalent to the Greening money of the CAP in Germany (which is €1.5bn/year). EAFRD funding is thus not sufficient to implement the EU and national biodiversity objectives for Natura 2000 [7]. Furthermore, *the multiple measures available without being tracked to Natura 2000 areas increases the difficulty in monitoring the impact of the RDP payments in achieving the objectives of the EU's Nature Directives.*

6.2.3 European Environmental Fund (LIFE)

In 1992, the EU founded the LIFE program that has been the main financial instrument aimed at “contributing to the implementation, updating and development of Community environmental policy and legislation” (Article 1, EC 1655/2000). There were four successive LIFE programs during the period 1992–2013 (LIFE I 1992–1995, LIFE II 1996–1999, LIFE III 2000–2006 and LIFE+ 2007–2013), each of them with specific objectives but all including the common priority of demonstrating how to implement the EU's Birds and Habitats Directives including the Natura 2000 network. During that period, LIFE co-funded about 3,954 projects, contributing approximately €3.1bn. These funds have not all been directed to on-the-ground conservation of species and habitats, but have also helped create and consolidate Natura 2000, environmental monitoring,

clean technologies and waste management, among other things. In 2014, a new extension of LIFE was approved for the period 2014–2017, with an overall budget of €1.1bn under the sub-programme for environment, which includes previous LIFE-Nature, and €0.36bn under the sub-programme for climate action.

Evaluating LIFE for the conservation of European biodiversity

LIFE-Nature has been at the core of the programme and received a significant proportion of the EU funds. Taking all the finished LIFE programmes together, LIFE-Nature co-funded some 1,448 projects and contributed €1,625m for a total investment (including the Member States' contribution) of about €2,964m. These funds have been continuously increasing at an average annual rate of 7% from the beginning of the programme (from €44m in 1992 to >€233m in 2013). A substantial part of these funds (around €2,050m) has been spent on conservation programmes aimed at helping to implement conservation actions on the ground for priority species and habitats that would also serve as demonstrations of best practices for future management.

These funds have not been homogeneously distributed across the EU regions [8]. The distribution of LIFE funds showed clear spatial biases, with significant portions of funds directed towards Northern and Central Europe, while several regions in Eastern and Western Europe received poorer attention (Figure 6). This spatial pattern of funding is inconsistent with the distribution of both biodiversity and threatened species. This has led to a *mismatch between the distribution of funds and real conservation needs in the EU*, for example with regard to the number of threatened vertebrate species that occur in these regions [8].

Similar biases in the distribution of LIFE-Nature funds are also found at the species level. The majority of funds were directed towards species of low global/continental conservation concern (75% of all funds are spent on Least Concern species). This resulted in *overfunding of non-threatened species* even in relation to a random distribution of funds, which is far from an ideal use of funding resources. On the contrary, *globally threatened species have been clearly underfunded* [8].

Evaluating LIFE for European forests

When looking at LIFE-Nature projects that explicitly targeted habitats (not only species), forest habitats were the second most relevant in number of projects funded (57 out of the 255 projects on habitats), and the third in terms of funds received (after freshwater and grassland habitats) (Figure 7a). *Forest habitats have been funded below average* (20% less than average across all other habitats) in the period 1992–2013 (Figure 7b). These differences increase when accounting for the spatial distribution of each habitat, given the predominant occurrence of forest habitats in Europe and their contribution to the list of priority habitats in Annex I of the Habitats Directive (largest representation of habitat types to priorities in the Annex).

6.2.4 The implementation of EU funding in practice

Late development of financing instruments – different levels and ways of use by the Member States

Specific funds for measures to implement Natura 2000 were **not initially considered** at EU level: the measures and instruments used to implement the policy were left to the Member States. In turn, the EU countries did not give this issue much attention either.

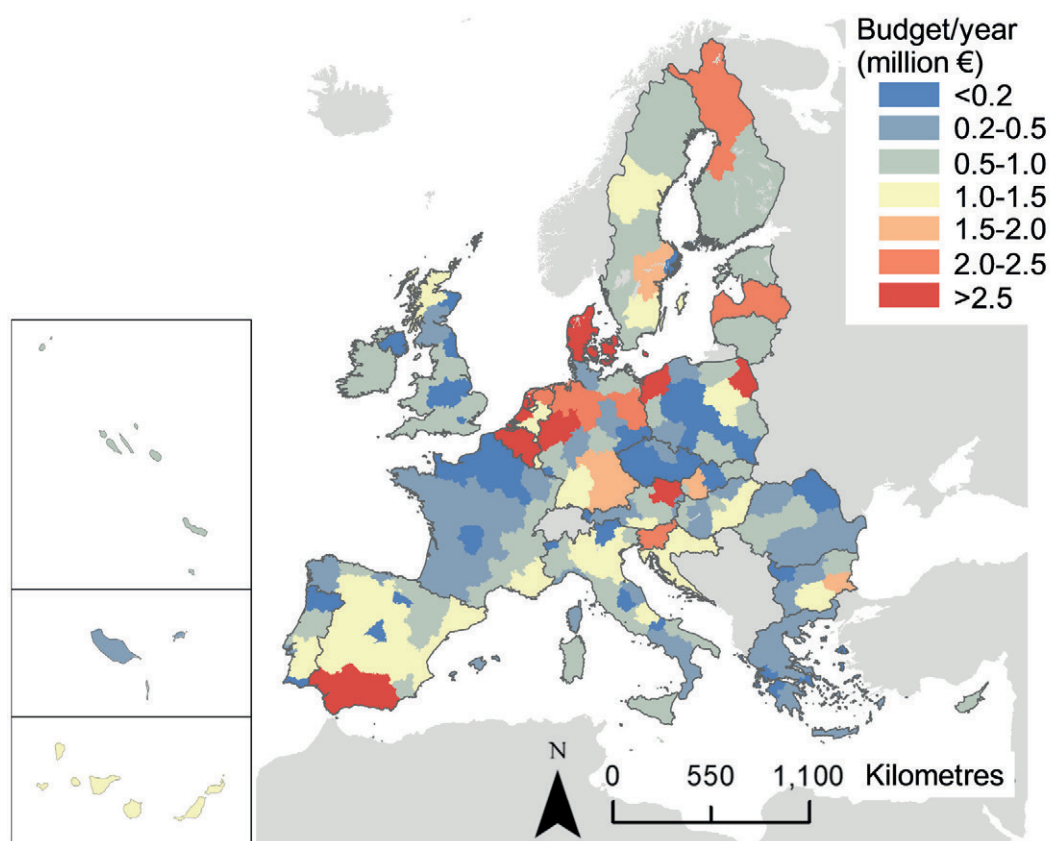


Figure 6: Distribution of LIFE-Nature funds (average budget in millions of euros/year) across regions in the EU. Regions were delimited according to the NUTS 2013 classification available from the Eurostat website (<http://ec.europa.eu/eurostat/web/nuts/>). Level 2 of this regional classification was used, except for Germany, the Netherlands, Belgium, Denmark and England where this would have resulted in extremely small spatial units, so level 1 was used instead in order to homogenise the size of regions.

As shown in Chapter 3, *the design and implementation of the Natura 2000 policy started with the assessment of conservation needs and designation of protected areas without a consideration of the potential costs and benefits and without planning compensation instruments.* The neglect of the financing issue is reported to be one of the major causes of landowner opposition to the Natura 2000 policy (Chapter 3). Only after years of debate were specific measures dedicated in the Rural Development Programmes, starting from 2007 onwards, when some Member States started to offer financial compensation. As a result, Member States have **implemented and funded Natura 2000 in quite different ways**, some of them supporting it with and some without EU co-financing [4, 6, 9].

For instance, **Austria** and **France** use EU co-funding to overcome domestic budget constraints, whereas **the Netherlands** applies its own budget sources [9]. The Natura 2000-specific measures in the EAFRD period 2007–2013 for agriculture (Measure 213) and for forestry (Measure 224) were used in quite different ways: while both measures were planned for by **Austria** and in some of **Germany's** federal states and **Spain's** provinces, none of them were included in the national RDPs in **France**, **the Netherlands** and **the UK**. **Bulgaria**, a few German federal states and some Spanish provinces planned to apply only the agricultural but not the forestry measure. **Greece** planned to support areas

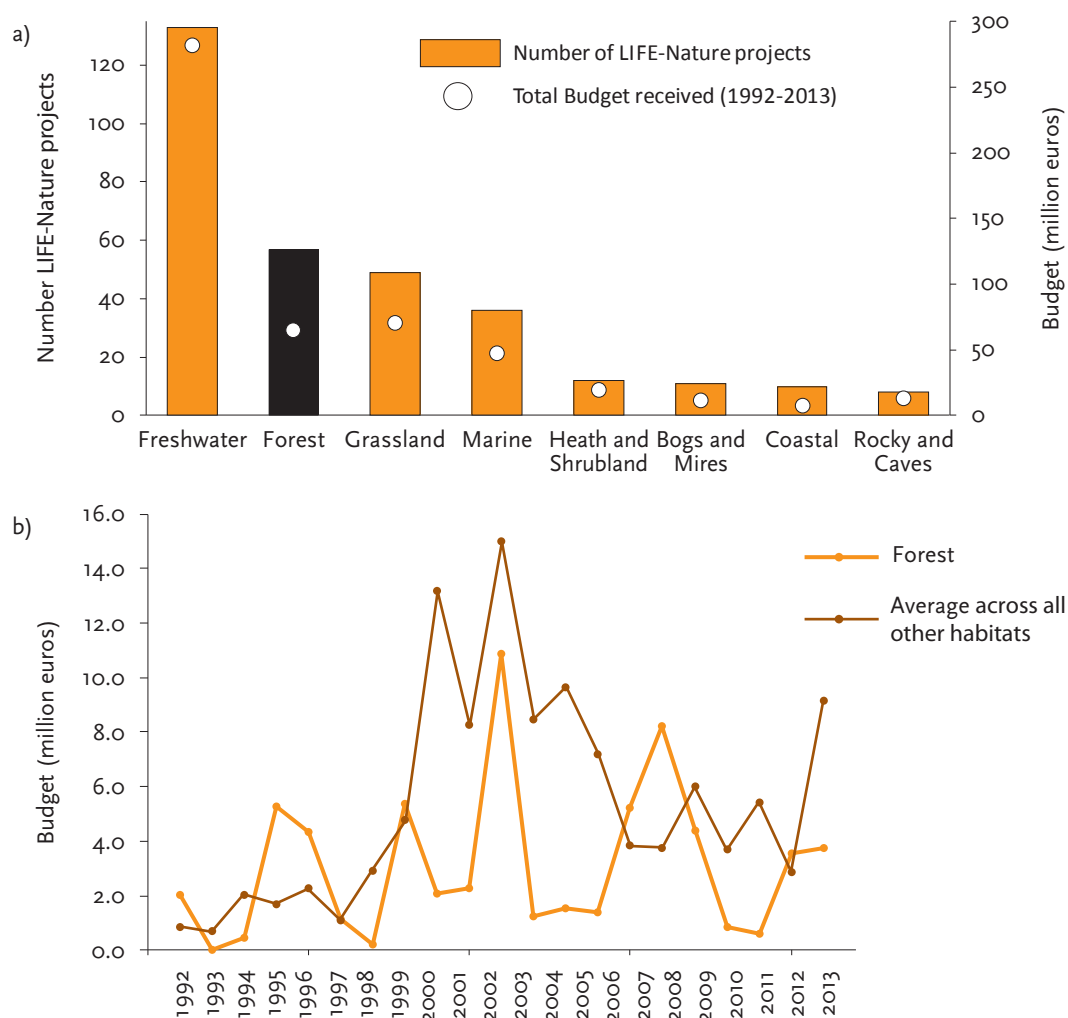


Figure 7: Number of LIFE-Nature projects addressing different types of habitats and average budget received by these habitat types in the period 1992-2013 (a); and temporal change in budget received by forest habitats and the average across all other habitat types (b).

affected by forest fires, while in **Belgium** (Walloon) and **Slovakia** private forest owners were compensated for non-intervention management regimes. In the **Czech Republic**, support was used to protect the high ecological value of private forests during conversion. In **Lithuania**, environment-friendly forest management was supported. **Hungary** used the support primarily for the collection of information about the status of Natura 2000 forest species and habitats on private forest land [4].

Sometimes, RDP measures other than the dedicated measures for Natura 2000 were used, for example measures relevant for forest protection in **Austria**. However, the specific amounts are not known since it is not documented which share of these measures are situated in Natura 2000 sites [1].

All in all, only a few percent of the estimated total costs for Natura 2000 [10] were foreseen in the national RDPs and LIFE programmes. For **Austria**, this share is 13%,

for France, the Netherlands, Spain, and the UK the percentages are less than 2%.¹⁴ *Not only do the foreseen measures cover only a very small part of the costs assessed for Natura 2000, only parts of the funds have been taken up and only parts of the budget have effectively been used by Member States for forest management on the ground.* In both EAFRD and LIFE programmes, the funds are used to a significant extent for setting up the Natura 2000 network, e.g., for ecological mapping and assessments, feasibility studies or other measures for supporting the Natura 2000 policy, and only to a small extent for direct investments in the forests for management measures.

The politics of Natura 2000 funding – the role of public administration

With the European Commission and Member States' decision to apply an "integrated approach" to the financing of Natura 2000 – i.e., to use several existing EU funds in various policy sectors and not to establish a comprehensive financing instrument for Natura 2000 – the solution of the funding problem is in effect left largely to the EU countries. According to the literature, the development and implementation of effective financial instruments are **hindered by the different priorities at multiple levels and different sectorial authorities** [4, 6, 9, 11].

The implementing agencies which belong to the environmental administration have two options for funding the necessary measures in Natura 2000: to use either their existing domestic nature conservation budgets or the EU co-financed instruments. The latter is attractive since it offers them an additional source of funding. This additional funding comes from the EU-level (co-financing share) and - in case of Rural Development funds - also from different national administrative budgets. The cross-sectoral funding logic may explain, to some extent, the restricted use of Natura 2000 measures in the RDP. Using those measures is in the interests of the environmental administration as an additional funding source. However, the agricultural administration does not always support those measures as it means that money flows from their agricultural budget to another policy sector - nature conservation [9, 11]. There are indications that, even if budgets for the Natura 2000 measures were foreseen in the RDPs (Measures 213 and 224 in the EAFRD period 2007–2013), their use was sometimes blocked or delayed during implementation [4, 9, 12]. In a study of Natura 2000 funding in six countries, and on the basis of expert interviews, signs of intentional delays were found for all four of the countries using EU funds: **Austria, France, Germany and Spain** [9]. In a situation where the available funds were apparently insufficient to compensate all Natura 2000 sites, the public authorities hesitate in offering the payments from the start. In addition, it seems that other purposes were seen as more important and unused budgets were redistributed towards these ends. This points to a key challenge where *the fragmented institutional set-up – the fact that environmental administrations are in charge of Natura 2000 implementation but the agricultural administrations manage Natura 2000-relevant RDP measures – seems not supportive of an integrated implementation and effective funding of Natura 2000 in forests.*

¹⁴ The estimated yearly financing requirements according to Gantioler (2010) [10] are for Austria around €57m, for France €428m, for the Netherlands €487m, for Spain €2.292m and for the UK €346m. The planned budgets 2007–2013 for Natura 2000 specific EAFRD and LIFE measures together are for Austria and France €7.5m each, for the Netherlands €5.7m, for Spain €18m and for the UK €5.6m (France, the Netherlands and the UK used LIFE funds only; calculated based on European Commission Mid-term Evaluation Reports).

The politics of property rights – the role of target groups

Although the debates about financing Natura 2000 mostly revolve around the question of sufficient funds, this is not the only or foremost concern of landowner interest groups [11]. Landowners' highest priority is to **keep their property rights** and decision-making freedom [13, 14, 15, 16, 17]. They therefore argue strongly for voluntary payment schemes or nature conservation contracts. There is evidence that forest owners often hesitate to use state subsidies, instead preferring to keep their management freedom, even if they are open to nature conservation or even if they practice conservation measures voluntarily [9]. For similar reasons, forest owners also shy away from overly bureaucratic procedures or long-term commitments in order to keep their freedom to make management decisions in the future.

With regard to specific EAFRD measures for Natura 2000 sites, the experience is that the level of the payments is often **not seen as attractive** to the landowners. The payment limits per hectare are regarded as rather low. There are examples where other RDP measures have been chosen for the same purpose but for which higher sum limits apply, instead of the foreseen Natura 2000 Measure 224. In **Austria**, for instance, forest protection measures were used in preference [9]. In the **German** federal state of Hesse, maintaining old and dead wood in Natura 2000 areas was financed from RDP Measures 225 or 227 [4].

Another reported hindrance for forest owners in using the subsidies on offer is a **lack of trust** [18]. For many countries, studies show a high level of conflict between the public administration and the target groups. The latter feel uninformed about the Natura 2000 policy and complain about a lack of involvement in the implementation process. Landowners fear further restriction of their property rights and their opposition to Natura 2000 policy may lead to a resistance against involvement in subsidy schemes [9]. Complaint about an absence of financing can be used as an argument to block the implementation of Natura 2000 policy. Overall, there is *a tension between calls by forest owners for compensation for (economic) disadvantages stemming from Natura 2000 implementation, and their reluctance to use available EU funds in order to maintain full decision-making freedom over forest management on their lands.*

Design issues regarding the effectiveness of EU funding instruments

Administration costs v forest investments: no dataset is available that collects all the administrative costs for the implementation and monitoring of Natura 2000 and the costs for management measures in forest sites [4]. The balance between administrative costs and investment into forest management can therefore only be roughly estimated. Following existing studies, it seems that more financial resources have flowed into the set-up of the Natura 2000 network (LIFE budgets are mostly used for this purpose) than into on-the-ground site management in the period 2007–2013 [9, 19, 20]. Funding from LIFE projects may be useful when seen as start-up investment for the longer term. Still, it remains unknown how far LIFE projects were able to develop long-term solutions to the conflict situations between different groups on the ground and the open questions of financing. After many years of (protracted) Natura 2000 implementation, it seems that there are still *more resources flowing into the designation and administration of the Natura 2000 network than into on-the-ground management of Natura 2000 sites.*

Short-term v long-term contracts: as elaborated in section 6.1.4, the optimal spatial and temporal design of funding instruments is not trivial. The periodical EU funding programmes do not allow for longer-term agreements, which would often be preferable

because of the long-term goals of forest conservation [19]. When looking at the practical use of funding, national or sub-national administrations find various ways to deal with this problem. While some countries work with short-term contracts according to the rules for rural development measures from EAFRD, others refrain from using EU funds but use only domestic financial sources. In contracts with landowners, some countries combine a longer-term contract but use EAFRD payments only for the first years or renew the payments if the new EAFRD programmes allow. In practice, contracts from five up to 20 or 40 years are found and, in the case of purely domestic programmes, even beyond 100 years. While short-term contracts are strongly criticised from the environmental side, longer-term commitments are seen as less attractive by landowners [9]. From a design perspective, a combination of long- and short-term contracts may be required, depending on the specific forest stand characteristics and habitat and species requirements [21]. Overall, two challenges in terms of the temporal design of funding schemes can be identified. First, *short-term contracts do not seem adequate for the long-term purposes of Natura 2000 in forests*. Second, *solutions that are based on longer-term contracts but are under the condition of unsecured future payments also seem questionable*.

State subsidies v payments by beneficiaries: the European Commission encourages the additional use of so-called “innovative financing instruments”. These refer to the concept of non-state market-based instruments where the direct beneficiaries pay for the biodiversity conservation measures [22]. Possible mechanisms include payments for ecosystem services, biodiversity offsets, habitat banking, entry fees, tourist levies, certification schemes and fiscal instruments. Although numerous examples for various kinds of payment schemes are reported in European forests [23], most of them are still subsidies or other public payments. Some of the rare examples of private instruments (where a private entity pays) are the watershed protection payments by **Nestle-Vittel in France** and a few biodiversity banking schemes. Such private or alternative financing mechanisms for Natura 2000 are also called for by researchers [13, 24, 25, 26]. In the wider literature on market-based instruments (MBI) or payments for ecosystem services (PES) where the direct beneficiaries pay for ecosystem services, a more critical view is growing [27, 28]. This recognises the *limits of and challenges for the implementation of innovative financing instruments*.

Examples of *market-based instruments for Natura 2000 purposes* are rare. On the contrary, it is mostly reported that such mechanisms have rarely been considered by the implementing agencies [9]. Studies report that – although forest managers and conservationists often argue to the contrary – there is little awareness among the public that nature conservation under Natura 2000 would benefit regional development through other sectors, for example, tourism [9]. According to expert interviews, there are rare examples where regions, municipalities or tourism companies thought of using Natura 2000 as a label for marketing purposes (regional marketing or eco-tourism) but those ideas were not implemented. A redirection of profits from the sectors that benefit most (e.g., tourism) to the land and forest owners is a major challenge. In the literature, tourism and recreation are seen more as threats for conservation rather than benefiting partners [29, 30].

A few examples of alternative financing attempts have been documented [9]. However, on closer look, they often appear not to be beneficiary-based payments in the narrow sense. For instance, **France** provides **tax exemptions** for land and forest owners of Natura 2000 sites but those are in fact another form of a state subsidy. The contracts, furthermore, do not include binding measures. In **Spain**, CaixaBank was obliged by law to use **10% of its profits to fund investments with benefits for the public**, among which nature

conservation activities such as Natura 2000 was one option. Here the payment comes from a public source and not from a direct (non-state) beneficiary. In summary, *design and use of innovative market-based instruments in the narrow sense ("beneficiary pays principle") are little documented in practice.*

Cost compensation v payments for ecosystem services: innovative financing instruments are often related to the core principle that it is the service that is provided which should be paid for. This principle is at the core of the concept of payments for ecosystem services (PES). It aims to pay for the service provided, not the costs for provision (output-orientation instead of input-orientation). Such true PES schemes in the strict sense are rarely found in general [31, 32, 33] and we did not find any examples for Natura 2000 purposes. In the German federal state of Baden-Württemberg, a PES scheme exists in the agricultural sector (MEKA Programme) that pays for nature conservation results. It appears to be successful although some cost-effectiveness issues still exist [19]. An innovative approach for forest biodiversity conservation was tried out in a pilot programme in Finland. In the METSO-Programme on "Nature Values Trading" (2002–2007) the traditional nature conservation regulatory governance was replaced by a competitive PES scheme. However, this innovative approach was discontinued in the follow-up programme in 2008 because of various institutional barriers, and it was instead included into pre-existing mechanisms [34]. *It appears difficult to realise the PES idea in practice, particularly with public money sources, and even more difficult in combination with the complex forest ecosystems with long-term dynamics and therefore uncertain conservation outcomes.*

Paying for nature v voluntary contributions to nature conservation: it is usually assumed that monetary incentives motivate land and forest owners for nature conservation (Chapter 6.1). In reality, this depends strongly on the design of the programmes, e.g., the clear conditions for the subsidies: efficiency is reduced if payments are given for measures which would have been done anyway, if not well-selected or if the agreed measures are not fulfilled by the contract partner [35]. Payments may even have negative effects when – through the payment offer – the willingness for voluntary contribution is reduced (see more details about monetarisation or crowding-out effect in 6.1.4). According to interviews, altruism must also be assumed in connection with Natura 2000 as many forest owners are ready to consider nature conservation aspects in their regular management [9]. There are documented examples where nature conservationists also voluntarily contribute to the Natura 2000 policy, e.g., through participation in expert panels or mapping and assessing ecological values. According to expert interviews, forest owners differ greatly in their attitudes towards subsidies, which implies that payment schemes need to be well targeted in order to make them effective. Furthermore, the historical policy framework conditions also affect the willingness of forest owners to participate: the non-participatory implementation of the Natura 2000 policy often caused resistance as the top-down implementation turned it into a non-voluntary scheme [11]. Thus, *the success of any paid or voluntary programme for forest biodiversity conservation within and beyond Natura 2000 depends on a range of political, economic and socio-psychological factors related to the design of the instrument as well as to the historical, local and sectoral contexts.*

Overall, the complex ecological processes in forests, and the long-term nature of forest dynamics, makes the design of effective funding instruments difficult. The fact that the positive effects of conservation measures can hardly be measured and assigned to certain beneficiary groups adds to this complexity.

Successful implementation of funding instruments requires a focus on the reasons for the funding but also acceptance by the target groups. Both may be reached through

better participation of stakeholders and administrative units at the local level when both sides, forest owners or users (forestry interests) and environmental groups (nature conservation interests) are involved [11, 36, 37]. A financial commitment by local level actors in addition to consultation efforts could be an important element in a new institutional set-up for funding schemes. *Participatory involvement and co-financing could create stronger “ownership” of the funding measures for Natura 2000 in forests by affected landowners and direct beneficiary groups.*

References:

- [1] EC, 2004. *Financing Natura 2000*. Communication from the Commission to the Council and the European Parliament. 15.7.2004 COM(2004)431
- [2] EC, 2009. *Report on implementation of forestry measures under the Rural Development Regulation 1698/2005 for the period 2007–2013*.
- [3] European Network for Rural Development (ENRD) http://enrd.ec.europa.eu/policy-in-action/rural-development-policy-in-figures/rdp-monitoring-indicator-tables/financial-and-physical-indicators_en.
- [4] Sarvašová, Z., Ali, T., Djordjevic, I., Lukmine, D., Quiroga, S., Suarez, C., Hrib, M., Rondeux, J., Mantzanas, K.T., Franz, K. (forthcoming). Natura 2000 payments for private forest owners in Rural Development Programmes 2007–2013 – a comparative view. *Forest Policy and Economics* (accepted).
- [5] https://ec.europa.eu/agriculture/rural-development-2014–2020/country-files_en
- [6] Sarvašová, Z., Quiroga, S., Suárez, C., Ali, T., Lukmine, D., Djordjevic, I., Hrib, M. (forthcoming, b). Understanding the drivers for Natura 2000 payments in forests: a Heckman selection analysis. In: *JNC* (submitted)
- [7] Ratte, 2016. *Nature Conservation and EU Financing – Challenges, Best Practices and Options*. NABU workshop held on 10th October 2016 in Bratislava, Slovakia <https://www.nabu.de/imperia/md/content/nabude/europa/161028-nabu-chista-ratte-federal-ministry-environment-germany.pdf>
- [8] Hermoso, V., Clavero, M., Villero, D., Brotons, L., 2016. EU's Conservation Efforts Need More Strategic Investment to Meet Continental Commitments. *Conservation Letters*, 1-7.
- [9] Geitzenauer, M., M. Blondet, J. de Koning, F. Ferranti, M. Sotirov, G. Weiss, G. Winkel, 2017. The Challenge of Financing the Implementation of Natura 2000 - Empirical Evidence from Six European Union Member States. *Forest Policy and Economics* (accepted, in press).
- [10] Gantioler S., R. M., 2010. *Costs and Socio-Economic Benefits associated with the Natura 2000 Network*. Final report to the European Commission, DG Environment: Brussels.
- [11] Winkel, G., Blondet, M., Borrass, L., Frei, T., Geitzenauer, M., Gruppe, A., Jump, A., de Koning, J., Sotirov, M., Weiss, G., Winter, S., Turnhout E., 2015. The implementation of Natura 2000 in forests: a trans- and interdisciplinary assessment of challenges and choices. *Environmental Science & Policy*, 52, 23-32.
- [12] CEPF and Eustafor, 2012. *Joint Position Paper on Sustainable Forest Management and Natura 2000*.
- [13] Rojas-Briales, E., 2000. Socio-economics of nature protection policies in the perspective of the implementation of Natura 2000 Network: the Spanish case. *Forestry*, 73/2: 199–207.
- [14] Young, J., Pichards, C., Fischer, A., Halada, L., Kull, T., Kuzniar, A., Tartes, U., Uzunov, Y., Watt, A., 2007. Conflicts between Biodiversity conservation and human activities in the central and eastern European countries. *Journal of the Human Environment*, 36 (7), 545–550.
- [15] Keulartz, J., 2009. European Nature Conservation and Restoration Policy-Problems and Perspectives. *Restoration Ecology*, 17 (4), 446–450.
- [16] Sumares, D., Fidelis, T., 2011. Natura 2000 and the narrative nature of nature: a case for critical discourse analysis. *J. of Integrative Env. Sc.*, 8 (1), 53–68.
- [17] Grodzinska-Jurczak, M., Cent, J., 2011. Expansion of Nature Conservation Areas: Problems with Natura 2000 Implementation in Poland? *Environmental Management*. 47 (1), 11–27.
- [18] Paavola, J. 2004. Protected Areas Governance and Justice: Theory and the European Union's Habitats Directive. *Environmental Sciences*, 1/1: 59-77.

- [19] Wätzold, F., Mewes, M., van Apeldoorn, R., Varjopuro, R., Chmielewski, T. J., Veeneklaas, F., Kosola, M.-L., 2010. Cost-effectiveness of managing Natura 2000 sites: an exploratory study for Finland, Germany, the Netherlands and Poland. *Biodiversity Conservation*, 2053–2069.
- [20] EC, 2016. *Fitness Check Natura 2000*. Evaluation Study to Support the Fitness Check of Bird and Habitats Directives. European Commission, Draft Final Report, Milieu Ltd. Belgium.
- [21] Juutinen, A., Reunanen, P., Mönkkönen, M., Tikkanen, O.-P., Kouki, J., 2012. Conservation of forest biodiversity using temporal conservation contracts. *Ecological Economics*, 81: 121–129.
- [22] EC, 2011. *Investing in Natura 2000: Delivering benefits for nature and people*. Commission staff working paper – Financing Natura 2000. Brussels: European Commission.
- [23] UNECE, 2014. *The Value of Forests. Payments for Ecosystem Services in a Green Economy*. Geneva Timber and Forest Study Paper 34. Geneva.
- [24] Ledoux, L., S. Crooks, A. Jordan, R. K. Turner. 2000. Implementing EU biodiversity policy: UK experiences. *Land Use Policy*, 17/4: 257–268.
- [25] Raitanen, E. 2011. EU State Aid Regulation & Incentives for Forest Biodiversity Conservation - Study of the Constraints. *Nordic Journal of Commercial Law*, /2011#2.
- [26] Klassert, C., Möckel, S., 2013. Improving the Policy Mix: The Scope for Market-Based Instruments in EU Biodiversity Policy. *Environmental Policy and Governance*, 23/5: 311–322.
- [27] Ferraro, P.J (2011). The Future of Payments for Environmental Services. *Conservation Biology*, 25: 6, 1134–1138.
- [27] Vatn, A., 2010. An institutional analysis of payments for environmental services. *Ecol. Econ.*, 69:1245–1256.
- [28] Muradian, R. & Gomez-Baggethun, E., 2013. The Institutional Dimension of Market-Based Instruments for Governing Ecosystem Services: Introduction to the Special Issue. *Society and Natural Resources*, 26: 10, 1113–1121.
- [29] Parolo, G., Ferrarini, A., Rossi, G., 2009. Optimization of tourism impacts within protected areas by means of genetic algorithms. *Ecol. Model.*, 220, 1138–1147. Primmer, E., Paloniemi, R., Similä, J., Barton, D. N., 2013. Evolution in Finland's Forest Biodiversity Conservation Payments and the Institutional Constraints on Establishing New Policy. *Society & Natural Resources*, 26:10, 1137–1154, DOI: 10.1080/08941920.2013.820814.
- [30] Ciapala, S., Adamski, P., Mrocza, A., Svajda, J., Witkowski, Z., 2014. Threats related to tourism and recreation in Natura 2000 areas, based on the analysis of the standard data forms (SDF) from the Alpine Bioregion of Slovakia. *Eco Mont-J. Protected Mt. Areas Res.*, 6, 55–60.
- [31] Muradian, R., Corbera, E., Pascual, U., Kosoy, N., May, P.H., 2010. Reconciling theory and practice : An alternative conceptual framework for understanding payments for environmental services. *Ecological Economics*, 69: 1202–1208.
- [32] Pattanayak, S. K., Wunder, S. & Ferraro, P. J., 2010. Show me the money: Do payments supply ecosystem services in developing countries? *Review of Environmental Economics and Policy*, 4:254–274.
- [33] Vatn, A., 2010. An institutional analysis of payments for environmental services. *Ecological Economics*, 69: 1245–1256.
- [34] Primmer E., Paloniemi, R., Similä, J., Barton, D.N., 2013. Evolution in Finland's Forest Biodiversity Conservation Payments and the Institutional Constraints on Establishing New Policy. *Society and Natural Resources*, 26: 10, 1137–1154.
- [35] Anthon, S., Garcia, S., & Stenger, A., 2010. Incentive Contracts for Natura 2000 Implementation in Forest Areas. *Environ Resource Econ*, 281–302.
- [36] Gil, A., Calado, H., Costa, A.C., Bentz, J., Fonseca, C., Lobo, A., Vergilio, M., Benedicto, J., 2011. A methodological proposal for the development of Natura 2000 sites management plans. *J. Coast. Res.*, 64, 1326–1330.
- [37] Enengel, B., Penker, M., Muhar, A., 2014. Landscape co-management in Austria: the stakeholder's perspective on efforts, benefits and risks. *J. Rural. Stud.*, 34, 223–234.

Summarising conclusions

What are the costs and the benefits of Natura 2000 policy?

Our review of the available literature highlights that the implementation of Natura 2000 policy seems to trigger *significant costs for forest owners, managers and enterprises*. This conclusion is also supported by the findings of the recent “fitness check” of the EU’s Habitats and Birds Directives by the European Commission. Stakeholders from the agricultural, forestry, fishing and hunting sectors underlined that “the Nature Directives carry a considerable cost in terms of their implementation, which they felt placed too high a burden in them” [1].

At the same time, studies show that EU citizens have a significant willingness-to-pay (WTP) for existing Natura 2000 forest sites and their further development. These findings point to the fact that *Europeans perceive real and substantial benefits from the implementation of the Natura 2000 network*. These scientific results are also supported by conclusions from the fitness check of the European Commission where the vast majority of respondents feel that the EU’s Habitats and Birds Directives are effective and important for biodiversity protection, and that the benefits delivered from their implementation far exceed the costs. The few existing cost-benefit analyses (CBAs) in the scientific literature share this policy conclusion, too: *the value of benefits provided by Natura 2000 sites largely overcome implementation costs*. However, the additionality of benefits delivered by the Natura 2000 network has been barely investigated in these studies. Moreover, conducting CBAs is a thorny undertaking given the current limited level of information on the monetary value of benefits provided by Natura 2000. It is therefore difficult to conclude in an unequivocal way whether or not the socio-economic benefits delivered by the Natura 2000 policy exceed the costs, especially at the EU level.

In a nutshell, *the value of ES delivered by Natura 2000 sites far exceeds the related implementation costs*. However, the establishment of Natura 2000 sites is faced with a *low legitimacy and acceptance* from forest owners and land use managers, who feel they have to bear the costs while not being well compensated for changing their management practices. This mismatch can be related to an inappropriate calibration of existing instruments under the Natura 2000 framework, which results in a *lack of cost-effectiveness*.

How is Natura 2000 policy funded?

Challenges have resulted whenever the Natura 2000 implementation process has sought to enforce changes in forestry and other land uses that imply costs (either incurred de facto or perceived) on the side of the affected landowners and land users. Although reliable estimates for the total costs do not exist, it seems that the *Natura 2000 policy implementation is currently significantly under budgeted*. Evaluations of the EAFRD and LIFE funding instruments show both implementation challenges and/or limited effectiveness. This study shows that *the available funding instruments at the EU level can cover only a small amount of the estimated costs of Natura 2000 implementation*. The budget gap is not filled sufficiently by national or alternative funding sources.

We show also that the Natura 2000 funding problem is not limited to lack of funds. It relates to a *lack of effective integration across policy sectors, diverging priorities across policy levels, and conflicting interests between land-use and conservation*. Various policy issues such as *how to compensate for complex and long-term effects of - and commitments to - conservation-oriented forest management*, exist as well.

This situation suggests *major deficits in the basic set-up, priority setting and monitoring of the EU funding instruments*, especially for the EAFRD. An effective and efficient implementation of public funding for forest nature conservation remains a challenging task. This is due to many issues which can compromise the administration and use of public subsidies (e.g., principal-agent problems, self-interest of public administrations, lack of capacities and/or interests by land and forest users). At the same time, *alternative market-based instruments*, where non-state beneficiaries (e.g., tourism businesses, recreation, habitat banking, public-private partnerships) would pay for nature conservation, *are rare and not very promising*. This is because of the public good (non-marketable) character of biodiversity and other ecosystem services (e.g., soil and water protection, climate regulation).

The *effectiveness and efficiency of the Natura 2000 funding instruments are highly questionable* since the distribution of both LIFE and EAFRD funds is rarely related to conservation needs and priorities. Evaluations show that LIFE overfunds non-threatened species and underfunds threatened species, whereas the forest-targeted EAFRD measures are less used in countries with higher proportions of forest areas under Natura 2000.

References:

- [1] European Commission, 2016. *Fitness Check of the EU Nature Legislation (Birds and Habitats Directives)*. EC: Brussels.

Policy Conclusions and Recommendations

Lead authors: Metodi Sotirov and Gerhard Weiss

Contributing authors: Marco Marchetti, Serge Garcia, Louise Ecochard, Emeline Hily, Sarah Greenwood, Alistair Jump

7.1 Forest biodiversity monitoring in Europe

Improve data quality, harmonization and standardization between FOREST EUROPE and Natura 2000

Reduce discrepancies between both processes concerning the type of indicators/parameters used, nomenclature and definitions adopted, and representativeness of the data. The mutual harmonization between both processes could be carried out by: (i) harmonizing the different sets of biodiversity variables and streamlining them in order to include both status and trends of habitats and species in forest ecosystems; and (ii) defining and adopting standardised indicators, which would be easy to measure (to be used during the Favourable Conservation Status evaluation) and could become the core set of indicators for biodiversity evaluation in the FOREST EUROPE process.

Establish common databases for biodiversity-related issues. This could be another key solution to collect and share data and information in the EU. A combination of nature-based and forestry-based information including social and economic information for forest resources is needed. This information has to be linked to global biodiversity conservation frameworks (e.g., UN Sustainable Development Goals, the UN Convention on Biological Diversity, the International Union for Conservation of Nature). Key findings from existing initiatives, e.g., LIFE+, H2020 projects, Natura 2000 management plans, at national and local level could be taken into account to *build a common monitoring framework for forest biodiversity in the EU.*

Systematically integrate additional key biodiversity variables in the FOREST EUROPE assessment process

Include important parameters for biodiversity such as the presence/absence of microhabitats, large trees, and old-growth forests. FOREST EUROPE could also borrow definitions and

appraisal methodology from Natura 2000 for assessing the conservation status of forest habitats and species (both plant and animal). This would allow the consideration of relationships between species and ecosystems, and of possible disturbances (e.g., through forestry, agriculture, climate change, infrastructural developments) on forest biodiversity. Biodiversity also needs to be assessed in other wooded lands (OWLs), which are not well measured to date.

Use FOREST EUROPE's updated Pan-European Criteria and Indicators in the Natura 2000 process

This would validate and/or complement the assessment of forest biodiversity. The new indicators on “Forest fragmentation” and “Common forest bird species” could be of particular importance for a more comprehensive assessment of forest biodiversity at a European scale. FOREST EUROPE's forest-specific C&I can be used to produce detailed maps and other information for the investigated Natura 2000 sites. All of these actions *support a more fine-grained evaluation of the favorable conservation status as required by Article 17 of the EU Habitats Directive.*

Understand better the changes in forest biodiversity status

Monitoring processes have to take into account how, and to what extent, forest biodiversity changes over space and time.

Reframe current indicators/parameters used by both processes to include important threats to forest-related species and habitats, such as climate change, land use change, and forest over- or under-exploitation. These aspects would be enhanced by including other types of information regarding current drivers, impacts, and response characteristics of forest biodiversity while facing external pressures and disturbances. The use of the DPSIR (Drivers, Pressures, State, Impact, Responses) assessment framework would help meet this goal.

Pursue a deeper understanding of other drivers influencing forest biodiversity conservation, such as social and economic transformations, via a two-way exchange of information between the policy and management side.

Better include biodiversity conservation activities in current forest planning and management frameworks at a local scale.

Secure appropriate European and national-level financial and administrative support for monitoring

The technical information needed to assess many individual forest habitats and species is often derived through extensive field work (mapping, measurements) and experts' assessments. These activities are time consuming and expensive.

Strengthen stakeholder consultation

Additional efforts are required to ensure that the participation of stakeholders, especially at national and local scales, is effective. Although both processes already include public

consultation, additional efforts are needed to make sure that private and public forest owners, forestry technicians, hunters, mushroom pickers, tourists and local communities in general are aware of the changes in status of biodiversity conservation in their respective territories.

The monitoring process would benefit from traditional or local knowledge from local stakeholders and environmental experts, in view of gaining a deeper understanding of the threats and challenges that affect forest biodiversity at local scale.

Strengthen the policy-science-practice interface and inter-sectoral collaboration

Enhance the transfer of knowledge from science to policy and practice, and the other way around. Existing policy-science-practice platforms such as EFI's ThinkForest forum¹⁵ and policy-science interplay approaches developed by European projects (DIABOLO¹⁶, INTEGRAL¹⁷) can be used to bridge information and communication gaps between policymakers, scientists and other relevant stakeholders in Europe.

Increase exchange, cooperation and learning between forestry and nature conservation experts at the national level as well as between the FOREST EUROPE and Natura 2000 processes. This would avoid differences in the interpretation and assessment of forest biodiversity conservation caused by the prevalence of specific policy interests and related sectoral mind-sets. In the case of FOREST EUROPE, cooperation could be pursued within expert level meetings and between the national forest inventories. Similarly, the involvement of stakeholders seems promising through (online) public consultations, the working group on Natura 2000 and Forests at the EU level, and the field work related to Article 17 reporting under the EU Habitats Directive.

¹⁵ http://www.efi.int/portal/policy_advice/thinkforest/

¹⁶ <http://diabolo-project.eu/>

¹⁷ <http://www.integral-project.eu/>

Implementation

Tackle ideological and informational challenges in Natura 2000 implementation

Use the conservation objectives and nature conservation knowledge in Natura 2000 management planning to raise awareness of biodiversity aspects in forest management. Nature conservation measures should be specified in clear qualitative (what? how? who?) and quantitative (how much? where? when?) terms during Natura 2000 management planning and applications. The extent to which positive conservation and/or restoration measures are compatible with specific forestry practices ('win-win') has to be clearly spelled out. Any trade-offs between nature conservation objectives and measures, and forestry practices ('win-lose', 'lose-lose') have to be explained and discussed among the responsible and affected parties.

Foster better communication and understanding of the Natura 2000 goals within the implementing administration and related bodies across all implementation levels.

Improve communication towards target groups, i.e. land and forest owners, managers, and users, and all interested stakeholders through interactive dialogue processes. These could take place in professionally moderated formal or official public settings instead of informal negotiations with selected groups. Participatory communication fora may lead to better implementation through the mutual learning and co-responsibility of the groups.

Tackle interest-based challenges in Natura 2000 implementation

Fund Natura 2000 measures in forests via co-funding from all administrative levels and from nature conservation and forestry/agriculture as the two main interested/affected sectors. Ideally, public or private local level beneficiaries would be required to co-finance the measures, at least to a small extent. This would ensure that stakeholders near specific Natura 2000 sites and measures have an interest in successful implementation. Co-funding from nature conservation and forestry would foster the integrated design of the measures. Without that, purposeful planning and implementation seems unrealistic, even with strong monitoring efforts in place.

Make appropriate cross-sectoral prioritization. Prioritization for the use of EU financial funds on regional or national level for priority forest species or habitats exists within the Prioritized Action Frameworks (PAFs) under the EU Habitats Directive and the (sub-)national Rural Development Programmes (RDP) under the Common Agriculture Policy. Priority planning needs to be done across sectors by involving both nature conservation and forestry expertise.

Install an effective monitoring and evaluation mechanism for the implemented measures. The current tracking of RDP payments and the monitoring system for Natura 2000 are not mainly designed for this purpose. A new system would have to monitor measures

and compare them with the overarching nature conservation objectives for the affected Natura 2000 sites. This would need to be carried out by independent parties to avoid conflicts of interest and potentially biased assessments.

Tackle institutional challenges in Natura 2000 implementation

Work towards effective policy integration between the nature conservation sector and the forest sector. This depends on the ambition and the willingness of the interested/affected policy actors to cooperate and the extent to which they see the status quo as suboptimal. Integration would imply co-responsibility for setting up Natura 2000 goals and mechanisms, joint implementation of measures, joint financing, joint monitoring of actions etc. It should be clear that to reach this ambitious goal, both sides – the nature conservation and forestry/land use sectors – would have to give up part of the power over their policy domains: the regulative power on the environmental side and the dedication of funds/management practice regulation from the forestry/rural development side. The current situation where regulation and financing/practical implementation are in different hands does not contribute to integrated policy design for Natura 2000 in forests.

If full co-responsibility for the whole Natura 2000 policy cannot be achieved, allocate the institutional responsibility for all aspects of Natura 2000 implementation – including regulatory and financing/management instruments – to one of the policy sectors while offering the other sector opportunities for involvement. The current institutional fragmentation of competences and instruments across the nature conservation and forest/agricultural sectors seems to be highly counterproductive.

Create better vertical policy and institutional integration across administrative levels. This could be achieved by intensified communication to create a common understanding of policy goals, and purposeful prioritisation and monitoring (see above).

Develop an effective integrated policy and management approach for Natura 2000 in forests

Scientific studies [1, 2, 3, 4] show that a lack of policy implementation can often be explained by the lack of integrated policy and management approaches or their lower effectiveness or legitimacy. Building on the recommendation made above and [1], an integrated policy and management approach should include:

- coordination and integration between nature conservation and forest policy *goals and instruments*
- inter-sectoral coordination between land-use/forestry and nature conservation *practices*
- application of inter-disciplinary *knowledge* across natural and social sciences
- cross-regional, international and *multi-level coordination* spanning EU, national, regional and local administrative levels
- inter-sectoral and multi-level *policy and management learning* based on stakeholder involvement, participation, exchange of experience and knowledge at professional forums.

Ecological effectiveness

Increase the positive effects of Natura 2000 in forests

Consider landscape-scale and long-term change and create a well-connected and flexible network to improve the connectivity and effectiveness of Natura 2000 conservation in forests.

Ensure site designation and management planning is flexible, integrated and adaptable, to allow forest species and habitats to remain represented despite changes over time. However, appropriate conservation biology-related safeguards need to be defined so that the protection offered by the designation and management of the sites is not undermined by this flexibility.

Take precautions to prevent a shifting baseline of conservation that could be potentially justified by the general argument that more flexibility and adaptability (e.g., in view of climate change) is needed.

Improve the consistency of Natura 2000 management

Better policy coordination across the EU (see 7.2) and a more standardised and consistent approach in data collection (see 7.1) would improve the effectiveness of a well-connected network. Forest managers should be involved in the process of assessing conservation status, and in providing management guidelines. All of this could improve the rate and consistency of management implementation across the Natura 2000 network.

Account for ecosystem goods and services within and beyond Natura 2000

Foster a better understanding of the trade-offs and synergies that can occur between ecosystem services, and between services and management objectives. Educate forest managers and users on the relevance of services in protected areas. This would further improve the management of Natura 2000 sites in forests.

Share and apply best practice examples

Enhance scientifically-supported work towards Natura 2000 management planning as well as the setting and application of conservation objectives. Replicate lessons learned from either integrating Natura 2000 objectives into forest management planning or integrating forest management aspects into overall Natura 2000 management plans.

Exchange of experience and application of good examples of integrative forest management (e.g., close-to-nature forestry; selective cutting; retention forestry) and/or segregative forest management (setting forest set-asides) would benefit on-the-ground implementation of conservation

objectives in Natura 2000 in forests. Both management approaches could ideally be linked in an appropriate matrix model to allow for both conservation and sustainable use of managed ecosystems from a landscape perspective. Cross-sectoral administrative coordination, active involvement of both regulatory agencies and target groups in professional forums as well as cooperation between public agencies with forest owners, land users, and stakeholders will be needed to implement these recommendations (see 7.2). Ideally, this would be complemented by the application of good examples of the design and provision of measures such as compensation payments and/or property valuations and swaps (see 7.2 and 7.4).

Economic effectiveness

Support more research and exchange of knowledge

Mobilise more financial resources for related research. More studies are needed to analyse and compare the cost-effectiveness and efficiency of different financial incentives for Natura 2000 in forests. Forest owners' acceptance of result-based instead of action-based payments should also be carefully studied, as the implementation of the former could bring important cost-effectiveness gains.

Experimentally design and implement result-based payments on a few Natura 2000 pilot forest sites to provide feedback and learning. Due to the slower pace and inherent complexity of the socio-ecological processes underpinning forest biodiversity conservation, the realization of conservation results could be hard to observe in the short term and/or result in higher risks and costs for forest owners.

Strengthen incentive-based conservation instruments

Enhance the use of compensation payments and other financial incentives. This is particularly important where Natura 2000 poses or can pose significant costs for forest owners and there is significant cost-motivated opposition to the implementation of the Natura 2000 policy and low participation of forest owners and managers in existing schemes for payments of ecosystem services.

Make compensation payments for the implementation of the Natura 2000 policy subject to different design principles and conditions. One principle is that forest owners are compensated when Natura 2000 leads them to deviate from their standard forestry practices (mostly aimed at sustainable forest use). This principle applies when forest owners are assigned comprehensive property rights on ecosystem goods and services, including public goods such as biodiversity. Instead, if biodiversity loss is seen as a consequence of forest owners' practices and the provision of public goods and services is assigned to public authority only, another principle can oblige forest owners and managers to provide public goods. In this situation, the burden of costs related to biodiversity conservation will be left with the forest owners and managers.

In either case, define appropriate financial incentives and standards for forest biodiversity conservation to trigger sufficient participation of forest owners while ensuring the effectiveness and efficiency of the measures.

Design economic incentives for flexibility and for the long term

Ensure implementing measures are flexible and adaptable over time. Measures need to be adaptable to ecological, climate and societal changes, as well as to new scientific information on and better understanding of the functioning of Natura 2000 in forests.

Design funding measures for the implementation of Natura 2000 in forests specifically for long-term dynamics and commitments. This will be needed given the slower pace and complexity of socio-ecological processes and feedbacks in forests as managed ecosystems.

References:

- [1] Sotirov, M., Cappelmann, L., Riemer, A., Eriksson O., 2013. Implementing the vision of sustainable forestry through integrated forest management? INTEGRAL First Policy Brief. www.integral-project.eu
- [2] Winkel, G., Blondet, M., Borrass, L., Frei, T., Geitzenauer, M., Gruppe, A., Jump, A., de Koning, J., Sotirov, M., Weiss, G., Winter, S., Turnhout, E., 2015. The implementation of Natura 2000 in forests: A trans- and interdisciplinary assessment of challenges and choices. *Environmental Science & Policy*, 52 (2015): 23-32.
- [3] Sotirov, M., Blum, M., Storch, S., Selter, A., Schraml, A., 2016. Do forest policy actors learn through forward-thinking? Conflict and cooperation relating to the past, present and futures of sustainable forest management in Germany. *Forest Policy and Economics* (in press; available online 28 November 2016; DOI: 10.1016/j.forpol.2016.11.011).
- [4] Sotirov, M., Storch, S., 2017. Resilience through policy integration in Europe? Domestic forest policy changes as response to absorb pressure to integrate biodiversity conservation, bioenergy use and climate protection in France, Germany, the Netherlands and Sweden. *Land Use Policy* (accepted, in press).

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EUROPEAN FOREST INSTITUTE

Yliopistokatu 6, FI-80100 Joensuu, Finland

Tel. +358 10 773 4300

www.efi.int

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