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POLICYMIX - Assessing the role of economic instruments in policy mixes for biodiversity conservation and ecosystem services provision

Assessment of existing and proposed policy instruments for biodiversity conservation in Germany

The role of ecological fiscal transfers

Christoph Schröter-Schlaack, Irene Ring, Stefan Möckel, Christiane Schulz-Zunkel, Nele Lienhoop, Reinhard Klenke and Thomas Lenk

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Assessment of existing and proposed policy instruments for biodiversity conservation in Germany: The role of ecological fiscal transfers.

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Valley of the river Mulde, by Irene Ring

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Summary and conclusions

Abstract

This summary description focuses on the coarse grain analysis as represented by the German national case study report (Deliverable 7.2.1) applying to the territory of Germany. We address and model the integration of ecological indicators into intergovernmental fiscal transfers from the national to the state, i.e. Länder level in Germany, and assess the role of ecological fiscal transfers in the overall German policy mix. The fine grain analysis in Germany covers two major topics:

1. Building on the coarse grain report on ecological fiscal transfers, detailed fine grain studies on different aspects of integrating ecological indicators in the German fiscal transfer system are pursued such as the development of appropriate conservation indicators, the detailed discussion of ex ante scenario modelling results, or the legal and institutional options and constraints for introducing ecological fiscal transfers. A substantial part of the fine grain analysis related to ecological fiscal transfers is already covered in the national case study report. Fine grain analysis on ecological fiscal transfers will be continued, resulting mainly in journal publications that will be integrated in the upcoming fine grain report.

2. As Germany is a federal country with its states being responsible for implementing nature and forest conservation policies, a second major focus of the German fine grain analysis relates to the topic of afforestation and related ecosystem services in the Free State of Saxony. Here, the local level analysis investigates economic incentives for afforestation in Western Saxony and discusses the role of these instruments in the Saxon policy mix. This second topic will be a major focus of Deliverable 7.2.2 – Assessment of existing and proposed policy instruments for biodiversity conservation at state and local level.

Case study location and conservation characteristics

The territory of Germany covers 357,123 km^2 and is influenced by a temperate seasonal climate. With more than 80 million inhabitants it is the most populous member state of the European Union and amongst the most densely populated countries on a global comparison (Federal Ministry for the Environment 2010a: 5). Agriculture is the dominant land-use type (~52 per cent). Though increasing in recent years, forest cover in Germany (~31 per cent) is substantially lower than European average (~45 per cent) (Federal Statistical Office Germany 2012). Conserving biodiversity is among the central elements of Germany's National Sustainability Strategy adopted in 2002 (Bundesregierung 2002). In 2007 Germany also adapted a National Strategy on Biological Diversity (Federal Ministry for the Environment 2007). The Biodiversity Strategy contains 16 indicators for monitoring current status and trend of biological diversity, roughly 330 objectives with timeframes and about 430 measures calling the various governmental and non-governmental actors to action. There are five main goals of the strategy, namely (1) biodiversity conservation, (2) its sustainable use, (3) reducing environmental pollution, (4) conservation as well as access and equitable sharing of benefits of

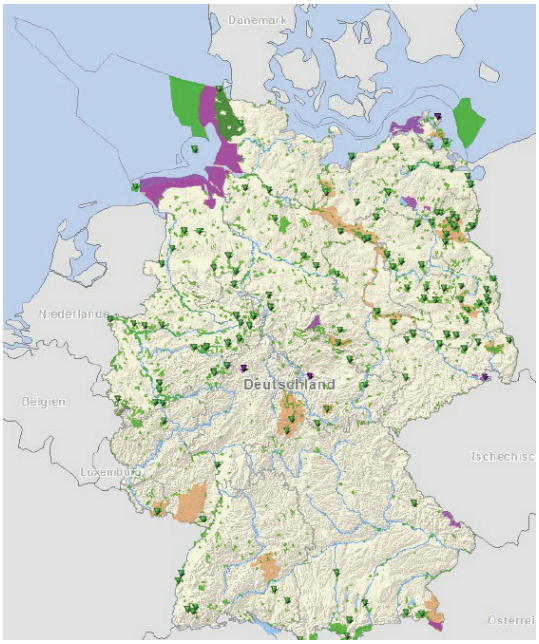

Figure 0-1: National Parks (purple), Biosphere reserves (orange) and nature reserves (green) in Germany Source: Federal Agency for Nature Conservation (2012e)

genetic resources, and (5) raising social awareness for biodiversity conservation as one of the top priorities for society. From an instrument perspective it is interesting to note that the strategy places strong emphasis on regulatory instruments, i.e. protected areas (Fig. 0-1) like national parks, biosphere reserves, nature reserves or Natura 2000 and interlinkage between critical biotopes, and the well-functioning management of these sites and corridors.

Another major focus is on stimulating sustainable use of ecosystems, i.e. cultivated landscapes used for agriculture and forestry, with a particular focus on the provision of habitats critical for the survival of endangered species or species for which Germany has a particular conservation responsibility. Against this background, the German POLICYMIX case study can be seen as an effort to support the aims of the Strategy on Biological Diversity and to facilitate the national TEEB-process by contributing to a better understanding of the interaction of policy instruments for biodiversity conservation with a particular emphasis on the role of economic instruments.

Current instruments in biodiversity conservation

Nature conservation has a long tradition in Germany dating back to the first half of the 19th century (Aßmann and Härdtle 2002). The most important legislative outputs at federal level are the Federal Species Conservation Act (Bundesartenschutzverordnung – BArtSchV), and the Federal Nature Conservation Act (Bundesnaturschutzgesetz – BNatSchG) firstly adopted in 1976 but recently reformed and in effect since March 2010 (Table 0-1). The new legislation intends to harmonise nature conservation laws nationwide. The objectives in the new Federal Act on Nature Conservation and Landscape Management are determined by three main aspects, 1) conserving biodiversity, 2) enhancing productivity and functionality of the ecosystem, and 3) safeguarding variety, singularity, beauty and recreational value of nature and landscapes.

The main regulatory instrument for nature conservation is the designation and management of protected areas. Several types of protected areas are defined by Germany's Federal Nature Conservation Act and are designated by land-use planning at state level. They can be classified by size, protection purpose and conservation objective, and by the resulting restrictions on land use. The main types are nature reserves, national parks, biosphere reserves, Natura 2000-sites, landscape reserves and nature parks.

Though since the end of the 1980's the variety and funds related to incentive-based instruments for nature conservation are growing, they are still of minor importance compared to the impact of regulatory instruments. A few of these financial support programmes are issued at the national level, e.g. Testing and Development Projects in Nature Conservation and Landscape Management are funded by the German Ministry for the Environment, as is the direct financial support for important large-scale nature conservation and riparian zone projects by the federal government.

Starting with the EU agricultural reform in 1992, environment-related subsidies for agriculture have been systematically expanded and developed into the current agri-environmental measures as part of the policy for developing agriculture and rural areas. By converting the former production- and product-related subsidies for farmers in Germany into land-related subsidies and linking these payments to compliance with defined environmental protection (cross compliance), incentives for the conservation and sustainable use of biological diversity have been significantly enhanced. In Germany, these support programmes are implemented at state level and mostly co-financed by the EU. Relating to our local level case study, the two most important incentive-based instruments for forest conservation in Saxony are 1) an agri-environmental scheme that supports afforestation on agricultural land and on other post-industrial sites, and 2) the Directive for Woodland and Forestry in Saxony that aims to increase forest conversion and supports forest-owners that take respective measures.

Table 0-1: Current (black) and new (blue) instruments for biodiversity and forest conservation in Germany, addressing various actors at different levels of government

Actors addressed		Regulatory Instruments	Incentive-based approaches
Public	Federal	• Federal Nature Conservation Act • Federal Species Conservation Act • Federal Forest Conservation Act	
	States	• State Nature Conservation Act • State Forest Act • State and Regional Development Plans • Landscape Planning • Offsets	• Life+ • Testing and Development projects in nature conservation • Funding for large-scale nature conservation areas • ***Ecological Fiscal Transfers at state level***
	Municipalities	• Local land-use planning • Green area planning • Offsets	• Conservation support programmes • ***Ecological Fiscal Transfers at municipal level***
Private		• Federal Nature Conservation Act and Federal Species Conservation Act • Local land-use planning • Offsets	• Agri-environmental schemes • Conservation support programmes • Directive for Woodland and Forestry in Saxony

New and potential economic instruments

Although the instrument box for biodiversity conservation seems to be well equipped (see Table 1), sufficient funding of nature conservation activities is still lacking and drivers of biodiversity loss and ecosystem degradation are persistent and often further spurred by other sectoral policies. This holds true for private conservation activities, e.g. by farmers or foresters but even more so for public policy makers in charge of landscape and conservation planning. Hence, the German case study looks at two promising instruments to complement the policy mix for biodiversity and forest conservation. Firstly, we explore from an ex ante-perspective the potential of integrating ecological indicators in intergovernmental fiscal transfers at federal level in Germany; and secondly, we study in depth the conditions for incentivizing farmers by PES for afforestation to contribute to the state's aim of increasing forest cover in Saxony, a German state with a particularly low share of forest on total land cover.

Despite advances in implementing instruments that reward conservation at the private level in Germany (e.g., PES to landowners), there are few instruments addressing public actors. This might lead to an under-provision of the public good biodiversity conservation, since in such context subnational governments do not have incentives to take conservation benefits into account, especially those affecting other jurisdictions beyond their own boundaries. Ecological fiscal transfer (EFT) is an instrument that has potential to address this issue by distributing money from higher to lower levels of government based on ecological indicators. So far, only Brazil, Portugal and to a certain extent France have adopted ecological fiscal transfers (Ring et al. 2011a). While ecological fiscal transfers are an innovative approach to German federalism, fiscal equalisation as such is not. There is an extensive field of regulation covering the relationship between federal level, states (so-called Länder) and municipalities. The constitutional rules for the distribution of legislative power and responsibilities among these governmental levels are mirrored by a complex mechanism of distributing public revenues in order to provide governments with the funds necessary to fulfil their responsibilities. Against this background, one set of questions tackled by the POLICYMIX project is whether it is suitable to integrate ecological indicators into the existing fiscal transfer system to account for the different levels of conservation activities by the states. What should an indicator for measuring the

different levels of conservation activities look like? What are the legal options and constraints such an approach would face? How would this kind of incentive mechanism interact with other types of regulation concerning nature conservation? In defining potential indicators, we build on existing experience with ecological fiscal transfers in Brazil and Portugal, and develop a series of protected area-based indicators for integration into the fiscal transfer system.

Instrument interactions in the federal/national/state policy mix

Ecological fiscal transfers build on existing protected area regulation in that they use officially designated protected areas as an indicator to allocate fiscal transfers. Hence, they synergistically complement conservation law with an economic incentive that accounts for state conservation costs and spillover benefits related to these protected areas (Ring et al. 2011a: 115). Depending on the indicators chosen, ecological fiscal transfers may also facilitate indirect conservation measures such as avoiding further fragmentation of landscapes by traffic infrastructure development or patchy settlement expansion. Furthermore, ecological fiscal transfers may provide the funds necessary to equip support programmes for conservation activities by private land users. From an institutional perspective it is also important to note that implementing ecological fiscal transfers at state level may also provide an impetus for introducing ecological indicators at other levels of intergovernmental transfers, e.g. fiscal equalisation at municipal level, thereby boosting impacts resulting from ecological fiscal transfers at state level.

Fine grain analysis – Research questions and challenges for biodiversity and forest conservation

As outlined before, the fine grain analysis in Germany covers two different levels and instruments:

1. Ecological fiscal transfers at state level in Germany

Ecological Fiscal Transfers share some characteristics with payments for ecosystem services (PES) as they incentivize decision-makers to change their behavior in an environmentally friendly way. However, it is important to note, that fiscal transfers are first and foremost a distributive instruments, i.e. aiming at leveling off differences in the available public budgets per capita at the respective governmental levels. Hence, when ecological indicators are introduced without increasing the overall amount of money available to distribute, there will always be winners and losers and thus some states will receive less with ecological fiscal transfers than under the status quo. Thus, effectiveness and efficiency of ecological fiscal transfers for biodiversity conservation cannot be evaluated in rigorous way. The main research questions tackled by the fine grain analysis regarding ecological fiscal transfers focus on 1) the creation of sound ecological indicators capable of representing the differences in conservation activities among the states, 2) options for their integration into the existing fiscal transfer scheme, and 3) simulation of ecological fiscal transfers as proposed to showcase potential distribution results as an input for further discussion with stakeholders about the potential role of ecological fiscal transfers in the conservation policy mix.

2. Agri-environmental incentive scheme for afforestation in Saxony

In Saxony, we focus on a new design of the agri-environmental scheme for forest increase. It has been found that this scheme in its current design is not attractive. This is due to very low compensation payments, partial reimbursement of investment costs and complicated application procedures. The current programme period is from 2007-2013. Authorities are now looking for ways to improve the scheme in the next programme period.

We investigate the terms and conditions under which landowners would be more interested to engage in the agri-environmental scheme for forest increase. These include economic issues (i.e. compensation payments, reversibility to agricultural use, contract length, competition of afforestation with other land uses), social /institutional issues (i.e. degree of administrative effort, consultation) and ecological issues

(farmer's interest in certain ecosystem services of forests, such as recreation, timber production, biodiversity). One possible reason for the limited interest of farmers in the agri-environmental scheme for forest increase is that agricultural production is more attractive. Since many farmers already participate in other agri-environmental programmes or conservation schemes, it might be possible that they are reluctant to change to yet another PES scheme. These terms and conditions will be investigated in a local case study area, namely Western Saxony (Figure 0-2).

Fine grain case study site description

1. Ecological fiscal transfers at state level in Germany

For the fine grain analysis of ecological fiscal transfers, the site descriptions relating to Germany have already been presented earlier.

2. Agri-environmental incentive scheme for afforestation in Saxony

In the Saxon fine-grain analysis the relevant ecosystem services are not related to existing forests but to new forests that will be grown on agricultural land in accordance with the agri-environmental scheme for forest increase. We look at the importance landowners in Western Saxony place on different ecosystem services and biodiversity aspects and investigate how these affect the decision to participate in the afforestation scheme. The ecosystem services include future recreational use and timber production. In terms of biodiversity, we ask for landowners' preferences for production forest (1 or 2 species, little diversity) and natural forest (several species, high diversity). Ecosystem services associated with new forests are identical in the Dutch case study, possibly Barrancos and further POLICYMIX case studies.

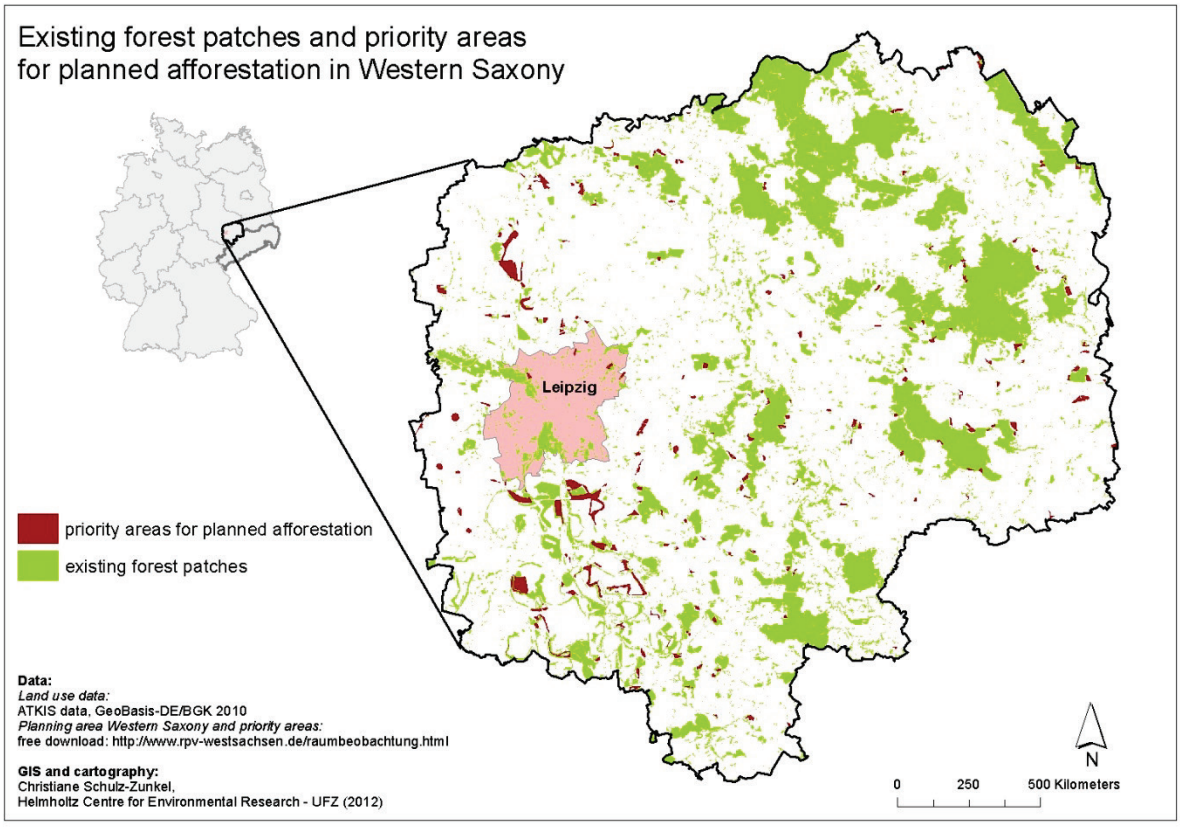

Figure 0-2: Western Saxony – Case study area for local level fine grain analysis in Germany

Economic instrument effectiveness

1. Ecological fiscal transfers at state level in Germany

Ecological Fiscal Transfers aim at public actors and provide incentives to public actors. If protected areas/area-related conservation indicators are integrated into intergovernmental fiscal relations, there is a spatially explicit consideration of these conservation areas in terms of increasing the fiscal needs of the relevant state government. Thus, existing protected areas are considered in a spatially explicit way – although potentially weighted according to conservation value and land-use restrictions associated with them. This might have two effects on conservation efforts: states could designate new protected areas, and states could re-designate their existing protected areas to stricter protection categories to receive a higher weighting factor. However, the incentive effect for future conservation is not spatially explicit. In this way, it is not possible to evaluate the ecological effectiveness of ecological fiscal transfers in a rigorous way. Regarding competing land uses at state or municipal levels, ecological fiscal transfers will most probably change land-use patterns in the long term as on average protected areas are valued higher and do provide monetary benefits to state or municipal budgets. Depending on the ecological indicator chosen, one may evaluate the change of this indicator in the long run.

2. Agri-environmental incentive scheme for afforestation in Saxony

With respect to the agri-environmental scheme for forest increase, we would like to compare the scheme with 1) other instruments for forest increase (mainly foundations) and 2) other competing instruments of relevance to farmers (i.e. premium for set aside land is more attractive). The most restricting factor in analysing cost-effectiveness is little knowledge about the transaction costs of the different instruments. In a questionnaire with farmers we will elicit the payments farmers receive for other conservation measures.

Economic instrument costs and benefits

1. Ecological fiscal transfers at state level in Germany

As mentioned above, the distributive aim of fiscal transfers makes it hardly impossible to rigorously assess the costs and benefits associated with integrating ecological indicators. Nevertheless, some qualitative judgements can be made. Firstly, by acknowledging conservation efforts as a public responsibility eligible for fiscal transfers, public actors are incentivized to rethink their long-term development strategies that are nowadays singularly focused on tax-creating land uses. Thereby a gap in the conservation policy mix is closed, as fiscal transfers address public decision makers that in turn create the framework for decisions by private land users, e.g. by land-use and land-development planning. Secondly, transaction costs of ecological fiscal transfers will be moderately low, since all necessary regulation for intergovernmental fiscal transfers is in place, ecological indicators chosen are mostly based on available data and only the basis for calculating size and direction of transfers is modified.

2. Agri-environmental incentive scheme for afforestation in Saxony

With respect to the agri-environmental scheme, we use a Choice Experiment and a follow-up questionnaire to investigate compensation required by landowners for converting some of their land into forest.

Economic instrument equity and legitimacy

1. Ecological fiscal transfers at st level in Germany

On the one hand, ecological fiscal transfers can provide a counterbalance in relation to existing, often adverse incentives for land use, such as attracting more inhabitants and businesses, agricultural land uses, settlements, construction and housing. On the other hand, intergovernmental fiscal transfers are not primarily targeted towards biodiversity conservation but strive towards levelling off substantial differences in available tax revenues per capita. In this way, fiscal transfers are per se a redistributive instrument, accounting for fiscal needs in relation to the fiscal capacities of relevant jurisdictions. Financial con-

stitutions (in Germany part of the Basic Law) and fiscal transfer laws thus represent the result of a complex bargaining process between the federal level and the states of what is considered fair and legitimate in a certain period of time. As these laws are always a result of political majorities, bargaining continues for law changes, especially of those states that pay more than they receive. If ecological indicators are newly integrated, the relative weight of other criteria in the distribution formulas is reduced that is mainly the number of inhabitants. As the number of inhabitants is the agreed abstract indicator for representing fiscal needs of various inhabitant-related public functions, e.g. infrastructure needs for housing and transport, social security and health care, education and cultural activities, loosing states with an ecological fiscal transfer scheme will also have less money for these other public functions. However, beside some qualitative judgements it is way beyond the scope of the POLICYMIX fine grain study to assess the welfare effects of this shift.

2. Agri-environmental incentive scheme for afforestation in Saxony

With respect to the agri-environmental scheme for forest increase we have included questions regarding the social impact of the scheme in the Choice Experiment. We plan to conduct qualitative interviews with farmers who refuse to participate in the afforestation scheme in the Choice Experiment to determine the reasons why they do not want to participate and the extent to which shortcomings in the implementation of the instrument play a role. This allows us to filter out possible social impacts and distributional fairness issues (i.e. is a certain group disadvantaged: part-time vs. full-time farmers, high soil fertility rate vs. low soil fertility rate, size of landholding).

Institutional opportunities and constraints for economic instruments

1. Ecological fiscal transfers at statevel in Germany

There are several options to integrate ecological indicators into the German fiscal transfer system at state level. We choose to integrate a conservation factor at the stage of horizontal equalisation, i.e. where fiscal needs and fiscal capacities of the states are compared and levelled off. This is due to the fact that already now, higher fiscal needs of states with very low population densities (which can be understood as an area-related indicator) are considered at this particular stage. In this way, conservation efforts are “translated” into additional inhabitants and thereby into higher fiscal needs. Another option would be to put conservation-related indicators side by side to population-based indicators. Moreover, as our preliminary simulation has shown, marine protected areas should be considered in a separate form. As our chosen indicator relates the protected area of a state to its overall area, the large size of marine protected areas in relation to the land size of the relevant states (such as Schleswig-Holstein) highly distorts the results. Furthermore, marine protected areas are associated with considerably different opportunity and management costs than their terrestrial counterparts, leading to a strong bias in favour of coastal states.

2. Agri-environmental incentive scheme for afforestation in Saxony

With respect to the agri-environmental scheme for forest increase, we have conducted a number of in-depth interviews with a variety of forestry authorities. According to these interviews, the main institutional constraints are related to the complicated application procedure and administrative effort, to the lack of personnel to promote the scheme and to assist farmers during the application process, and to the fact that the scheme is voluntary.

Integrated policy mix assessments at fine grain assessment level

1. Ecological fal transfers at state level in Germany

As ecological fiscal transfers are introduced at the national/state level, please see section on “Instrument interactions in the federal/national/state policy mix” above.

2. Agri-environmental incentive scheme for afforestation in Saxony

In the local fine grain analysis, conclusions will be derived regarding the agri-environmental incentive scheme for afforestation in Saxony, whether the instruments acceptance by farmers and thus effectiveness in terms of forest increase can be enhanced through design changes. This will be discussed in the light of its co-existence with other existing instruments, such as foundation's activities for forest increase, and other agri-environmental measures possibly competing with the afforestation scheme.

1 Introduction

1.1 Background of the POLICYMIX-project

In most countries, the conservation and sustainable use of biodiversity builds on strategies involving a wide range of policy instruments. Within these policy mixes, the use of economic instruments for biodiversity policies and the provision of ecosystem services gains increasing attention (Bräuer et al. 2006; European Environment Agency 2006; Madsen et al. 2010; Ring and Schröter-Schlaack 2011a). Especially in the context of the recent international initiative on The Economics of Ecosystems and Biodiversity (TEEB), economic approaches to biodiversity conservation and ecosystem governance gained momentum (TEEB 2010a, b, 2011a, b, 2012). However, there are still many open questions regarding the combination of several instruments in a policy mix. For example, what is the role of economic instruments vis-à-vis regulatory approaches in biodiversity policies? How can the various instruments be assessed in their contribution to conservation objectives, cost effectiveness, social and distributional impacts as well as institutional requirements, when the focus is on assessing policy mixes rather than single instruments?

Against this background, POLICYMIX focusses on the role of economic instruments in a mix of policy instruments for biodiversity conservation and sustaining ecosystem service provision. It develops an integrated evaluation framework that encompasses not only the costs of conservation but also the economic benefits, social impacts and institutional prerequisites associated with certain conservation policy instruments and their combinations. This framework will be employed in six national case studies across Latin America and Europe, with Germany being one of them. The practical aim is not only that of gaining a better understanding what type of instruments and policy mix works when, how and why but also to learn from the success and failures of economic instruments in conservation between the case studies.

1.2 Research question and motivation of the German case study

Since the 1970s, the dominant government response to the rise of environmental degradation and pollution in Germany has been the application of 'direct regulation' to prohibit or restrict environmentally harmful activities. Very often the term 'command-and-control' is used synonymously, revealing the idealised mechanism underlying 'direct regulation' – to command certain behaviour (through standard setting and prescription of management practices) and to control actors for their compliance. 'Direct regulation' is successfully applied to cope with many environmental problems such as pollution to air, water and soils, prevention of hazardous events and to trigger urgent environmental improvements, e.g. by banning certain substances. The approach is of special importance to biodiversity conservation, e.g. by setting land aside in protected areas or by specifying best management standards for farmers and loggers.

Economic instruments for biodiversity conservation and sustainable management of natural resources, such as payments for environmental services, eco-taxes or tradable permits are hypothesised to be more cost-effective and incentive-compatible. As not only the benefits but also the costs associated with carrying out conservation activities will vary across space, scales and times, more flexible mechanisms, economic instruments able to consider the uneven distribution of costs and benefits of environmental protection might safeguard the required level of conservation at lower costs. Moreover, land users are incentivised to work towards conservation goals instead to strive against costly protection measures. Given the public budget constraints and the ever growing demand for land for economic development, finding the right mix of policy instruments is a crucial factor to design future-proof conservation policies.

Despite advances in implementing instruments that reward conservation at the private level (e.g., PES to landowners), there are few instruments addressing public actors. This might lead to an under-provision of the public good biodiversity conservation, since in such context subnational governments don't have in-

centives to take conservation benefits into account, especially those affecting other jurisdictions beyond their own boundaries. Ecological fiscal transfer (EFT) is an instrument that has potential to address this issue (see also section 4). Ecological fiscal transfers are distributed from higher to lower levels of government based on ecological indicators. So far, only Brazil, Portugal and to a certain extent France have adopted ecological fiscal transfers. In Brazil, states use ecological fiscal transfers as compensation mechanism for municipalities, taking into account, for instance, protected area coverage (May et al. 2002; Ring 2008a). Portugal is the first EU member state to recognise protected areas as an indicator for the redistribution of public revenues through fiscal transfers from national to local governmental level (Ring et al. 2011a; Santos et al. 2012). French municipalities lying in the core area of a National Park or in the perimeter of a Marine Park receive an 'ecological allocation' for the protection of these areas.

However, up to now, all ecological fiscal transfer systems operate only towards the local level. There is no ecological fiscal transfer at federal level, e.g. between states. This is a matter of concern, since biodiversity conservation and regulatory arrangements of many ecosystem services are usually associated with the national level. It is especially true for countries of the European Union, where on top of federal regulation both the European Habitats Directive as well as the European Birds Directive have tremendous influence on member state nature conservation activities.

While ecological fiscal transfers are an innovative approach to German federalism, fiscal equalisation as such is not. There is an extensive field of regulation covering the relationship between federal level, states (so-called Länder) and municipalities. The constitutional rules for the distribution of legislative power and responsibilities among these governmental levels are mirrored by a complex mechanism of distributing public money in order to provide governments with the funds necessary to fulfil their responsibilities. As of now, transfers are assigned at a per capita basis, following the constitutional principle of equivalent living conditions for all people in Germany.

Against this background, the question arises, whether it is suitable to integrate ecological indicators into the existing transfer system to account for the different levels of conservation activities by the German states. What should an indicator for measuring the different levels of conservation activities look like? What are the legal constraints such an approach would face? How would this kind of incentive mechanism interact with other types of regulation concerning nature conservation?

Answers to these questions are derived using the POLICYMIX framework for evaluating policy mixes for biodiversity conservation and ecosystem service management. The framework was developed during the first project years and draws upon a review of policy instruments (Ring and Schröter-Schlaack 2011a) and guidelines for the assessment of the ecological, economic, social, and institutional impacts of policy instruments and their interactions (Brouwer et al. 2011; Grieg-Gran et al. 2011; Primmer et al. 2011; Rusch et al. 2011). The next subsection examines this framework further and also highlights the steps of analysis for the German case study on ecological fiscal transfers.

1.3 The POLICYMIX evaluation framework

The German case study on Ecological Fiscal Transfers is following the three step-two pathway-model developed within the POLICYMIX project to evaluate instrument mixes for biodiversity conservation and ecosystem service management (Schröter-Schlaack and Ring 2011). However, before entering the model, it is necessary to clearly define what is meant by the term 'policy mix'. In order to provide a more rigorous basis for analysing policy mixes, the following pragmatic working definition is suggested (Ring and Schröter-Schlaack 2011b: 15):

> *A policy mix is a combination of policy instruments which has evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors.*

Building on a review of policy mix frameworks (Ring and Schröter-Schlaack 2011b: 22 et seq.), the POLICYMIX model for assessing instruments in policy mixes for biodiversity and ecosystem governance includes three steps and two pathways, as described below.

1.3.1 Step 1: Identifying challenges and context

When it comes to analysing policy mixes, the focus is not on maximising the effectiveness or efficiency of individual policy measures but on the complementarity of the instruments involved, their interplay and the ability of the policy mix to address all drivers of the underlying problem. The appropriate mix of instruments and actors will hence depend upon the nature of the environmental problem, the target groups and wider contextual factors (Gunningham et al. 1998).

Against this backdrop, the first step of the proposed framework consists in gaining a thorough understanding of the policy object, i.e. biodiversity conservation and (forest) ecosystem services management. Although the below listed questions should neither be understood as comprehensive nor exclusive, they may cover the most relevant questions to answer. Firstly, what are important characteristics of biodiversity and ecosystems that will influence appropriateness, applicability and success of certain instruments and their combinations? Secondly, what are the policy objectives regarding biodiversity conservation and ecosystem service management? Thirdly, what are the drivers of biodiversity loss and ecosystem degradation? Fourthly, who are the main actors whose behaviour is impacting biodiversity and influencing ecosystem service provision? And lastly, what are cultural and constitutional constraints (or enabling conditions) that may hamper (or facilitate) the inclusion of certain policy instruments?

1.3.2 Step 2: Functional role evaluation

There are three main determinants that influence the composition of the mix and that define the functional role of different instruments within the policy mix, namely the performance (and composition) of the existing policy (mix), the context-specific strengths and weaknesses of the individual instruments and lastly the interaction of the instruments within the policy mix.

Firstly, an analysis of the performance of existing policies will point to their shortcomings regarding the challenges of biodiversity conservation and ecosystem service management. Moreover, experience with existing policies in place shape what further instruments can be added more easily.

Secondly, the different strengths and weaknesses of instruments are of different importance for different conservation and management goals. For instance, ‘direct regulation’ is deemed to be effective in securing a safe minimum standard of biodiversity conservation and critical ecosystem service provision. In contrast, the main argument in favour of economic instruments is that they allow compliance costs borne by policy addressees to be reduced, e.g. in sustaining provision of marketable ecosystem services.

The third determinant for the role of individual instruments is how the additional instrument will interact with existing policies. Each instrument works by a different mechanism, either prescribing certain actions (‘direct regulation’), incentivising positive actions (payments for environmental services, subsidies, tax reliefs, fiscal transfers), penalising negative impacts (offsets, taxes, permit trading) or providing information to stipulate motivation and self-regulation (certification). Some of these mechanisms are deemed to be complementary, e.g. facilitating policy instruments by informative measures. Others are deemed to be counterproductive, e.g. limiting the compliance options of policy addressees by ‘direct regulation’ may restrict the flexibility inherent to economic instruments and will thus limit the potential cost savings from applying economic instruments. Ultimately, a ‘policyscape’ depending on the specific characteristics of the landscape, its uses and the associated formal and informal institutions can be drawn.

Hence, depending on these three aspects, instruments will have different roles to play within a policy mix. They may either be the leading approach, often introduced as initial regulatory impulse and amended by other policies to avoid negative side effects. On the contrary, the same instrument may also be applied later to facilitate already existing policies. For example, 'direct regulation' is very often the pioneering approach to reduce environmental loads and to safeguard biodiversity conservation. It may be augmented later by economic instruments to reduce opportunity costs of implementing more ambitious conservation goals or by informative measures to enhance compliance and reduce costs for monitoring and enforcement. Nevertheless, there may be also situations, where economic instruments are the main policy in place, e.g. taxes to correct for externalities in utilising marketable ecosystem services. Later on, the economic instrument may be augmented by 'direct regulation', e.g. zoning, to spatially allocate compliance activities to biodiversity hot spots.

1.3.3 Step 3: Policy evaluation and design

The last step of the proposed framework turns the focus to the evaluation and design of single instruments, i.e. how to improve an existing or design a new instrument so that the additional value of the relevant instrument to the existing policies is maximised? Although there is ample (economic) literature on instrument choice and design, these contributions very often strive towards developing optimal single instrument policies. However, as outlined above, the characteristics of and challenges associated with biodiversity conservation and ecosystem service management will in many instances require the simultaneous use of multiple instruments. And whenever more than one instrument is implemented, the interaction of instruments is of fundamental importance for overall performance of the policy mix. Against this background, the overall aim of instrument evaluation and design is shifted towards the specific role of single measures within a policy mix and how single instruments facilitate the performance of the overall policy mix.

To develop policy recommendations POLICYMIX refers to the traditional evaluation criteria while moving beyond the core criteria of effectiveness and efficiency in economic analyses, and group them into four basic assessment categories: conservation effectiveness, cost-effectiveness, social impacts and policy legitimacy, and institutional aspects. All of these aspects are highly context-specific and so are the methods from various scientific disciplines needed to derive some concrete recommendations. Work packages 3 to 6 of the POLICYMIX project discuss detailed assessment criteria for policy and larger governance analysis and recommendations regarding these aspects, thereby encompassing knowledge and techniques from natural science disciplines, such as biology and landscape ecology, to social sciences, such as economics, sociology and law (Brouwer et al. 2011; Grieg-Gran et al. 2011; Primmer et al. 2011; Rusch et al. 2011).

Finally, depending on the policy-relevant outcomes of the evaluation and design of instruments in step 3, it may be necessary to reconsider the original challenges and the context of the conservation problem in relation to the policy instruments analysed (step 1) and/or the functional role of the relevant instruments in the policy mix (step 2).

1.3.4 Linking the three steps to the two pathways of ex post and ex ante analysis

Depending on whether the focus is on evaluating the contribution of an existing instrument within the policy mix (ex post-perspective) or on guidance for the introduction of a new policy instruments into an existing range of measures (ex ante-perspective), two different pathways lead through the three steps described above. Hence, the POLICYMIX frameworks suggest a three steps-two pathways-model for the analysis of instruments in policy mixes (see also Figure 1-1 below):

a. **Ex post analysis**: In a specific context and at a certain point in time, a mix of existing instruments is usually already present. This existing mix can be assessed with a range of evaluation criteria where different instruments contribute to the success or malfunctioning of the overall policy mix in specific ways. To improve the success of the overall policy mix, the focus of analysis may be on:

   2a. **Functional role evaluation**: focus on the overall existing policy mix assessing the roles of several instruments vis-à-vis each other, using the classification of instrument roles (complementarity, redundancy, conflict, sequencing/path dependency, context dependency).

   2b. **Impact evaluation**: one selected policy instrument is evaluated against the background of the other instruments in the policy mix using evaluation criteria for single instrument analysis as well as using evaluation criteria for analysing policy mixes.

b. **Ex ante analysis**: A new policy instrument is introduced against a background of already existing instruments. Both the new and the existing instruments form the policy mix. To improve the success of the overall policy mix, the focus of analysis may be on:

   3a. **Prospective functional role analysis**: assessing the overall policy mix including the new instrument looking at the roles of several instruments vis-à-vis each other, using the classification of instrument roles (see above).

   3b. **Scenario analysis:** the new policy instrument is evaluated or designed against the background of the other instruments in the policy mix using evaluation criteria for single instrument analysis as well as using evaluation criteria for analysing policy mixes.

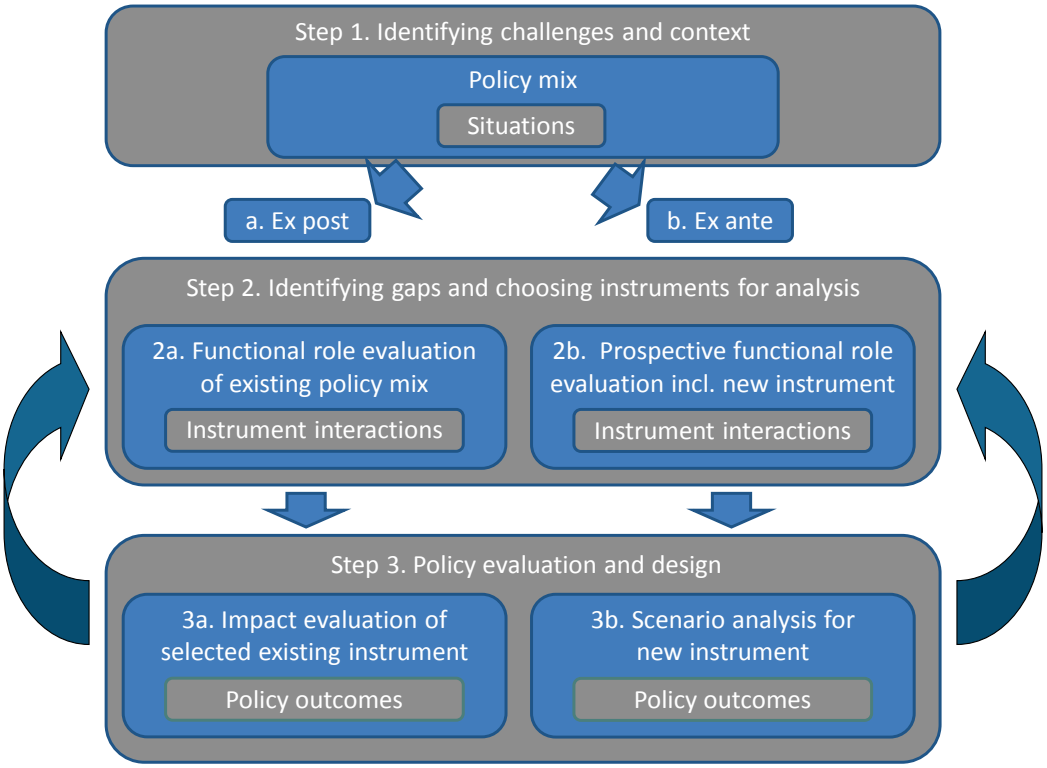

Figure 1-1: Three steps-two pathway-model to evaluate policy mixes
Source: Schröter-Schlaack and Ring (2011: 201)

1.4 Outline of the report

The German case study for assessing the role of ecological fiscal transfers in the German policy mix for nature conservation and ecosystem service provision follows the ex ante-pathway through the three steps (see also Figure 1-2 below). After identifying the challenges and policy context of biodiversity protection and nature conservation in Germany (Step 1 of the POLICYMIX framework, section 2 of this report), the focus of analysis shifts towards identifying the existing instruments and revealing the prospective role of ecological fiscal transfers within this policy mix (Step 2b of the POLICYMIX framework). To this end, the existing policy instruments for nature conservation in Germany are sketched (section 3 of this report), and the state of the art research on ecological fiscal transfers is reviewed (section 4).

Furthermore, by developing different sets of ecological indicators to be introduced into the fiscal equalisation mechanism, potential policy outcomes will be sketched and evaluated (Step 3b of the POLICYMIX framework). In order to do so, legal options and constraints for the integration of ecological indicators into the existing fiscal transfers in Germany are explored (section 5), and a range of ecological indicators to measure the difference in nature conservation activities among German states are developed (section 6 of this report). Using a model of the German fiscal equalisation mechanism, simulation runs of the integration of these indicators into the existing transfer scheme are conducted and the results presented (section 7). In the light of these results, conclusions regarding the role of ecological fiscal transfers in the German policy mix for biodiversity conservation are drawn (section 8).

Figure 2 summarises the approach and outline of this report.

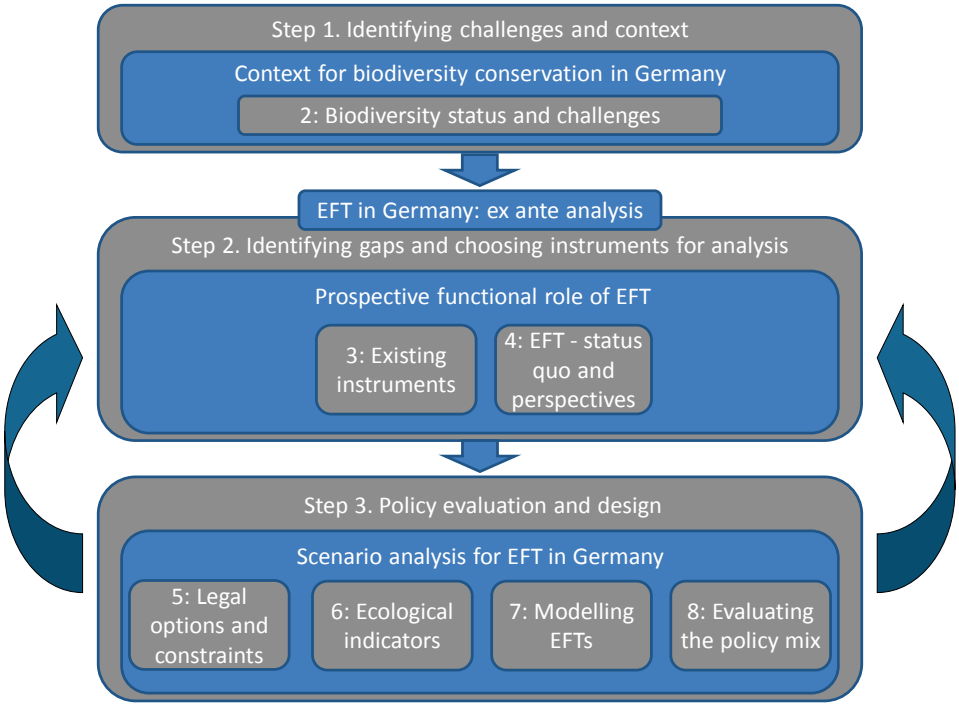

Figure 1-2: Analysing the introduction of Ecological Fiscal Transfers (EFT) for biodiversity conservation in Germany
Source: own representation

STEP 1: Identifying challenges and context

2 The context for biodiversity conservation in Germany

2.1 Biodiversity status and trends in Germany

The territory of Germany covers 357,123 km^2 and is influenced by a temperate seasonal climate. With more than 80 million inhabitants it is the most populous member state of the European Union and amongst the most densely populated countries on a global comparison (Federal Ministry for the Environment 2010a: 5). Agriculture is the dominant land-use type (~52 per cent). Though increasing in recent years, forest cover in Germany (~31 per cent) is substantially lower than European average (~45 per cent). Despite its overall stable and in some regions declining population, the share of land used for settlements and traffic infrastructure is constantly growing, reaching 13.2 per cent of the total area of Germany in 2009 and contributing to the loss and fragmentation of natural habitats (Federal Statistical Office Germany 2012).

Germany is characterised by a high diversity of landscapes; Riecken et al. (1994) present a catalogue of more than 500 habitat types in its territory. From an ecosystem perspective, Germany's landscape is highly influenced by anthropogenic activities, only the high mountainous areas in the south are perceived as nearly unaltered ecosystems (Beck et al. 2006). The patchy landscape, however, leads to small, often fragmented populations of plants and animals. According to current knowledge, Germany hosts approximately 48,000 animal species, 9,500 plant species, and 14,400 species of fungi (Federal Agency for Nature Conservation 2008). Additionally, Germany is poor in endemic species and there are no hot spots of species diversity, which conversely may help in species conservation (Schaefer 2005: 111).

Conserving biodiversity is among the central elements of Germany's National Sustainability Strategy adopted in 2002 (Bundesregierung 2002). In 2007 Germany also adopted a National Strategy on Biological Diversity (Federal Ministry for the Environment 2007). To observe and evaluate recent trends in biodiversity at federal level, an indicator comprising information on species diversity, landscape quality and sustainability of land use was developed as part of these strategies and is published bi-annually[1]. Although the indicator value has hardly changed in the last ten years under consideration (1998 to 2008), it remains still below the estimated historical values for 1970 and 1975 and stood at 67 per cent of the target value in 2009 (see Figure 2-1).

The 2010 progress report also disclosed sub-indicators for farming land (66 per cent of the goal for 2015), for housing areas (59 per cent), and for coasts and seas (56 per cent). In the last ten years under consideration these sub-indicators moved significantly away from the target figure. For inland waters (73 per cent) and the Alps (57 per cent) no such trend was evident. Only the sub-indicator for forests has shown a positive trend, still it is only at 81 per cent of the target value for 2015.

[1] *The calculation of the indicator is based upon the development of the stocks of 59 bird species which represent the most important types of landscape and habitat in Germany (farmland, forests, settlements, inland waters, coasts and seas and the Alps). The s of the bird population (based on the numbers of territories or breeding pairs) reflects the suitability of the landscape as a habitat for the bird species. This indicator also reflects the development of a number of other species in the landscape and sustainability of land use, since besides birds there are also other species that rely on a richly structured landscape with intact, sustainably used habitats. A body of experts has determined target population values for 2015 for each individual species, which could be reached if the European and national legal provisions relating to nature conservation and the guidelines on sustainable development are implemented quickly. Every year a value for the overall indicator is calculated based on the degree to which the goals for all 59 bird species have been achieved.*

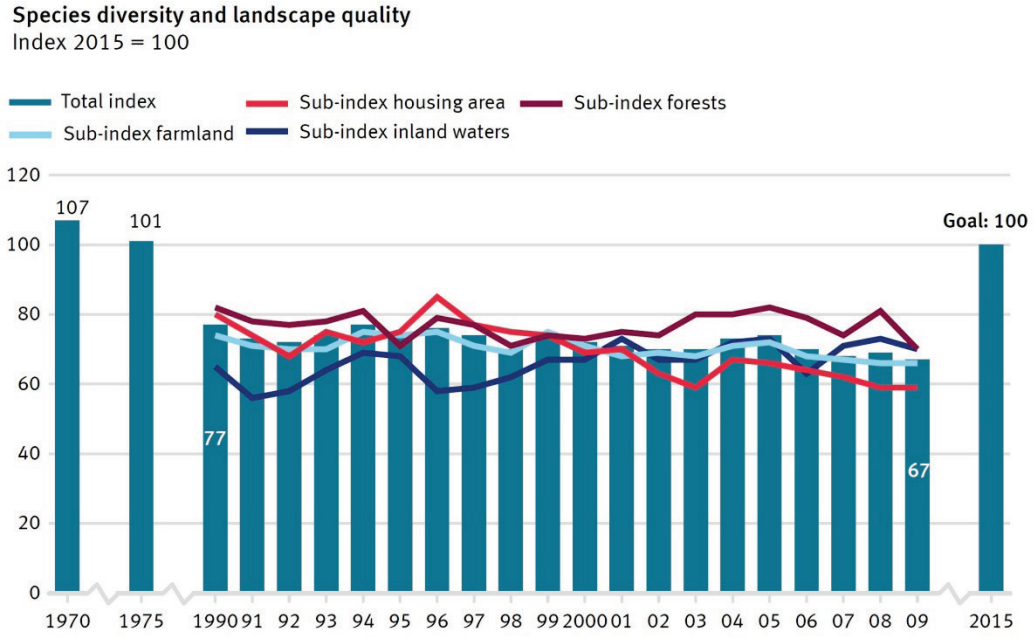

Figure 2-1: Indicator on species diversity and landscape quality of Germany's Sustainability Strategy Source: Federal Statistical Office of Germany (2012a: 16)

Of the more than 3,000 endemic ferns and flowering plants in Germany, according to the Red List, 26.8 per cent are at risk of extinction and 1.6 per cent have already disappeared. 36 per cent of Germany's endemic animal species are at risk of extinction and 3 per cent are extinct, or there have been no further recorded sightings. 72.5 per cent of the habitats occurring in Germany are under threat (Federal Ministry for the Environment 2007), in particular peatlands, pastures and meadows with scattered fruit trees (Bundesamt für Naturschutz 2007).

Regarding forest ecosystems, there are 71 different tree species recorded in Germany (Schmidt et al. 2003). Three quarters of all forested areas are populated by four tree species, spruce (28 per cent of total forest area), pine (24 per cent), beech (15 per cent), and oak (10 per cent). Alien tree species, such as Douglas fir and Japanese larch account for roughly 4 per cent of forests (Federal Ministry of Food 2009a). A recent assessment found 27 per cent of forests to be damaged (compared to 30 per cent in 1991), 37 per cent at a warning stage (38 per cent in 1991) and 36 per cent undamaged (32 per cent in 1991). The tree species most threatened is beech, of which 50 per cent of total stock is classified as damaged. Oaks showed slight improvements in recent years; however, still 48 per cent are damaged (Federal Ministry of Food 2009a).

2.2 Drivers of biodiversity loss and challenges for biodiversity conservation

2.2.1 Persistent drivers of biodiversity loss

Main drivers of biodiversity loss in Germany include direct destruction and degradation of habitats (mainly due to the conversion to agricultural land and settlement areas), fragmentation of landscapes (mainly due to infrastructure development), and intensive land-use practices in agriculture, including plant protection measures, fertilisation, drainage of wetland meadows and lowland moors as well as the abandonment of extensively used agricultural land (Federal Ministry for the Environment 2007: 17). Other factors that are projected to pose a major threat to biodiversity in the future encompass climate change and invasive non-native species (Federal Ministry for the Environment 2007: 18). Important drivers of change regarding forest ecosystems still relate to air pollution, conversion to intensive forestry practices and alien

tree species (Federal Ministry of Food 2009b). Endangering factors for coastal habitats include disturbances due to increased recreational use and overbuilding, such as from coastal protection measures.

Looking at some of the drivers mentioned above in more detail, it is remarkable that despite steady population numbers in Germany the amount of land taken up for settlement areas and infrastructure is continuously increasing over the last decades (see Figure 2-2). Most of this increase comes at the expense of agricultural land, while forest cover has increased substantially (see Figure 2-3).

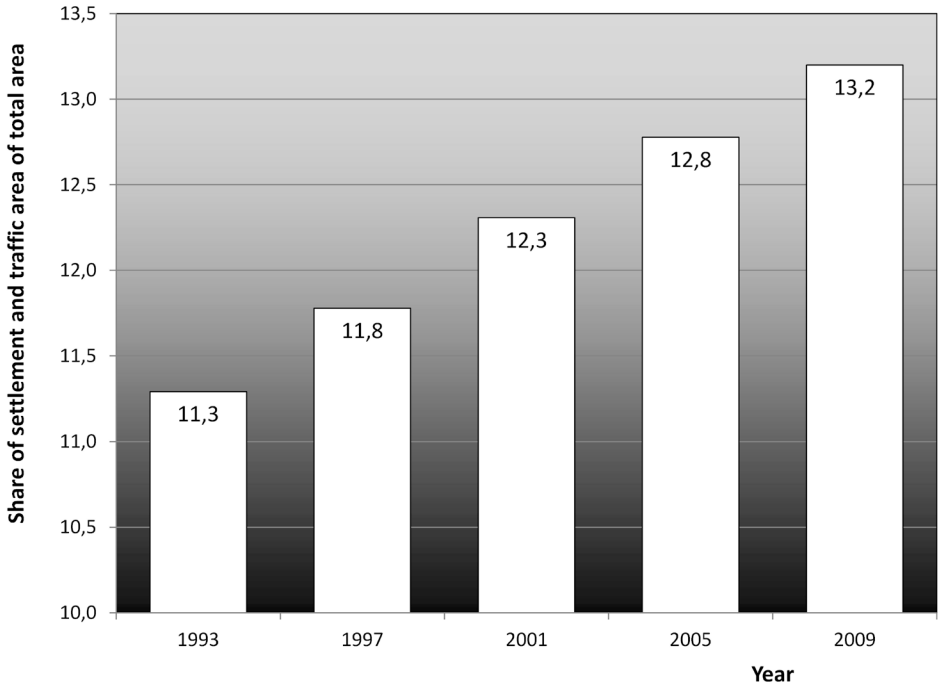

Figure 2-2: Share of settlement and traffic area of Germany's total area
Source: Federal Statistical Office of Germany (2012b)

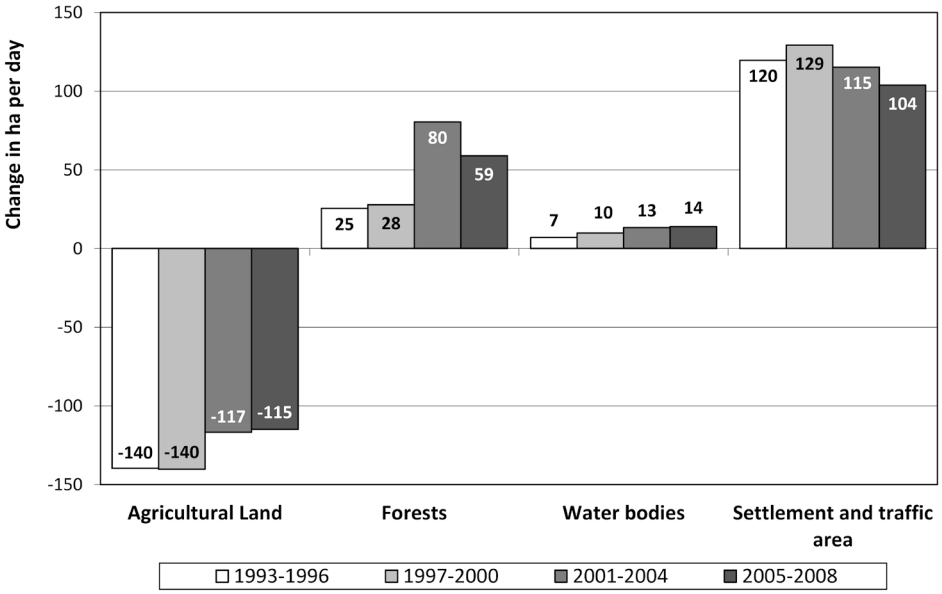

Figure 2-3: Change of major land-use types in Germany in hectares per day
Source: Federal Statistical Office of Germany (2012b)

Landscape fragmentation is a result of patchwork conversion and development of sites, e.g. for settlements, and linking these sites with linear infrastructure, such as roads, railways or high tension power lines (Saunders et al. 1991; Theobald et al. 1997). Fragmentation modifies the ecological interrelations between the segments of the landscape and acts as barrier against the dispersal of animal and plant species (Jaeger 2000). Contiguous, low-traffic areas of at least of 100 km^2 are now only found in less than 27 per cent of Germany's territory, with large regional discrepancies (see Table 2-1).

Table 2-1: Distribution of undissected low-traffic areas in Germany

State	Land area in km^2	Effective mesh size in km^2	Undissected low-traffic areas larger than 100 km^2		
			No. of areas	Area in km^2	Percentage of territory
Baden-Wuerttemberg	35,751	34.72	18	2,736	7.65
Bavaria	70,549	68.55	86	15,026	21.30
Brandenburg	29,477	154.67	85	16,608	56.34
Hesse	21,114	37.95	12	2,097	9.93
Lower Saxony	47,618	172.28	81	14,771	31.02
Mecklenburg-Western Pomerania	23,147	95.58	106	17,085	73.81
North Rhine-Westphalia	47,618	27.93	5	1,230	2.57
Rhineland-Palatinate	19,847	60.00	22	3,823	19.26
Saarland	2,568	19.38	0	55	2.15
Saxony	18,414	69.93	22	4,176	22.68
Saxony-Anhalt	20,445	112.17	40	7,218	35.30
Schleswig-Holstein	15,763	71.35	21	3,182	20.18
Thuringia	16,172	102.70	33	6,190	38.28
Germany	**357,123**	**83.75**	**562**	**94,427**	**26.44**

Source: Federal Ministry for the Environment (2007: 129)

Moreover, traffic infrastructure is not only a source of landscape fragmentation it also acts as a pathway for pollution and noise (Losch and Nake 1990). This is of special importance for heavily urbanised areas with high daily commuting traffic (see Figure 2-4).

Nutrient loading by diffuse contaminations from air pollution and agricultural practices is another major threat to biodiversity on a global as well as a national level (Beck et al. 2006; Phoenix et al. 2006). Though a significant reduction in SO_2-emissions have been achieved throughout the 1980s (Wätzold 2004), contamination levels of other pollutants remained nearly constant over the last decade (see Figure 2-5). Exemplarily, critical loads for acid concentrations are reached at 80 per cent of all forests areas, and even at 90 per cent for eutrophication (Federal Ministry of Food 2009b: 10 et seq.).

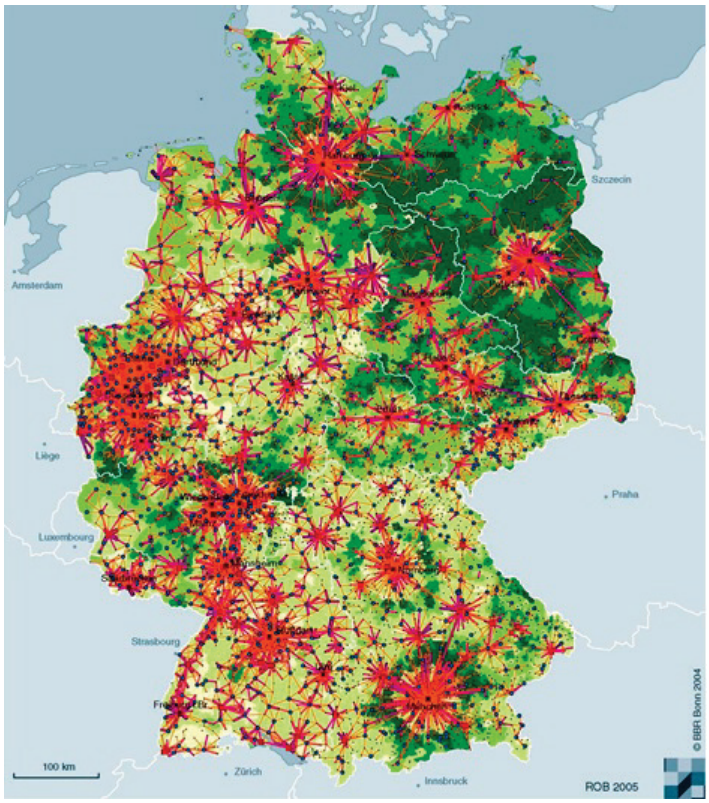

Figure 2-4: Daily commuting traffic around Germany's urbanised areas
Source: Bundesamt für Bauwesen und Raumordnung (2005: 81)

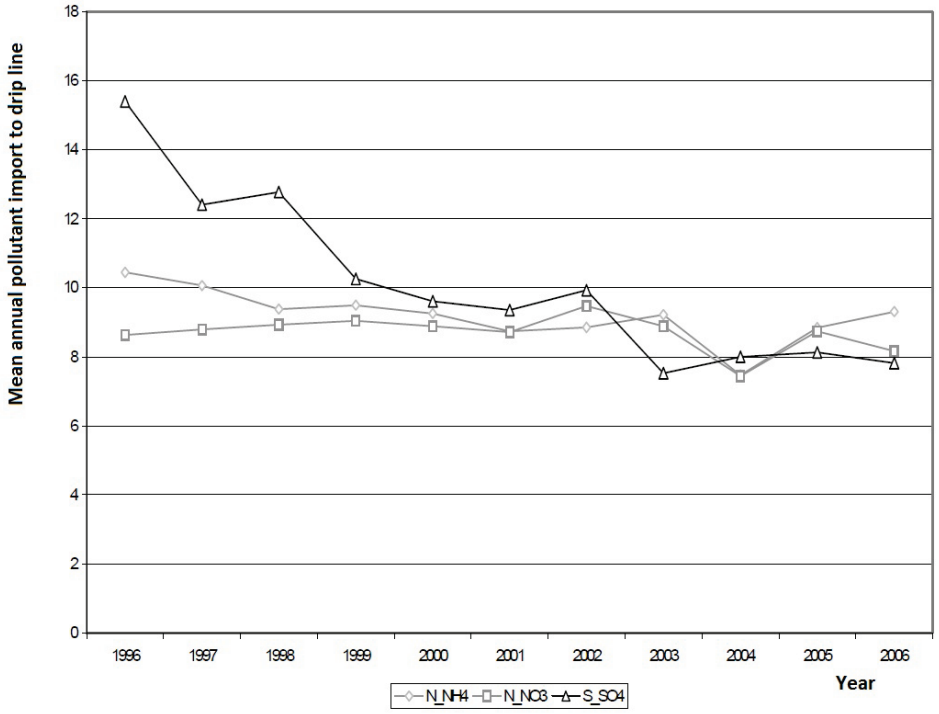

Figure 2-5: Mean annual import of selected pollutants to tree drip line
Source: Federal Ministry of Food, Agriculture and Consumer Production (2009b: 12)

In the future, not only direct effects of climate change but also the threats resulting from climate mitigation policies, such as the increasing cultivation of fuel crops or short rotation forestry, will certainly have an effect on the quality of landscapes, biodiversity and their ability to provide a wide range of ecosystem services. As yet it remains to be seen in what ways the demographic changes, in particular the estimated population decline in most rural and some urban areas in Germany, will affect species diversity and the quality of the landscape.

2.2.2 Challenges to biodiversity conservation

Germany is a federal state and responsibility for nature conservation rests with the states (Länder). Although most biodiversity policies are set up at federal level, like the Federal Nature Conservation Act, or even European level, like the EU Habitats and Birds Directives, implementation takes place at state level. Differences in state level implementation of these regulations and the necessity to coordinate action may hamper the overall effectiveness of nature conservation activities.

The same holds true for Germany's system of spatial planning, which is a comprehensive and in principle powerful tool to steer regional and local development via state level and regional level development plans. However, landscape planning focused on environmental and nature conservation issues is but one input in establishing the comprehensive plan and most often conservation issues are disregarded by local and regional decision makers – leading to a lively debate on how to make conservation concerns more prominent (see inter alia ARL 1999; Bizer 1997; Henger and Bizer 2010; Kistenmacher 1996; Nuissl and Schröter-Schlaack 2009; Schröter-Schlaack 2011).

Moreover, biodiversity is a multidimensional and cross-cutting issue that is impacted by several human activities and different drivers of loss. Thus a policy response to halt biodiversity loss and ecosystem degradation should also be a cross-cutting policy issue. So far however, sectoral policies dealing with only some ecosystem services are the dominant action taken. It is still to be seen, if the German National Strategy on Biodiversity might help in mainstreaming conservation issues and the sustainable use of ecosystem services to sectors out of the environmental pillar (see also section 2.3).

Table 2-2: Public expenditure for nature conservation

Year	Expenditure for environmental protection in million €	of which spending for nature conservation in million €	Total public expenditure in million €	Share of expenditure for environmental protection of total public spending in per cent
1992	2,200	261	903,200	0.24
1994	2,900	1,009	923,400	0.31
1996	3,000	888	970,700	0.31
1998	2,700	716	963,300	0.28
2000	2,600	758	930,400	0.29
2002	2,300	not reported	996,900	0.23

Source: Data collected by SRU (2007: 66 et seq.)

Another major challenge to effective biodiversity conservation policies is a lack of adequate funding. Although the importance of biodiversity conservation as a global policy challenge as well as a national concern is increasingly acknowledged in Germany (see also the following section 2.3), public funds attributed to environmental protection, and nature conservation activities in particular, have not significantly increased over the years and accounted for less than 0.3 per cent of total public expenditure in 2002, the last year for which data could be acquired (see Table 2-2) (SRU 2007). At municipal level, expenditure for nature conservation also accounts for less than 1.0 per cent of total spending (Perner and Thöne 2007: 20).

Looking at this from a perspective of political economy, it is no wonder. As stated above, implementing nature conservation, e.g. the Natura 2000-network is a task of the German states. They need to provide the necessary administrative capacity and funding to (at least partially) endow support programmes for private landholders. Annual Costs for implementing and managing the Natura 2000-network were estimated to be around € 5.1 billion for the EU27 and around € 620 million for Germany (Gantioler et al. 2010). Hence, nature conservation is a costly activity for the states, whereas at least some of the benefits provided are of national if not international importance. What is more, in nearly all instances nature conservation decreases public budgets as it diminishes tax income generating activities. All tax income for Germany's governmental levels is generated either by economic activity (VAT, income and corporate taxes) or by land development (property taxes). Hence, setting land aside for protected areas or reducing economic activity causes costs in terms of foregone tax revenues. Although payments for private landholders and farmers to stimulate biodiversity friendly land-use practices are a long established tool in environmental policy in Germany and the EU, benefits provided by public conservation activities are neither acknowledged nor rewarded at the relevant decentralised levels. Given the fiscal architecture, assigning land to development is a rational strategy at state and municipal level to compete for new residents and economic development – and thus for additional income.

Additionally, for private actors still many environmentally harmful subsidies exist, such as commuting allowances that spur urban sprawl and an orientation towards individual motor traffic (Potter et al. 2006; Umweltbundesamt 2005). Property taxes are levied on an outdated assessment basis that provides no incentives for dense development of their premises – to the contrary, it makes developed but yet not built on-land a highly attractive investment. In turn, this leads to a leapfrogging development and an increasing uptake of land for urban development. Although a wide range of solutions were proposed, reforming property taxation is still a task to do (see inter alia Apel et al. 1995; Brueckner and Kim 2003; Josten 2000; Löhr 2004; Reidenbach 1999).

This holds true for the public realm, where many transfers are devoted to promoting economic growth in rural areas by subsidising traffic infrastructure investments or the development of industrial zones. In turn, this also promotes urban sprawl and an increasing dependence on car use for travel and transportation. In this regard it is interesting to find that in Germany on average more than 60 per cent of the resources provided by the European Agricultural Fund for Rural Development (EAFRD) – a major building block of the shift of European development policies towards sustainability – are spent on issues other than improving the environment and the countryside[2] (see Table 2-3), such as improving the competitiveness of the agricultural and forestry sectors, improving the quality of life in rural areas and diversification of the rural economy, and LEADER that helps to implement local development strategies through public-private partnerships (Council of the European Union 2005).

[2] *Regarding land management, the support is to contribute to sustainable development by encouraging farmers and forest holders to employ methods of land use compatible with the need to preserve the natural environment and landscape and protect and improve natural resources. The main aspects to take into account include biodiversity, the management of Natura 2000 sites, water and soil protection and climate change mitigation. Against this backdrop, the Regulation provides, in particular, for support for mountain regions with natural handicaps and other disadvantaged areas (defined by the Member States on the basis of common objective criteria) and for agri-environmental or forest-environmental payments, which only cover commitments that go beyond the corresponding obligatory standards. Assistance also covers support for non-productive investments linked to the achievement of agri- or forest-environmental commitments or the achievement of other agri-environmental objectives, as well as measures aimed at improving forestry resources with an environmental objective (support for the first afforestation of agricultural land, establishment of agroforestry systems or restoring forestry potential and preventing natural disasters).*

Table 2-3: EAFRD resources spent on axis 2 "improving the environment and the countryside"

State	Population (Mio.)	Total EAFRD resources in million €	of which spent on axis 2 "improving the environment and the country-side" in million €	Axis 2 budget in per cent of total EAFRD resources	Axis 2 budget in € per capita
Baden-Wuerttemberg	10.775	1,789.6	1,054.1	58.9	97.8
Bavaria	12.546	3,501.9	2,069.6	59.1	165.0
Brandenburg and Berlin	5.973	1,385.0	428.0	30.9	71.6
Hamburg	1.790	71.3	11.3	15.9	6.3
Hesse	6.068	722.4	279.6	38.7	46.1
Mecklenburg-Western Pomerania	1.638	1,157.4	275.5	23.8	168.2
Lower Saxony and Bremen	8.461	2,125.6	410.2	19.3	48.5
North Rhine-Westphalia	17.836	803.5	434.7	54.1	24.4
Rhineland-Palatinate	4.000	677.9	261.7	38.6	65.4
Saarland	1.015	56.5	20.4	36.1	20.1
Saxony	4.141	1,206.4	383.6	31.8	92.6
Saxony Anhalt	2.327	1,323.5	309.7	23.4	133.1
Schleswig-Holstein	2.834	493.5	137.7	27.9	48.6
Thuringia	1.638	1,073.7	420.9	39.2	257.0
Germany	**81.042**	**16,388.2**	**6,496.9**	**39.6**	**80.2**

Source: Own compilation using data from Federal Office for Agriculture and Food (2009: 9)

2.3 Context: Biodiversity policy goals and key issues in Germany

Biodiversity is declining at an alarming rate world-wide and ultimately threatening the basis for human survival (Millennium Ecosystem Assessment 2005; TEEB 2010a). Noting that the challenge of halting biodiversity loss is highly complex and could not be solved by uncoordinated conservation efforts, the international community recognised the need for global cooperation. The result was the Convention on Biological Diversity (CBD), adopted in 1992 at the UN Conference on Environment and Development (UNCED) in Rio de Janeiro. Today, the Convention has 193 parties, including Germany.

Article 6 of the CBD requires each party to develop a National Biodiversity Strategy and Action Plan (NBSAP) for implementation of the Convention's objectives, to integrate the plan's objectives into sectoral policies and to report to other parties about related efforts, successes and failures. In 2007, the German federal government adopted a National Strategy on Biological Diversity to halt the loss of biodiversity in Germany and to reconcile protection with the interests of users (Federal Ministry for the Environment 2007). The strategy is based on the 1998 European Union's biodiversity strategy (European Commission 1998); with links to a number of related national sector strategies, inter alia Germany's National Sustainability Strategy (Bundesregierung 2002), the 'Agro-biodiversity'-Strategy and the Strategy on the conservation and sustainable use of biological diversity in Germany's forests now merged into a Strategy on the Conservation and Sustainable Use of Biodiversity for Food, Agriculture, Forestry and Fisheries of the German Federal Ministry of Food, Agriculture and Consumer Protection (2010) and Germany's National Strategy for the Sustainable Use and Protection of the Seas (Federal Ministry for the Environment 2008).

The National Strategy on Biological Diversity contains 16 indicators for monitoring current status and trends of biological diversity (see Figure 2-1 above for the indicator on species diversity and landscape

quality), roughly 330 objectives with timeframes and about 430 measures calling the various governmental and non-governmental actors to action. In its preamble ambitious aims are set for the strategy: it shall not only address all government institutions at federal, state and local governmental level, but also all societal players to mobilise and pool all forces with the aim of significantly minimising the threat to biological diversity in Germany (Federal Ministry for the Environment 2007: 7).

There are five main goals of the strategy, namely (1) biodiversity conservation, (2) its sustainable use, (3) reducing environmental pollution, (4) conservation as well as access and equitable sharing of benefits of genetic resources, and (5) raising social awareness for biodiversity conservation as one of the top priorities for society. Within the context of the POLICYMIX project to assess the role of economic instruments in policy mixes for biodiversity conservation and ecosystem services provision, some aims of the strategy are of particular relevance, see Table 2-4.

Table 2-4: Relevant goals and concrete aims of the German National Strategy on Biological Diversity

Main goal	Sub goal	Topic	Aim
B1) Conserving biodiversity	B1.1) Biodiversity	B1.1.1) Biodiversity as a whole	To halt the decline of biodiversity in Germany by 2010 (…). Thereafter, we hope to reserve the downward trend.
		B1.1.2) Species diversity	(…) (…) By 2020, species for which Germany has a particular conservation responsibility will have achieved viable population sizes. (…)
		B1.1.3) Diversity of habitats	By the year 2020, throughout 2 per cent of Germany's territory, Mother Nature is once again able to develop undisturbed in accordance with her own laws, and areas of wilderness are able to evolve. By 2010, Germany has a representative and functional system of interlinked biotopes covering 10 per cent of its territory. (…) By 2010, the development of the European Network Natura 2000 is complete. By 2020, a well-functioning management system for all large protected areas and Natura 2000 areas has been established.
	B1.2) Habitats	B1.2.1) Forests	By the year 2020, the conditions for typical biotic communities in forests have been further improved. (…) Semi-natural management forms use natural processes to strengthen the ecological functions. (…) By 2020, forests with natural forest development account for 5 per cent of the wooded area. (…)
	B1.3) Landscapes	B1.3.2) Cultivated landscapes	Through sustainable use, with due regard for the requirements of nature conservation and landscape management, the biological diversity of cultivated landscape will be increased by 2020 (…) Those German landscape which are deemed to be particularly worthy of preservation (…) will be maintained in perpetuity. The proportion of cultivated landscapes deemed particularly worthy of preservation will continue to increase.

Main goal	Sub goal	Topic	Aim
B2) The sustainable use of biodiversity	B2.2) Government as a role model		When drafting and amending statutory regulations, proper consideration is given to the conservation of biological diversity. Suitable areas of public land permanently exhibit a high diversity of near-natural habitats and species which are typical of the region. (…)
	B2.7) Land use for human settlement and transport		By the year 2020, the additional land used for human settlement and transport will be no more than 30 ha per day. Ideally, in the long term, the actual use of new land should be largely replaced by the reuse of existing land. (…)
	B2.8) Mobility		Impairments caused by traffic, e.g. as a result of pollutants, noise and light, will be continuously reduced (…) (…) By 2020, as a general rule, the existing transport routes will no longer cause any significant impairment to the system of interlinked biotopes. (…) The current proportion of undissected low-traffic areas of more than 100 km^2 will be retained.
B3) Environmental influences on biodiversity	B3.2) Climate Change		(…) By 2020, the natural storage capacity of land habitats for CO_2 (e.g. as a result of the re-watering and renaturation of peatlands and the increase in semi-natural forests) has increased by 10 per cent.
B5) Social awareness			In 2015, at least 75 per cent of the population will rate the conservation of biodiversity as one of the top priorities for society. The significance of biodiversity is firmly anchored in social consciousness. Human activity is increasingly tailored to this realisation, leading to a significant decline in the pressures on biodiversity.

Source: Own compilation based on Federal Ministry for the Environment (2007: 26-61)

From an instrument perspective it is interesting to note that the strategy places strong emphasis on regulatory instruments, i.e. protected areas like Natura 2000 and interlinkage between critical biotopes, and the well-functioning management of these sites and corridors. Another major focus is on stimulating sustainable use of ecosystems, i.e. cultivated landscapes used for agriculture and forestry, with a particular focus on the provision of habitats critical for the survival of endangered species or species for which Germany has a particular conservation responsibility. Although no explicit instruments are mentioned to strive towards sustainable usage, market-based instruments and payments for environmental services in particular may play an important role here.

From an actor point of view a key issue is the role and leadership of public actors. Not only shall public institutions at all levels in Germany be transparently committed to conservation and sustainable use of biological diversity and should act as a role model in every facet of their conduct (Federal Ministry for the Environment 2007: 44), but they should also protect suitable areas of public land for permanent protec-

tion (see sub-goal B2.2 above). The fact that land-use planning, and thus the decision about where new settlement and traffic areas to be placed and in what size, is a sovereign function of German states, regional and local level planning authorities underlines the importance of government action for achieving the goals of the strategy.

Nevertheless, the strategy also acknowledges the fact that due to the cross-cutting character of biodiversity and its conservation actions should not be limited to the environmental sector or the public realm, although these are the most important building blocks in implementing the strategy. Very recently, the Federal Ministry for the Environment launched a first of its kind-support programme to enhance implementation of the National Strategy on Biological Diversity and endowed it with an annual budget of € 15 million. Funding may be acquired by projects which exemplarily highlight ways of implementing the strategy's goals in one of these priority areas:

- species on Germany's protection responsibility,
- Hot Spots of biodiversity in Germany,
- safeguarding ecosystem service provision,
- other measures of significant importance for the strategy.

The first progress report on Germany's National Strategy is envisaged for spring 2013. At about the same time, Germany will launch its national follow up-study to the international TEEB-initiative that published its report suite between 2008 and 2012 (TEEB 2008, 2010a, b, 2011a, b, 2012). TEEB (The Economics of Ecosystems and Biodiversity) focusses on the economic importance of biodiversity and ecosystem services and the costs associated with biodiversity loss and ecosystem degradation. The German TEEB process entitled "Natural Capital Germany" will reflect the open architecture of the international initiative. Headed by study leader Bernd Hansjürgens, Natural Capital Germany will collect, review and synthesise the state of knowledge on biodiversity, ecosystem services and their importance for human well-being and economic growth at national and local scale in Germany. Its results will be published in four main reports with inputs from a broad range of contributors, including scientists as well as experts from public administrations, business and NGOs. Three of these reports will come with a thematic focus on the interface between biodiversity and ecosystem services and 1) climate change mitigation and adaptation, 2) rural development and nature conservation, and 3) public health and human well-being in urban agglomerations. A fourth report will focus on the challenges for mainstreaming biodiversity and ecosystem services into decision-making in Germany and highlight potential avenues for further developing public policies. The report suite will be completed by two short brochures, an introduction to Natural Capital Germany and another one on the opportunities for and responsibilities by businesses and enterprises.

Against this background, the German POLICYMIX case study can be seen as another effort to support the aims of the Strategy on Biological Diversity and to facilitate the national TEEB-process by contributing to a better understanding of the interaction of policy instruments for biodiversity conservation with a particular emphasis on the role of economic instruments. The second step of the POLICYMIX framework conducted in the next part of this report therefore takes a closer look at the existing range of instruments for biodiversity conservation and tries to identify potential room for improvement.

STEP 2: Identifying gaps and choosing instruments for analysis

3 Existing instruments for nature conservation in Germany

3.1 Regulatory instruments

Nature conservation has a long tradition in Germany dating back to the first half of the 19th century (Aßmann and Härdtle 2002). The most important legislative outputs at federal level are the Federal Nature Conservation Act, adopted in 1976 (Bundesnaturschutzgesetz – BNatSchG) and the Federal Species Conservation Act (Bundesartenschutzverordnung – BArtSchV). A reform of the Federal Nature Conservation Act was agreed by the German Bundestag on 19 June 2009 and came into effect on 1 March 2010. The new legislation intends to harmonise nature conservation laws nationwide. The objectives in the new Federal Act on Nature Conservation and Landscape Management are determined by three main aspects, 1) conserving biodiversity, 2) enhancing productivity and functionality of the ecosystem, and 3) safeguarding variety, singularity, beauty and recreational value of nature and landscapes. From a policy instrument perspective a divide between instruments primarily targeted at protecting habitats and instruments working towards species protection can be drawn, although very often these approaches overlap in target area, actors or activities addressed.

3.2 Nature conservation by land-use planning

The main regulatory instrument for nature protection is the designation and management of protected areas. Land-use planning and the designation of protected areas is a sovereign act of the German states and thus not uniformly organised throughout Germany (Koch and Hendler 2001). In most of the states, state level development plans are substantiated by regional development plans that determine scope and size of land-use activities and local development planning by the municipalities. At state or regional level land-use plans also encompass sectoral planning, such as planning for traffic infrastructure or mining as well as landscape planning. Landscape planning identifies issues of relevance to nature conservation and landscape management and incorporates them into regional planning and local land-use plans.

Several types of protected areas are defined by Germany's Federal Nature Conservation Act and are designated by land-use planning at state level. They can be classified by size, protection purpose and conservation objective, and by the resulting restrictions on land use. The main types are nature reserves, national parks, biosphere reserves, Natura 2000-sites, landscape reserves and nature parks. Two or more protected areas of different types can overlap or even cover the same area of land.

Nature conservation areas are among the oldest types of protected area in Germany. In a nature reserve, the intensive protection of nature and landscape takes precedence, as a matter of principle, over other forms of use. Any activity causing destruction or alteration in a nature reserve is prohibited. As per December 2005 nature reserves accounted for 3.5 per cent of Germany’s territory (Federal Agency for Nature Conservation 2012e).

National parks were first introduced into the Federal Nature Conservation Act in 1976. In a national park, the criteria defined for nature reserves must apply to the greater part of the area concerned. Germany currently has 14 national parks covering a total of 1,029,496 ha (Federal Agency for Nature Conservation 2012d).

Another category of conservation area, the biosphere reserve, was introduced in 1998 for natural regions which are particularly worthy of protection. At minimum, biosphere reserves must fulfil the criteria defined for landscape reserves and primarily serve to conserve, develop or restore a landscape characterised by traditional, varied use and the historical species and biotope diversity that has developed there (Deutsches

Nationalkomitee für das UNESCO Programm: Der Mensch und die Biosphäre 1996). They also serve as models for developing and testing sustainable management practices. The total area of all 16 biosphere reserves in Germany is 1,846,904 ha. Excluding North Sea and Baltic marine and mudflat areas (534,646 ha), this represents 3.7 per cent of German territory (Federal Agency for Nature Conservation 2012a).

Natura 2000 areas reported to the European Commission accounted for 14.1 per cent of Germany's territory in 2007 (Federal Ministry for the Environment 2007: 127). The Natura 2000-network mainly comprises broad leaf and mixed forests (33.1 per cent), arable land and vine stocks (21.4 per cent), coniferous forests (18.2 per cent) and pastures (17.8 per cent), whereas inland waters only account for 4 per cent of all sites (Raths et al. 2006: 75). Gaps in the representativeness of the network exist for water bodies and rivers, grassland ecosystems and forests as well as fish and bat species (Ssymank et al. 2003; Steer et al. 2008).

Landscape protection areas, like nature reserves, have a long tradition in Germany. However, landscape reserves are not primarily intended to protect an untouched natural environment but focus instead on protecting cultural landscapes that are subject to human use. They aim to preserve and develop these landscapes specifically in relation to their functions of benefit to people, including their role in recreation. Germany currently has 7,409 landscape reserves covering a total of 10.2 million ha, or some 28.5 per cent of the country's land surface. This percentage is exceeded in the states (Länder) of North Rhine-Westphalia, Saarland and Brandenburg. Forest regions in Lower Saxony, North Rhine-Westphalia, Thuringia and Bavaria in particular tend to be designated as landscape reserves (Federal Agency for Nature Conservation 2012b).

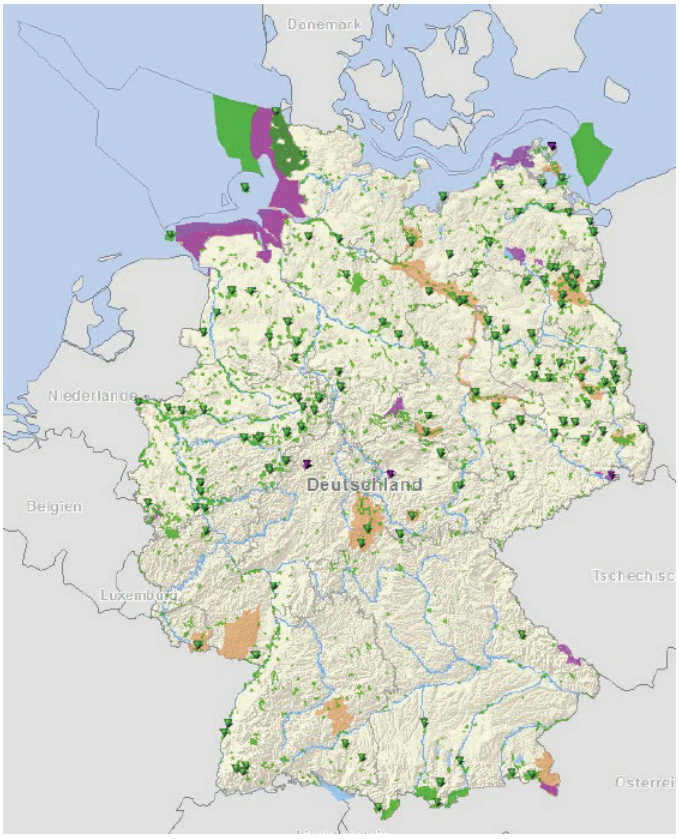

Figure 3-1: *National parks (purple), biosphere reserves (orange) and nature reserves (green) in Germany*
Source: Federal Agency for Nature Conservation (2012e)

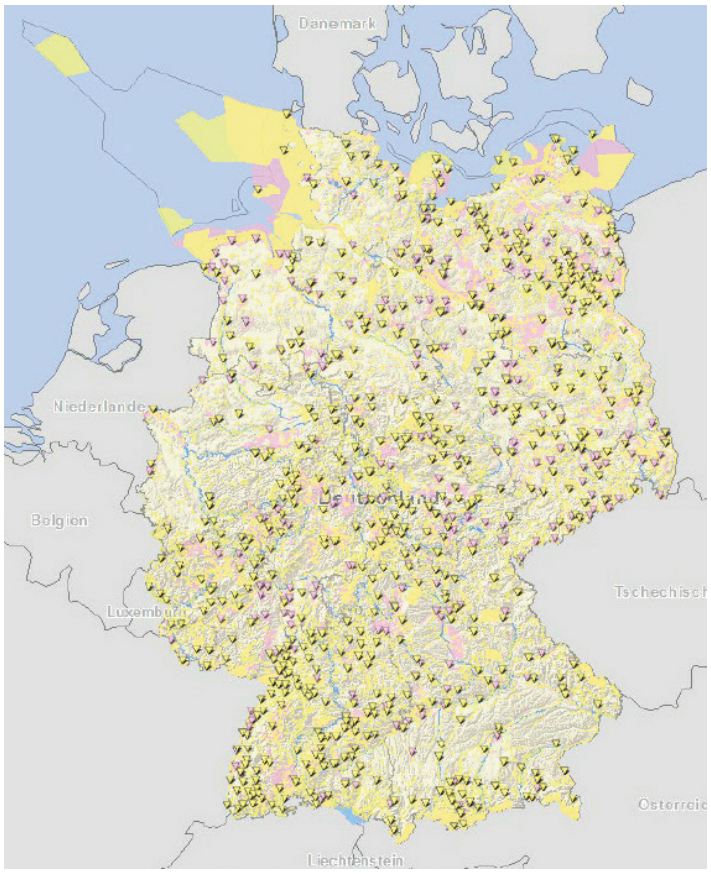

Figure 3-2: Natura 2000-areas in Germany
Source: Federal Agency for Nature Conservation (2012e)

Nature parks cover a wide area and are particularly suitable for recreational purposes because of their landscape and natural assets. Very popular with the public, the nature parks epitomise the concept of combining nature conservation with outdoor recreation. Nature parks are zoned, which allows managing visitor flows while preserving the quiet zones that are especially important for nature conservation. With a total area of 9.5 million ha, nature parks cover 27 per cent of Germany's land surface. The share of land covered by nature parks increased by 33 per cent (about 2.4 million ha) between 1998 and 2010. Protected areas account for some 56 per cent of land within nature parks. Nature conservation areas account for about 5 per cent of land in nature parks in Germany (Federal Agency for Nature Conservation 2012f).

3.2.1 Species conservation

The protection of endangered plant and animal species is one of the oldest and most important endeavours in nature conservation. These species face many different threats: the habitat loss resulting from intensive human use or the growing pressure from introduced alien species. The reform of the Federal Nature Conservation Act in 2009 introduced a number of provisions into Germany‘s species protection law. Uniform legislation to protect all wild animal and plant species is now established at federal level, in part for the first time. It includes various prohibitions aimed at protecting sites that regularly provide habitats for a wide range of species.

Another new feature of the legislation is the power to issue statutory ordinances which would enable naturally occurring species in Germany to be granted special protected status if their populations are endangered and their main distribution area is Germany, giving rise to a national responsibility to protect

them. In terms of the protection afforded to them, these species would have equal status to the species covered by the Birds and Habitats Directives (Federal Ministry For The Environment 2010b).

The Federal Nature Conservation Act also contains provisions on the control of invasive species. At present, around a dozen animal species and some 30 plant species are classified as invasive in Germany. The on-going process of climate change is likely to exacerbate the problem of invasive species in Germany. The new provisions envisage a step-by-step approach, ranging from monitoring of neophyte species to the removal and control of invasive species and mitigation of impacts associated with their spread (Federal Ministry For The Environment 2010b).

3.3 Economic instruments

3.3.1 Agri-environmental schemes

Starting with the EU agricultural reform in 1992, environment-related subsidies for agriculture have been systematically expanded and developed into the current agri-environmental measures as part of the policy for developing agriculture and rural areas. By converting the former production- and product-related subsidies for farmers in Germany into land-related subsidies and linking these payments to compliance with defined environmental protection (cross compliance), incentives for the conservation and sustainable use of biological diversity have been significantly enhanced. In order to encourage farmers to provide environmental services beyond following good agricultural practice and basic legal standards a specific axis of the Rural Development policy for the period 2007-2013 has been established by the EU. Aids may be paid to farmers who sign up voluntarily to agri-environment commitments for a minimum period of five years. Longer periods may be set for certain types of commitment, depending on their environmental effects (European Commission 2010).

Moreover, a national programme for Germany (adopted in 1999) for the conservation and sustainable use of genetic resources for food, agriculture, forestry and fishing has also been developed, comprising a number of specialist programmes on the individual sub-aspects of genetic resources, together with a sectoral strategy on 'Forestry and biological diversity' (adopted in 2000) (Federal Ministry for the Environment 2007). There are several financial programmes targeted at forest ecosystems in particular, such as grants for environmentally friendly forest management, enhancement of storm protection, or afforestation accounting for more than € 67 million in 2006 (Federal Office for Agriculture and Food: 69).

3.3.2 Nature conservation support programmes

Though since the end of the 1980's the variety and funds of incentive-based instruments for nature conservation are growing, they are still of minor importance compared to the impact of regulatory instruments. By now, different types of financial support programmes exist that differ in regard to activities supported, the source of funding as well as the potential addressees of funding. The following paragraphs will summarise the main approaches.

At EU level, specific nature conservation activities that are of importance to the EU's conservation goals may apply for funding via the LIFE+ support programme. Since the launch of the LIFE programme by the European Commission in 1992, a total of 297 projects have been co-financed in Germany. Of these, 187 focused on environmental innovation, 104 on nature conservation, three on capacity building and three on information and communication. These projects represent a total investment of € 686.3 million, of which € 255.4 million has been contributed by the European Union (European Commission 2011).

Since 1987, the German Federal Ministry for the Environment, Nature Conservation and Nuclear supports Testing and Development Projects in Nature Conservation and Landscape Management to demonstrate

government conservation policy ideas and fine-tune them in the field to improve the basis for future decision making. Testing and Development Projects are intended to help maintain biodiversity with a special emphasis combining conservation and use aspects. They aim to implement key research findings, test new and improved applications of already proven methods and bring together the experience gained (successes and failures) and produce generally applicable recommendations (Federal Agency for Nature Conservation 2012g).

For some important large-scale nature conservation and riparian zone projects German states receive direct financial support from the federal government. The federal government assumes up to 75 per cent of the overall costs, while states usually pick up 15 per cent and project sponsors (district authorities, self-governing corporations set up by a group of local authorities) and registered associations the remaining 10 per cent. Selection of large-scale conservation projects is based on criteria covering representativeness, size, near-natural conditions, threat status, and best-practice model potential. Large-scale nature conservation projects differ from other nature conservation activities on grounds of their complexity and the size of the area involved. Funding is largely used to purchase land or enter into long-term leases, pay compensation and to cover the costs of management and development planning (including socio-economic studies and, where necessary, mediation), habitat-structuring measures, staffing and materials, project-related information activities and project evaluation (Federal Agency for Nature Conservation 2012c).

3.4 Addressing public actors: the gap for ecological fiscal transfers

Although the instrument box for biodiversity conservation seems to be well equipped (see table 3-1), sufficient funding of nature conservation activities is still lacking and drivers of biodiversity loss and ecosystem degradation are persistent and often further spurred by other sectoral policies (see section 2-2 above). In order to secure biodiversity conservation as a relevant and important public function as well as to provide adequate funding, Ecological Fiscal Transfers (EFT), i.e. integrating ecological indicators into existing intergovernmental distribution scheme, is a promising avenue to explore.

Whilst the significance of socio-economic functions has a comparably long tradition in federal systems, the respective consideration of ecological functions is still waiting to be fully realised (Ring 2002). Ecological public functions consist of the protection and sustainable use of natural resources, living organisms, ecosystems and landscapes. These precautionary-type functions also comprise activities aiming at the conservation of nature as a sound living basis for human life, including recreational purposes. Furthermore, ecological public functions address negative effects of human activities on the environment, including environmental pollution in the form of emissions, waste and contaminated sites, but also impaired or destroyed landscapes (Ring 2002).

International experience has shown that ecological fiscal transfers for nature conservation usually build on direct regulation for nature and biodiversity conservation. This is due to the fact that designated protected areas within a certain jurisdiction represent an easily available indicator to be included into relevant intergovernmental fiscal relations. In this way, existing regulatory arrangements are complemented by an economic instrument that compensates lower-level governments for the decentralised costs of providing conservation services related with spillover benefits beyond their own boundaries. Through ecological fiscal transfers a financing gap is closed accounting for the provision of nature-related services of public actors at lower levels of government. In this way, ecological fiscal transfers to public actors complement payments for ecosystem services that mostly address land users and thus local private actors (Ring 2008b; Ring et al. 2011).

Table 3-1: Instruments for biodiversity conservation in Germany

Actors addressed		Regulatory Instruments	Incentive-based approaches
Public	Federal	• Federal Nature Conservation Act • Federal Species Conservation Act	
	States	• State and Regional Development Plans • Landscape Planning • Offsetting	• Life+ • Testing and Development projects in nature conservation • Funding for large-scale nature conservation areas • Ecological Fiscal Transfers at state level
	Municipalities	• Local land-use planning • Green area planning • Offsetting	• Conservation support programmes • Ecological Fiscal Transfers at municipal level
Private		• Federal Nature Conservation Act • Federal Species Conservation Act • Local land-use planning • Offsets	• Agri-environmental schemes • Conservation support programmes

Source: Own compilation

Ecological fiscal transfers from federal to state and from state to local governmental levels have been discussed for more than a decade in Germany (SRU 1996; Ring 2002; Unnerstall 2004; Perner & Thöne 2005; Czybulka and Luttmann 2005; Ring 2008b). However, so far proposals for introducing ecological fiscal transfers at state level are missing. Thus the following section 4 takes a closer look at the status quo of fiscal transfers in Germany and explores options where to integrate ecological indicators in order to improve incentives for public actors to engage in nature conservation activities and to provide the funds necessary for biodiversity conservation.

4 Ecological fiscal transfers in Germany – Status quo and perspectives

4.1 Intergovernmental fiscal relations in Germany

Germany is a federal state comprising 16 states (among them the 3 city-states Berlin, Hamburg and Bremen), the so-called Länder (Preamble and Art. 20 I German Constitution, also called Basic Law) and the municipalities (Art. 28 II German Constitution). According to Article 72 et seq. of the German Constitution the federal level has comprehensive legislative powers by which it can create a unified legal framework in many fields of law. The Länder are responsible for the execution and implementation of federal laws (Art. 83 German Constitution), some of the tasks are further devolved to the municipalities. However, the federal level has a direct right of implementing and enforcing regulation only in fields covered by Articles 87 to 90 of the German Constitution. Besides, there are also some joint tasks of the Federation and the states (Art. 91a and 91b German Constitution) (see also 5.2).

The federal distribution of responsibilities and legislative powers between the federal, state and municipal level requires an appropriate fiscal distribution of public revenues. Intergovernmental fiscal relations are

regulated through the German Constitution. According to Article 104a I and V of the German Constitution the Federation and the German states shall principally cover the expenditures resulting from the discharge of their responsibilities and authorities. For current fiscal relations between the federal and the state level (Länder) the Standards Act (Maßstäbegesetz) and the Financial Equalisation Act (Finanzausgleichsgesetz) as of 2001 are applied. In addition, there are intergovernmental fiscal relations within the German states (except the city-states) that are regulated in 13 different fiscal equalisation laws to the local level. The latter cover intergovernmental fiscal transfers from the states to the local governmental level, consisting of municipalities, cities and districts.

The fiscal equalisation between federal level and the German states contains four stages at two levels (see Figure 4-1). The primary level distinguishes between the distribution of tax revenues between the Federal Government and the states and the distribution among the states themselves (vertical and horizontal primary tax distribution). At the secondary level two compensation mechanisms are provided according to Article 107 II of the German Constitution which take the overall fiscal capacity of the states into account, namely the fiscal equalisation among the states and supplementary federal grants. The fiscal equalisation is characterised by the two main principles of financial autonomy and of financial solidarity (Hidien 1999: 34; Korioth 1997: 92 et seq.).

The procedural regulations of intergovernmental fiscal relations between the Federation and the German states covering the two levels and four stages can be described in more detail as follows (Federal Ministry of Finance 2010; Federal Ministry of Finance 2012).

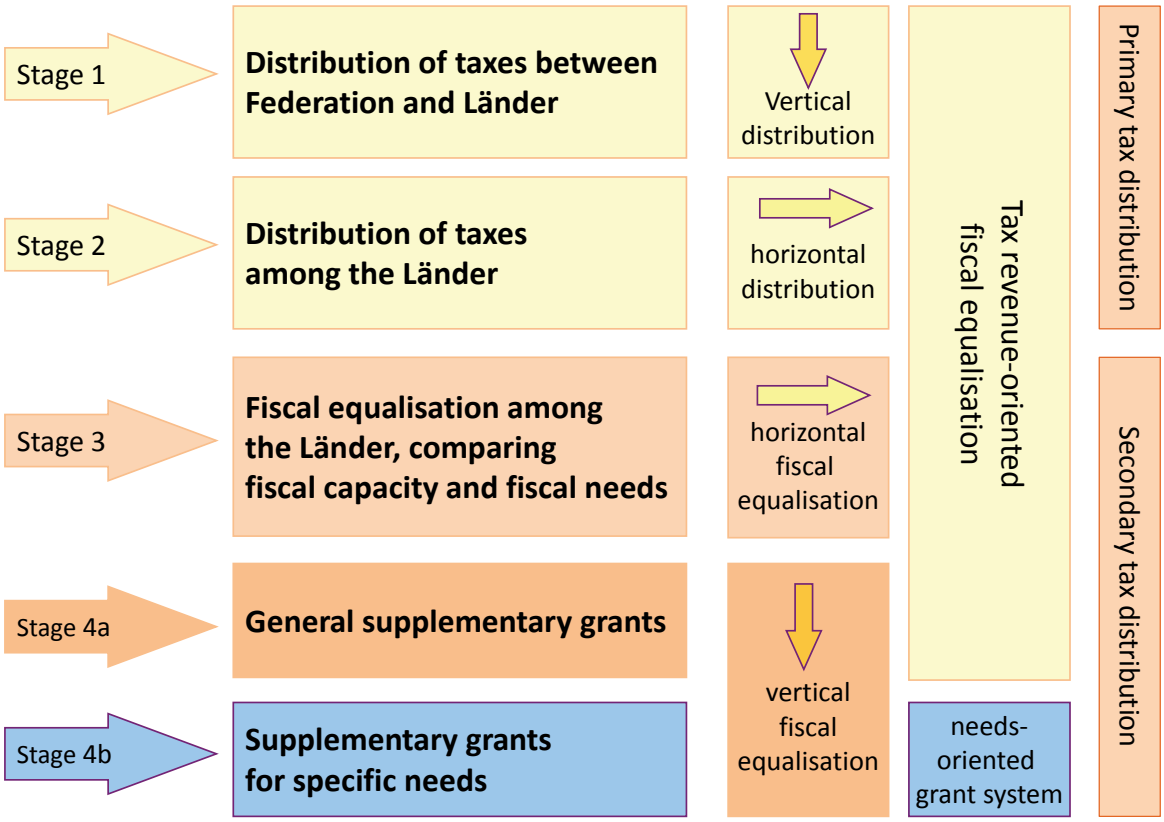

Figure 4-1: Intergovernmental fiscal equalisation in Germany
Source: own representation

4.1.1 Primary distribution of tax revenue

1. First, the overall tax revenue is distributed to the two levels of government – namely the Fedtion a the German states, while the municipalities receive a supplementary grant of revenue (vertical distribution).
2. Next, the total state part of the tax revenue is distributed among the various states (horizontal distribution). In this second phase, all taxes except the value-added tax (VAT) are distributed according the derivation principle: the German states receive the tax revenues collected within their territory. Regarding the VAT, at least 75 per cent of the state's VAT portion is distributed according to the state's population number, and up to 25 per cent are distributed as so-called supplementary portions to those states whose revenues from income tax, corporation tax and land taxes per capita are lower than the per capita average of all the states. This already closes part of the gap between the tax revenue of the fiscally weak states and the average of all states.

4.1.2 Secondary distribution of tax revenue

3. In a third stage, there is horizontal fiscal equalisation between poor Länder and rich Länder as regulated in the Basic Law, the Financial Equalisation Act and the Standards Act (fiscal equalisation among the Länder). Poor Länder receive adjustment payments which are funded by the wealthy states. The adjustment payment a Land receives or has to pay depends on the cover ratio of its fiscal capacity and needs. Fiscal capacity includes the sum of public revenue at the Länder level (Länder share of joint taxes and tax revenues of the Länder) and 64 per cent of the sum of municipal tax revenues. It is principally assumed that fiscal needs per inhabitant are the same in all Länder. Therefore the population number is the abstract indicator for calculating fiscal needs of each of the Länder. However, two exemptions are applied: Firstly, for the city-states Berlin, Bremen and Hamburg (being cities and Länder at the same time) the population number is fictitiously increased by 35 per cent due to higher financial requirements per inhabitant than the normal Länder. Secondly, the three sparsely populated Länder of Brandenburg, Mecklenburg-Western Pomerania and Saxony-Anhalt also have been recently acknowledged to have slightly higher fiscal needs, and their population number is virtually increased by 3, 5 and 2 per cent respectively. The exact size of adjustment payments of a Land depends on the amount by which its fiscal capacity per fictitious inhabitant falls below the average or exceeds the average fiscal capacity per inhabitant. Linear-progressive topping-up or skimming-off schedules are used to calculate the differences from the average and determine what poor Länder receive and rich Länder have to pay.
4. In addition, poor Länder also receive funds from the Federation (supplementary federal grants). These grants consist of general supplementary federal grants on the one hand and supplementary grants for specific needs on the other. General supplementary federal grants further reduce the gap between the average fiscal capacity per (fictitious) inhabitant and that of poor Länder still remaining after stage 3. If fiscal capacity of a poor Land is still less than 99.5 per cent below average, the shortfall is made up proportionally by 77.5 per cent. Supplementary federal grants for special needs compensate individual poor Länder for special burdens. For example, the eastern German Länder and Berlin receive, based on the Solidarity Pact II, special-need supplementary federal grants until the year 2019 to build up their infrastructure.

In a wider sense, all these stages together represent the intergovernmental fiscal relations or "fiscal equalisation" between the federal and the Länder level in Germany. In a narrow sense, horizontal fiscal equalisation among the Länder is related to stage 3 only (regulated), where fiscal capacities and fiscal needs are compared to determine the exact amount a rich Land has to pay (currently Baden-Württemberg, Bavaria and Hesse) and a poor Land receives (all remaining Länder). The German Constitution prescribes that the fiscal capacity per capita needs to be safeguarded for all phases including stage 4a

(Figure 4-1), the distribution of general supplementary grants. This means that the sequence from the richest to the poorest Land in terms of tax revenue per capita is not allowed to change by any redistribution or equalisation mechanism including this stage.

4.2 The role of ecological public functions in intergovernmental fiscal relations

Intergovernmental fiscal transfers play an important role in regional and local development by way of securing financial resources to state and local governments to execute their various public functions. Sustainable development in the long term requires the acknowledgement and financing of economic and social, but also ecological public functions at relevant governmental levels in federal systems. Whereas the German Länder on the one hand and the districts and municipalities on the other are responsible for numerous public functions related to nature and biodiversity conservation, appropriate indicators to consider these ecological functions in fiscal relations are almost completely missing (Ring 2002). Even when conservation tasks are among the tasks explicitly mentioned for certain fiscal transfers from the state to the local level, the amount of transfers may still depend on an abstract, partially weighted population indicator. This is the case, for example, in Saxony, where municipalities receive lump-sum transfers for general needs (Bedarfszuweisungen) for public functions to be executed by the state level that have been delegated to the local level. Although the Saxon Ministry of Finance mentions conservation tasks among the tasks delegated to the local level, these transfers for general needs are only calculated based on an abstract population-related indicator. Population numbers may well be correlated with a number of public services, but certainly not with conservation-related tasks of local governments.

Following the general decentralisation rule for the allocation function of public services (Musgrave 1959; Oates 1972), lower levels of government should be assigned the task of providing public goods and services. As long as ecological characteristics (e.g., the mobility of environmental media) or economies of scale do not suggest the provision at a more cost-efficient centralised level, ecological public goods and services should also be provided as decentralised as possible (Ring 2002). Hence, the subnational levels of the states (or Länder in Germany) and the local governments play an important role in federal systems for the achievement and implementation of environmental and conservation objectives.

However, a considerable number of these tasks are associated with spatial externalities or spillover effects: The costs of providing ecological goods and services mainly accrue at the level of the Länder or municipalities, whereas conservation benefits may reach far beyond municipal or state boundaries. The principle of fiscal equivalence is violated that advocates achieving a "match between those who receive the benefits of a collective good and those who pay for it" (Olson 1969). Without adequate solutions, e.g., at least the compensation of part of the costs accruing to local and state public actors, the relevant public goods and services will be underprovided (for nature conservation, see for example: Bergmann 1999; Perrings und Gadgil 2003; Ring 2004). The practical consequences of such spatial externalities have been empirically investigated by List et al. (2002) for species protection in the United States. In their study of federal and state spending under the Endangered Species Act in the US, they identified the phenomenon of free riding on the part of the states. States tend to spend less (relative to the federal government) on those species that demand a large habitat area and whose preservation causes conflicts with economic development.

Although developed for other public goods, such as education, a solution to this kind of problem has already been suggested by Olson (1969). Provided diseconomies of large-scale operation call for decentralised provision, spillover externalities should be internalised through government grants from more centralised levels, compensating decentralised governments for the external benefits of their expenditures. The principle idea of using intergovernmental fiscal relations for this kind of problem in environment and conservation policies has been picked up by a number of authors (e.g., Ewers et al. 1997; Köllner et al. 2002; Ring 2002, 2008a, b; Kumar and Managi 2009).

4.3 International experience

Since the early 1990s, Brazilian states have been the first globally to introduce the so-called "ICMS Ecológico", a fiscal instrument considering ecological indicators for the distribution of state-level VAT to municipalities. Next to the already existing economic and social indicators, an increasing number of states also acknowledges protected areas, water protection zones and further environmental indicators to allocate intergovernmental fiscal transfers from the state to the local level (May et al. 2002; Ring 2008a; Ring et al. 2011). In Europe, Portugal is the first EU member state to consider Natura 2000 and further national conservation areas as indicators to distribute fiscal transfers from the national to the local level (Santos et al. 2012). This change has been realised through the New Portuguese Local Finances Law as of 2007 that introduced an article on sustainable development and the necessary arrangements to include conservation areas as an indicator next to the general area indicator. France also knows regular fiscal transfers to municipalities that partly or fully lie within national parks or similar strictly protected areas (Borie et al. 2012). In Poland, a group of mayors from over 100 municipalities advocate a reform of intergovernmental fiscal relations to compensate municipalities for additional financial requirements in relation to conservation tasks. In the context of the implementation of the Natura 2000 network, municipalities had to take over new tasks in the management of these protected areas without being assigned the necessary financial resources to actually fulfil these tasks (Grodzinska-Jurczak and Cent 2011). In Norway, distribution factors to compensate municipalities for additional expenditures on nature conservation have been subject to a preliminary evaluation (Håkonsen 2009; Håkonsen and Lunder 2009).

4.4 Ecological fiscal transfers in Germany

In Germany, the Advisory Council on the Environment has long suggested the integration of nature conservation into communal fiscal transfer systems (Bauer et al. 1996; SRU 1996; Ewers et al. 1997). As part of the different fiscal equalisation laws at the local level, ecological public functions are mainly considered in the form of specific purpose transfers, with the dominance of end-of-the-pipe-related public functions (sewage or waste disposal) (Ring 2001, 2002, 2008b). Long-term and precautionary public functions concerning nature or resource conservation are still widely missing. In the meanwhile a number of academic publications do exist in Germany that discuss the integration of nature conservation into communal fiscal equalisation, develop concrete proposals to consider appropriate indicators and model the consequences for selected German Länder (Bauer et al. 1996; SRU 1996; Rose 1999; Ring 2001; Perner and Thöne 2005; Schröter and Ring 2006; Ring 2008b).

Investigations to consider nature conservation and environment-related public functions in fiscal equalisation between the federal and the Länder level are much scarcer (Seitz 2001; Czybulka und Luttmann 2005). Czybulka and Luttmann (2005) rightly stress that an ecological reform of state-communal fiscal relations cannot be thought without an ecological reform of fiscal equalisation between the federal and the Länder level in Germany. Only at the level of fiscal equalisation among the Länder "the additional financial requirements of those Länder can be absorbed that are endowed with above-average natural capital worth to be protected" (Czybulka and Luttmann 2005: 79f.). Fiscally weak and less densely populated Länder such as Mecklenburg-Western Pomerania, being endowed with above-average designated protected areas in comparison to the Länder average, contribute significantly to achieving national and international conservation and biodiversity objectives. Although it is now acknowledged that such states have comparatively higher financial requirements per capita due to low population densities (through the so-called "Dünnsiedelfaktor"), the special financial requirements due to ecological public functions are still not considered.

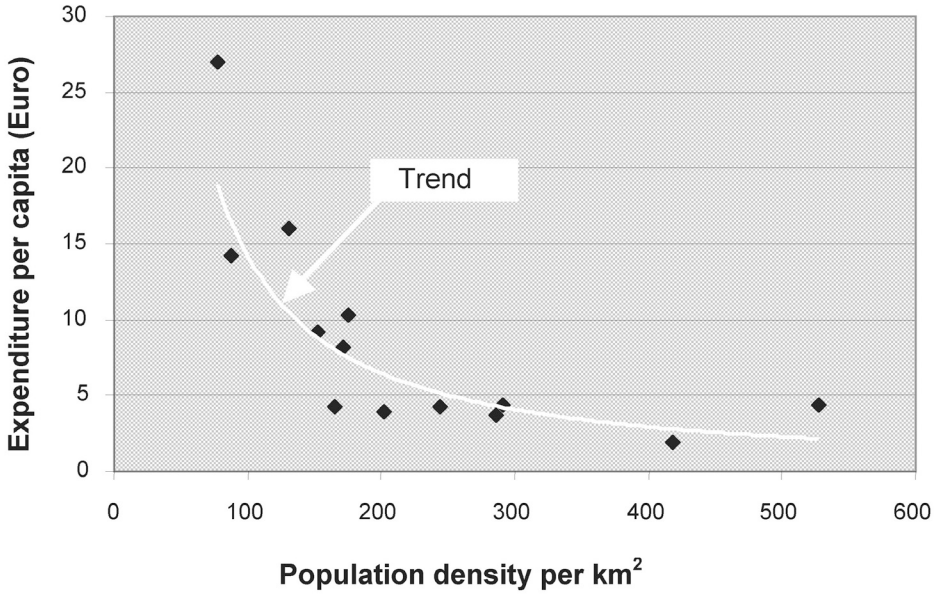

Figure 4-2: Conservation expenditures per capita of German Länder in 2001
Source: Ring (2008c) based on data from Bundesamt für Naturschutz, dept. II, 1 Jan. 2004; data: Stratmann 2002

However, as Figure 4-2 shows, also the costs of biodiversity conservation are distributed unequally among the Länder (Ring 2008c). First, we will consider public expenditures for nature conservation in relation to population density. Empirical data for the various German Länder indicate that states with a lower population density bear the highest expenditures per capita (Ring 2004). This is related to the fact that nature conservation normally takes place 'in space'. The conservation value of landscapes often increases in remote and less inhabited areas where numerous large-scale reserves can be found.

Second, the unequal distribution of conservation costs also concerns the spatial distribution of nature reserves and related costs across the Länder. These costs not only include measures for the conservation and sustainable use of biodiversity, but also the costs of long-term land-use restrictions to be borne by communities. Depending on the protection category, local land-use planning can be heavily restricted. The lowest protection category of landscape reserves is still quite homogeneously distributed across the German states. However, there is an increasing concentration of protected areas for the categories of nature reserves, biosphere reserves, nature parks, and national parks. Three out of 16 states (Mecklenburg-Western Pomerania, Lower Saxony, and Schleswig-Holstein) hold 90 per cent of all German national park areas (Urfei 2002).

Despite the unequal distribution of conservation costs across German Länder, financial requirements considered in the existing transfer scheme are based on the number of inhabitants. But the required resources to well manage conservation areas are at best incidentally related the number of inhabitants in a state. Therefore, the objective of the subsequent chapters is 1) to provide legal options and constraints for their consideration, 2) to develop appropriate ecological indicators for inclusion into intergovernmental fiscal relations between the federal and the Länder level in Germany, and 3) to carry out an ex ante scenario analysis to model the distributive consequences of considering a variety of different conservation-related indicators in German fiscal equalisation.

STEP 3: Policy evaluation and design

5 Legal options and constraints for ecological fiscal transfers in Germany[3]

5.1 The possibilities of considering ecological concerns in the fiscal equalisation scheme

Following Article 20a of the German Constitution, federal level, Länder and municipalities are obliged to protect the natural resources as well as animals. According to the Federal Nature Conservation Act the protection of nature and landscape is a compulsory task of the Länder which have to fulfil it on their own responsibility (Art. 83 German Constitution). Germany on the other hand is obliged to comply with European nature conservation law, especially the Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EEC), to adopt protection measures and designate nature reserves (Natura 2000-sites). Furthermore the European legislation on water protection, based on the EU Water Framework Directive, demands that water bodies have to be brought to a good ecological status. Germany has devolved most of the European tasks to the Länder (cf. §§ 32-36, 44-45 Federal Nature Conservation Act, § 27 Federal Water Act). Still these public functions keep their national and European importance. At Länder level, the protection of nature and landscape gained different significance depending on natural characteristics and political orientation of the government.

5.1.1 Primary vertical and horizontal distribution

Both the vertical and horizontal tax distribution at the primary level (stages 1 and 2 of Figure 4-1) are only of limited suitability for the integration of ecological indicators into the fiscal equalisation mechanism. While Articles 106 III and 107 I of the German Constitution grant the legislator scope for decision-making regarding the vertical distribution of the value-added tax between federal level and Länder (stage 1), its primary target is to ensure that all Länder get the funds necessary to fulfil their public functions. Concerning the horizontal distribution between the Länder (stage 2), up to 25 per cent of the revenues of the value-added tax can be used to support Länder with below average public revenues per capita. However, environmental and nature conservation issues cannot be considered without an amendment of the German Constitution, making them less feasible for implementation. A more promising avenue might be to integrate ecological indicators at the horizontal equalisation among the Länder on the secondary level, covered in the next section.

5.1.2 Fiscal equalisation among the Länder

The horizontal fiscal equalisation among the Länder (Länderfinanzausgleich) amends the primary tax revenue distribution on a third stage (Figure 4-1). Article 107 II 1 of the German Constitution requires that disparate fiscal capacities among the Länder have to be equalised. This requirement of equality is restricted to the effect that only 'a reasonable equalisation' is permissible which ensures that Länder have the funds necessary to fulfil their constitutionally assigned duties (Federal Constitutional Court law reports 72: 330 (400)). The equalisation should maintain the fiscal autonomy and sovereignty of the Länder and their autonomous competence to fulfil duties without completely levelling the differences among the Länder or changing the order of their fiscal capacity (cf. Federal Constitutional Court law reports 1: 117 (131); 72: 330 (383, 386f., 397ff.); 101: 158 (222); Kirchhof 1982: 9f.; Hidien 1999: 33ff.; Korioth 1997: 116ff.). Ac-

[3] *This is an excerpt of a broader in-depth analysis of the legal options and constraints for introducing ecological fiscal transfers among the German Länder. The full text is published in German language in Möckel (2013, in press).*

cording to the Federal Constitutional Court and the prevailing opinion Article 107 II 1 of the German Constitution allows only equalising fiscal capacities and not fiscal needs (Federal Constitutional Court law reports 86: 148 (223); Sachs 2009, Art. 107 m.n. 27 et seq.; von Münch 1996, Art. 107 m.n. 15b, 16). Fiscal needs can only be included in the fiscal equalisation among the Länder in case they are not based on concrete special needs, but increase the abstract fiscal needs. For special needs supplementary federal grants are more suitable.

Abstract fiscal needs are only those needs which occur in all Länder because of constitutional task fulfilment and structurally given features and which can be generally illustrated on the basis of generally-abstract, politically non-influenceable features (cf. Hidien 1999: 131ff.; Ossenbühl 1984: 55f.; Korioth 1997: 579 et seq., 585 et seq.). In Germany the number of inhabitants has been established as the standard indicator of comparison, legally recognised both in the German constitution (Article 107 I GG) and by the Federal Constitutional Court (law reports 86: 148 (238 et seq.); 72: 330 (400 et seq.); 101: 158 (223, 228 et seq.).

However, the Federal Constitutional Court has considered it legally permissible to modify the inhabitant indicator if – because of given structural characteristics of the Länder – no reasonable equalisation will be achieved (Federal Constitutional Court law reports 101: 158 (223, 230 et seq.); 86: 148 (239); 72: 330 (400 et seq.); approving: P. Selmer 1993: 11 (49); von Münch 1996, GG, Bd. 3, Art. 107 m.n. 16; Dolzer et al. 2011, Art. 107 m.n. 158, 163; restrictive Hidien 1999: 192 et seq., 198f.; Korioth 1997: 605 et seq.). According to the Federal Constitutional Court admissible structural characteristics are differences in population density either well beyond (like in the city-states of Hamburg, Berlin und Bremen) or below (in states like Mecklenburg-Western Pomerania, Brandenburg or Saxony-Anhalt) the federal average (Federal Constitutional Court law reports 101: 158 (223, 230f.); 86: 148 (236)). The modifications of the inhabitant factor which have been accepted and partly considered as required by the Federal Constitutional Court equalise relevant differences among the Länder.

One important influencing factor of the fiscal capacities and the abstract fiscal needs is the area of the Länder. A substantial part of the revenues are directly (land tax, real estate acquisition tax, revenues from public forests) resp. indirectly (incomes of private farmers, forest managers and fishermen, incomes from lease of property) related to the area of the Land. Furthermore parts of public spending depend on the size of the Land. Admittedly important site-specific infrastructure spending (highways, railway lines, waterways) are funded by the federal government. But according to Articles 83, 104a I German Constitution the Länder are organisationally and financially responsible for site-specific environmental protection. Especially sparsely populated Länder with little population-related revenues usually have many protected areas and surface waters and consequently outstanding expenditures on site-specific environmental protection per inhabitant (Marggraf 2003: 145, 149 et seq.; Czybulka, Luttmann 2005: 79). In the context of fiscal equalisation to the local level, area has been identified as a first, although indirect, indicator to represent fiscal needs related to ecological public functions (Ring 2001).

The search for appropriate indicators which fulfil the requirements on abstractness, generality and political non-controllability is difficult. For example, the designation of national protection areas (nature, water and forest reserves) and the measures to achieve the goals of the EU Water Framework Directive (WFD) are at the discretion of political decision-makers or authorities and are thus politically influenceable. Natura 2000 sites on the other hand can because of European requirements only be determined and designated according to specific criteria with regard to nature conservation. Currently, Natura 2000 sites cover 15.4 per cent of Germany's terrestrial territory. However at state level, the share of Natura 2000 sites on the total area varies +/- 10 per cent, leading to substantial differences regarding fiscal capacities and fiscal needs of the Länder.

Likewise abstract, general and hardly politically influenceable are the indicators of the German Sustainability Strategy (Bundesregierung 2002: 89 et seq.; Bundesregierung 2008: 39 et seq.). The sustainability indicators are legally qualified indicators for abstract fiscal needs of the Länder. They can complement the total population-indicator. When including environmental indicators the requirements for fiscal equalisation apply, namely the prohibition of levelling and alterations of the order of the fiscal capacity per capita of the Länder.

5.1.3 Secondary vertical distribution (supplementary federal grants)

On the fourth and last level of the fiscal equalisation Article 107 II 3 of the German Constitution regulates that the Federation provides grants to financially weak Länder from his own funds to assist them in meeting their general fiscal needs (supplementary federal grants). The Federal Constitutional Court has acknowledged the general supplementary federal grants and the special needs grants which have different functions in its decisions concerning fiscal equalisation. The ecological increased demand regarding Natura 2000 sites, sustainability efforts and the improvement of species and landscape quality constitutes as already explained basically fiscal needs which can be equated from the Federation by supplementary federal grants. Still the general supplementary federal grants are subject to the same precepts as the fiscal equalisation among the Länder. The ecological increased demand can also be seen and quantified as a concrete special need when taking the actual expenditures of the single Länder as a basis. The Federation is allowed to fund also tasks with special needs grants which are no objective and abstract fiscal needs with regard to the fiscal equalisation among the Länder because of political scopes for decision-making and administrative discretion. The prohibition of leveling and the fiscal capacity order do not apply (Federal Constitutional Court law reports 116: 327 (381 et seq.). But special needs grants have to be limited regarding time and amount and regularly reviewed (Federal Constitutional Court law reports 101: 158 (235), 116: 327 (383 et seq.).

5.2 Other possibilities of a joint financing of national environmental protection tasks

Beside the fiscal equalisation the German Constitution knows other forms of task aid by the Federation. Environmental protection tasks of the Länder could be defined as tasks of the Federation in terms of Art. 85 of the German Constitution by federal law. The constitution of the administrating regional authority would be left to the Länder. The Federation would bear the costs of task fulfilment completely according to Art. 104a II GG. Especially with regard to binding European environmental protection tasks (for example Natura 2000, the implementation of the Water Framework Directive) the obligation of the Federation towards the EU justifies a responsibility and a more stringent control right and right of scrutiny of the Federation.

A comparative form of administration by commission is the federal administration which exists only in the areas of responsibility named in Art. 86 et seq. of the German Constitution (for example defence, Federal Border Force, federal highways). According to Art. 89 of the German Constitution with the federal waterways already a site-specific environmental protection task of the Federation exists as he must implements the goals of the Water Framework Directive (Möckel 2010). The creation of a federal administration for Natura 2000 sites and all surface waters demands an amendment of the German Constitution according to Art. 79 of the German Constitution which requires a two-thirds majority in the Bundestag and the Federal Council. It has to be considered disadvantageous that as a result a new parallel environmental authority structure to the regional environmental authorities would be established.

Beside the administration and the federal administration, in respect of which the Federation bears the costs alone, Art. 91a and 91b of the German Constitution provide the institution of joint tasks where the Federation supports the Länder regarding the fulfilment of their tasks, especially by providing financial resources. Currently only the joint task agrarian structure and coastal preservation exists (Art. 91a I No. 2 German Constitution). A joint task environmental protection respectively nature conservation would do justice to the national importance of the Natura 2000 network, the implementation of the Water Framework Directive and the national sustainability goal achievement. But a new joint task requires a two-thirds majority in the Bundestag and the Federal Council according Art. 79 of the German Constitution.

6 Indicators to assess conservation responsibilities of the German states

6.1 Selecting indicators for our analysis

In terms of nature and biodiversity conservation indicators comprise data from various monitoring schemes for visualising pressures, threats, conditions, effects as well as measures in relation to biodiversity and nature conservation. They aim at envisioning nature conservation goals that are determined before and they are also used for policy advice (see Sukopp 2010). In the framework of POLICYMIX the term indicator is seen in several ways regarding the different demands of the project; firstly to find legal implementations of the fiscal transfer, secondly to measure and evaluate protecting biodiversity and thirdly to model an ecological fiscal transfer and make it understandable for policymakers.

To observe the attainment of the main goal of the COP 7, i.e. to significantly reduce of the loss of biodiversity until 2010 and the stopping of biodiversity loss until 2020, several indicators sets are already established (e.g. EEA 2012; Federal Ministry for the Environment 2007). For choosing an indicator set in the context of POLICYMIX we firstly reviewed the existing indicator sets as well as other approaches that already tackle the implementation of an ecological fiscal transfer (Ring 2002; Santos et al. 2012). Secondly we chose indicators that are known to be suitable to be implemented in fiscal transfers like protected areas (PAs) (Ring 2008a; Santos et al. 2012). We also decided to include indicators, like landscape fragmentation (EEA 2011) and the responsibility for species protection (Schmeller et al. 2008b), that describe the condition of landscapes outside and between PAs and thus reflect achievements for biodiversity conservation beyond those areas. Practically, another important reason for choosing these indicators was a good and available set of data.

Summing up, the chosen indicators should mirror biodiversity and nature conservation most evidently. Further they need to be easily communicable to policymakers to allow for the implementation of an ecological fiscal transfer. Thus for the indicator application we chose a stepwise selection and combination of the indicators, in order to stress the different significances but also to make the whole process of indicator selection and combination as understandable as possible.

6.2 The importance of area-based and qualitative protection for biodiversity

One of the main instruments of nature and biodiversity conservation in Germany is the protection of endangered habitats and landscapes that deserve protection. It is widely known that species conservation only works through protecting respective habitats. Beyond that the size and amount of PAs is an important indicator concerning the value of landscapes as habitats and gives information about the social value of protecting nature and landscapes (Walz and Schumacher 2010).

In Germany several conservation categories exist, with different legal standards. Strong conservation rules for maintaining and developing rare and endangered species and habitats particularly apply especially to national parks and nature reserves. Moreover, national parks play an important role as concerning their size, thereby ensuring undisturbed behaviour of natural processes in major parts of the area. National parks and nature reserves maintain crucial components of the national habitat connectivity network according to § 21 BNatSchG and the European Natura 2000 network in Germany. Furthermore this is an important contribution to the global network of PAs.

The European Natura 2000 network is an essential component of area conservation activities in Germany (see section 3-1). It has the primary function of preserving and recovering favourable conservation conditions of meaningful European species and habitats. In Germany the amount of Natura 2000-sites account for 15.4 per cent. These areas will gradually be transferred into PAs, but only some of them will be strictly protected as national parks, nature reserves or core areas of biosphere reserves. But also protected areas with less strict regulations like landscape reserves and nature parks serve as conservation areas for species and habitats and are important for supporting the establishment of a national habitat network. Moreover such areas are often able to buffer more strict PAs against external negative influences, keep edge effects low and act against further landscape fragmentation.

However, indicators that are only based on the size of PAs do not make assertions about the actual achieved nature and biodiversity conservation goals. It needs to be stated that even the combination of several existing PAs cannot include all protected species and habitats or those deserving protection. Thus further financial incentives for private and public land owners are needed to encourage species and habitat protection beyond the boundaries of PAs. Consequently, we also take into account further indicators that describe qualitative aspects regarding efforts in biodiversity conservation accomplished by the Länder. Such qualitative aspects can be described, among others, by the indicators '*landscape fragmentation*' and '*responsibility for species conservation'*. By choosing those we aim to prevent a segregation of the landscape into protected and non-protected areas and thus do not ignore the conditions of the matrix (the areas between PAs).The quality of the overall landscape is of crucial importance for protecting and maintaining biodiversity.

In the following sections we describe these indicators in more detail and show how they can depict efforts in biodiversity conservation accomplished by the German Länder, either as single indicators or in combination. In the first step, we select rather simple indicators that refer to PAs and thus account for the special importance of area-based conservation activities. A modest approach in this respect is an analysis of '*Natura 2000-sites'* (see 6.3.1). Furthermore we use indicators for '*nature and species conservation*' as well as '*landscape protection*' provided by the Leibniz Institute of Ecological Urban and Regional Development (IÖR), which include Natura 2000-sites and the more strict or less strict types of protected areas (see Walz and Schumacher 2010 and section 6.3.2). In a second step we extend the area-based by qualitative indicators. We include an index on '*landscape fragmentation*' that was also provided by the IÖR (see 6.3.3), and an index displaying the states' '*responsibilities for species conservation*' according to Gruttke (2004) and Schmeller et al. (2008b) (see 6.3.4).

6.3 Chosen indicators

6.3.1 Natura 2000-sites

Area based indicators are a simple and straightforward way to indicate nature conservation activities. Concerning the legal justification of introducing such indicators into fiscal transfers at the federal level, Natura 2000-sites seem to be most appropriate. They are important for biodiversity and nature conservation particularly with regard to the establishment of a European network of PAs to maintain endangered habitats and species in Europe. Germany reported 14 per cent of the terrestrial areas as Natura 2000-sites

(EC 2013). 33.1 per cent of these represent deciduous and mixed forests and 18.2 per cent coniferous forest (Raths et al. 2006). This shows the importance of the Natura 2000-sites in forests and thus the extraordinary responsibility of forestry to achieve conservation objectives (Möckel 2008 169). 41 per cent of the marine areas (including the exclusive economic zone) are reported as Natura 2000-sites (BfN 2013) and show that Germany has an extraordinary task in protecting marine biodiversity. For further calculations we therefore separate between terrestrial and marine Natura 2000-sites.

Tables 6-1 and 6-2 show the amount of terrestrial and marine Natura 2000-sites on the total area of the German states. Especially Schleswig-Holstein, Hamburg und Mecklenburg-Western Pomerania have outstanding tasks for nature conservation in Germany, whereas North Rhine-Westphalia and Berlin only accomplish an under-average contribution. Schleswig-Holstein for example holds an overall amount of 58.3 per cent Natura 2000-sites; about 51 per cent are marine sites. This clarifies why the separation between terrestrial and marine Natura 2000-sites is important for further analysis in order to prevent misleading interpretations of the data.

Outstanding advantages of this indicator are its high transparency, easy replicability and the availability of excellent data bases. Moreover, there are widely harmonised management restrictions for those areas (FFH-impact assessment Art. 6 Abs. 3 und 4 FFH-RL, 'Verschlechterungsverbot' Art. 6 Abs. 2 FFH-RL, general aims: preserving and recovering favourable conservation conditions Art. 3 Abs. 1 FFH-RL). The main disadvantage is the implied assumption of an identical importance of the various Natura 2000-sites for nature and species protection.

Despite the existing range of data on Natura 2000-sites, there are still problems of data compatibility. It was not possible to fully reconstruct the official statistical data provided for the size of the Natura 2000-sites. This is especially true for the demarcation of terrestrial and marine parts of the Natura 2000-sites in coastal areas and estuaries, where clarifications regarding the available data are lacking. However the data presented below is the best approximation we could derive from the existing data sets. Taken this into account the data seems adequate for any further calculations. Table 6-1 presents the amount of terrestrial Natura 2000-sites on the total area of the federal states, whereas Table 6-2 presents the total amount of e Natura 2000-sites, including both terrestrial and marine sites.

6.3.2 Area-based indicators for nature, species conservation and landscape protection

Area-based indicators for nature, species and landscape conservation are generated by using the size of PAs together with different weightings regarding the type of PAs. The indicator 'nature and species conservation' is built-up by the sum of strict PAs like national parks, nature reserves, and Natura 2000-sites (Table 6-3). The indicator shows that these PAs are rather heterogeneously distributed across Germany. In the north east of Germany this indicator shows highest values (e.g. in Mecklenburg-Western Pomerania, Brandenburg).

The indicator 'landscape protection' represents PAs like landscape reserves, nature parks and biosphere reserves (Table 6-4). Those PAs are heterogeneously distributed in Germany as well and also show quite a large range. It is important to interpret both indicators only in the context of each other. In cases where high values are found for nature and species conservation only intermediate but more often only low values are indicated for landscape conservation. The indicator values refer to administrative territorial units, which includes marine PAs (see Walz and Schumacher 2010).

Table 6-1: Share of terrestrial Natura 2000-sites on total area of German States

State	Total area [sqkm]	Share of total area of Germany [%]	Area of terrestrial Natura 2000-sites [sqkm]	Share of terrestrial Natura 2000-sites on total area of state [%]
Baden-Wuerttemberg	35751.45	10.02	6332.12	17.72
Bavaria	70549.97	19.76	8021.83	11.38
Berlin	891.54	0.25	63.24	7.1
Brandenburg	29481.95	8.26	7779.65	26.39
Bremen	404.28	0.12	84.36	20.87
Hamburg	755.16	0.22	64.7	8.57
Hesse	21114.91	5.92	4437.47	21.02
Mecklenburg-Western Pomerania	23188.98	6.5	5562.6	23.99
Lower Saxony	47634.98	13.34	4637.55	9.74
North Rhine-Westphalia	34088.01	9.55	2869.53	8.42
Rhineland-Palatinate	19853.58	5.56	3846.88	19.38
Saarland	2568.66	0.72	299.45	11.66
Saxony	18419.7	5.16	2927.28	15.9
Saxony Anhalt	20448.86	5.73	2320.13	11.35
Schleswig-Holstein	15799.07	4.43	1118.36	7.08
Thuringia	16172.41	4.53	2721.87	16.84
Summa / Federal	**357123.51**	**100**	**53086.95**	**14.87**

Source: Own calculations based on BfN (2010)

Table 6-2: Share of terrestrial and marine Natura 2000-sites on total area of German States

State	Total area [sqkm]	Share of total area of Germany [%]	Area of terrestrial Natura 2000-sites [sqkm]	Area of marine Natura 2000-sites [sqkm]	Total area of Natura 2000-sites [sqkm]	Share of total Natura 2000-sites on total area of state [%]
Baden-Wuerttemberg	35751.45	10.02	6332.12	0	6332.12	17.72
Bavaria	70549.97	19.76	8021.83	0	8021.83	11.38
Berlin	891.54	0.25	63.24	0	63.24	7.1
Brandenburg	29481.95	8.26	7779.65	0	7779.65	26.39
Bremen	404.28	0.12	84.36	16.84	101.2	25.04
Hamburg	755.16	0.22	64.7	137.54	202.24	26.79
Hesse	21114.91	5.92	4437.47	0	4437.47	21.02
Mecklenburg-Western Pomerania	23188.98	6.5	5562.6	5173.78	10736.38	46.3
Lower Saxony	47634.98	13.34	4637.55	3977.5	8615.05	18.09
North Rhine-Westphalia	34088.01	9.55	2869.53	0	2869.53	8.42
Rhineland-Palatinate	19853.58	5.56	3846.88	0	3846.88	19.38
Saarland	2568.66	0.72	299.45	0	299.45	11.66
Saxony	18419.7	5.16	2927.28	0	2927.28	15.9
Saxony Anhalt	20448.86	5.73	2320.13	0	2320.13	11.35
Schleswig-Holstein	15799.07	4.43	1118.36	8092.53	9210.89	58.31
Thuringia	16172.41	4.53	2721.87	0	2721.87	16.84
Summa / Federal	**357123.51**	**100**	**53086.95**	**17398.19**	**70485.14**	**19.74**

Source: Own calculations based on BfN (2010)

Table 6-3: Share of 'nature and species conservation'-area on total area of German States

State	Total area [sqkm]	Share of total area of Germany [%]	Area of "Nature and species conservation" [sqkm]	Share of "Nature and species conservation" [%]
Baden-Wuerttemberg	35751.45	10.02	6256.51	17.5
Bavaria	70549.97	19.76	7972.15	11.3
Berlin	891.54	0.25	69.55	7.8
Brandenburg	29481.95	8.26	7812.72	26.5
Bremen	404.28	0.12	86.52	21.4
Hamburg	755.16	0.22	78.54	10.4
Hesse	21114.91	5.92	4476.37	21.2
Mecklenburg-Western Pomerania	23188.98	6.5	6956.7	30
Lower Saxony	47634.98	13.34	5430.39	11.4
North Rhine-Westphalia	34088.01	9.55	3715.6	10.9
Rhineland-Palatinate	19853.58	5.56	3811.89	19.2
Saarland	2568.66	0.72	315.95	12.3
Saxony	18419.7	5.16	2928.74	15.9
Saxony Anhalt	20448.86	5.73	2392.52	11.7
Schleswig-Holstein	15799.07	4.43	1658.91	10.5
Thuringia	16172.41	4.53	2749.31	17
Summa / Federal	**357123.51**	**100**	**56712.29**	**15.89**

Source: IÖR-Monitor (2011)

Table 6-4: Share of 'landscape protection'-areas on total area of German States

State	Total area in sqkm	Share of total area of Germany in %	"Landscape protection"-area in sqkm	Share of "Landscape protection"-area on total area
Baden-Wuerttemberg	35751.5	10.0	12477.3	34.9
Bavaria	70550.0	19.8	6631.7	9.4
Berlin	891.5	0.2	230.0	25.8
Brandenburg	29482.0	8.3	2358.6	8.0
Bremen	404.3	0.1	74.8	18.5
Hamburg	755.2	0.2	255.2	33.8
Hesse	21114.9	5.9	2977.2	14.1
Mecklenburg-Western Pome	23189.0	6.5	8000.2	34.5
Lower Saxony	47635.0	13.3	12385.1	26.0
North Rhine-Westphalia	34088.0	9.5	17521.2	51.4
Rhineland-Palatinate	19853.6	5.6	7584.1	38.2
Saarland	2568.7	0.7	1546.3	60.2
Saxony	18419.7	5.2	5157.5	28.0
Saxony Anhalt	20448.9	5.7	6400.5	31.3
Schleswig-Holstein	15799.1	4.4	3791.8	24.0
Thuringia	16172.4	4.5	3541.8	21.9
Summa / Federal	**357123.5**	**100.0**	**90933.2**	**25.5**

Source: IÖR-Monitor (2011)

With regard to forests it can be summed up that around 26 per cent of all German forests are under protection (Natura 2000, nature reserves, biosphere reserves, and national parks) with more or less strict limitations regarding commercial logging. The degree of such limitations depend on the zone within the PAs and can range from strict protection without any permission to use towards less strict protection levels where a limited use under defined conditions is still allowed. Another 41 per cent of forested areas are also protected with only minor constraints regarding the commercial logging (landscape reserves, nature parks). Overall two third of all forests in Germany are located in PAs of various types. The largest amounts of forests in PAs can be found in the Saarland and North Rhine-Westphalia, but these are mainly less protected, whereas Mecklenburg-Western Pomerania has the lowest amount of protected forests but mainly under a higher status of protection (Polley 2009).

6.3.3 Assessing fragmentation

Landscape fragmentation is the result of the transformation of large connected habitats to small isolated habitat remnants, e.g. by urbanization or land use intensification (Saunders et al. 1991). Fragmentation is one main cause for the loss of biodiversity (Henle und Streit 1990). Nowadays large connected areas with low fragmentation are rare and can only be recovered under high efforts. Only 26 per cent of the overall territory in Germany is still covered by non-fragmented areas of a minimum size of 100 km² (Federal Ministry for the Environment 2007: 129). For most of the animal and plant species further fragmentation and isolation means an irreversible loss of habitats.

The quantification of landscape fragmentation is supposed to support the implementation of environmental quality guidelines (Jaeger 2000). It may take place in two ways: by geometric-structural measurements or by functional measurements. The geometric-structural measurements include, among others, the typology-independent amount of the number of non-fragmented areas >100km² (resp, >50km²) (Lassen 1979) as well as the typology-sensitive amount of the effective mesh size (Jaeger 2000). The effective mesh size serves to measure landscape connectivity as i.e. the degree to which movement between different parts of the landscape is possible. The determination of the effective mesh size has an advantage over other methods: It is based on the probability that any two points randomly chosen in a region are connected and thus not separated by barriers. The more barriers fragmenting the landscape, the lower the probability that the two points are connected and the lower the effective mesh size (EEA 2011). To exemplify, one can think of two animals in different locations and the probability that they find one another within the region without having any barriers to cross, i.e. non-fragmentation describes the ability of species to move freely in the landscape. Vice versa, if one point is located in a fragmented landscape it is isolated from all other points. The effective mesh size is calculated by multiplying this probability by the total area of the reported unit. The smaller the effective mesh size, the more fragmented the landscape (see EEA 2011).

Based on these findings, we use the effective mesh size for POLICYMIX (Table 6-5). Relatively high values for effective mesh size occur especially in sparsely inhabited regions which are positively assessed in regard of landscape ecology (Source: IÖR, indicator fact sheet).

Comparing this indicator with the ones that are area-based (see 6.2) it can be shown that German states with large areas designated for nature conservation (including all type of PAs) coincidently do have either larger parts with highly fragmented areas or do have a general high degree of fragmentation caused by infrastructural elements, like roads. This is especially true in such states that are dominated by PAs with a less strict conservation status like North Rhine-Westphalia and Rhineland-Palatinate. The most expansive landscapes with large non-fragmented areas can be found in Brandenburg and Mecklenburg-Western Pomerania. Here also the biggest PAs with rather strict conservation status can be found. It seems obvious that this indicator may improve the ecological modification of ecological fiscal transfers since substantial differences between the federal states can be identified and important areas concerning biodiversity conservation beyond designated PAs are considered.

Table 6-5: Effective mesh size in the federal states

State	Total area [sqkm]	Effective mesh-size [sqkm]
Baden-Wuerttemberg	35751.45	21.27
Bavaria	70549.97	33.79
Berlin	891.54	12.32
Brandenburg	29481.95	54.37
Bremen	404.28	43.52
Hamburg	755.16	0
Hesse	21114.91	20.06
Mecklenburg-Western Pomerania	23188.98	58.47
Lower Saxony	47634.98	35.95
North Rhine-Westphalia	34088.01	13.9
Rhineland-Palatinate	19853.58	18.28
Saarland	2568.66	14.26
Saxony	18419.7	20.32
Saxony Anhalt	20448.86	45.58
Schleswig-Holstein	15799.07	44.69
Thuringia	16172.41	32.13
Summa / Federal	357123.51	**32,7**

Source: IÖR-Monitor (2011)

6.3.4 Assessing responsibilities for species conservation

Another more complex indicator is the assessment of the responsibility for species conservation for each federal state. By now several approaches in this regard have been developed across Europe and the World (see Schmeller et al. 2008a).

In Germany the responsibility for species conservation is implemented in the BNatSchG under §54 (1) 2 BNatSchG in the form of a so-called 'Verordnungsermächtigung'. According to this regulation it is imperative to protect species, if its population is endangered and if they are mainly distributed in the considered reference area (in this case: Germany), i.e. if there is a *national responsibility* for its protection. In the German Red Lists this 'national responsibility' for species conservation is already included as an additional declaration to protect species in Germany. In general, the assessment of the national responsibility for species conservation is a concept that enables countries to detect for which species, from a global perspective, they bear a substantial responsibility. It can then be identified which species needs higher attention and what efforts are necessary to preserve the global population and their genetic diversity (Gruttke 2004). So countries or even states have an important responsibility for species when protection within their area is essential for the global viability. It becomes clear that the concept of the responsibility for species conservation is not restricted to rare and / or declining species (Gruttke 2004) but is a supplement to the red list species and also to the indicators chosen for EFT here.

For the POLICYMIX-project we use a method that was developed during the EU-funded project EuMon. This approach shows some distinct advantages like a) the possibility of direct comparisons between provinces, countries, regions, and even continents, b) transparency of conservation decisions, c) the ability to explain demands for financial support for the conservation of populations and species of high international importance especially for poorer regions and d) by providing a common approach that may help decision makers see where biodiversity monitoring needs to be improved to close information gaps in distribution, abundance, and taxonomic status of species (Schmeller et al. 2008b).

Figure 6-1 shows the schematic overview respectively the decision tree of the assessment of national responsibilities for species conservation in Europe (Schmeller et al. 2008b). The method comprises three steps. The first step is to select the taxonomic unit (resp. species) to be able to concentrate conservation efforts on distinct units. The second step consists of determining the distribution pattern of the species: 'local' defines species with a patchy distribution within one biogeographic region, 'wide' defines species distribution more than one biogeographic region and 'regional' means that two-third of the species distribution area is located in one biogeographic region. In general, distribution patterns serve as an estimate of a species capability to deal with threat factors and thus it provides information about migration and isolation.

The third step involves the calculation of the proportional distribution in the focal area as the ratio of the distribution pattern expected (DP_{exp}) and observed (DP_{obs}) (Formula 6.1). These two values are compared and if the DP_{obs} is twice higher than the DP_{exp} the probability of the occurrence of a species in the focal area is high, otherwise it is classified as low (see Schmeller et al. 2008b).

(6.1)
$$DP_{\exp} = \frac{distribution_{reference\_area}}{reference\_area_{total}}$$
$$DP_{obs} = \frac{distribution_{focal\_area}}{focal\_area_{total}}$$

For our purposes we need to modify the method slightly. Instead of comparing DP_{exp} with DP_{obs} we just build the ratio which corresponds to the species distribution pattern. The ratio of 1 obviously represents the central point since then species would be distributed across the whole reference as well as the whole focal area. In turn, if the ratio is smaller than 1 species are distributed in the whole reference area but only in some parts of the focal area. If the ratio is bigger than 1 species are distributed only in some parts of the reference area but across the whole focal area.

For a first analysis to be used for in modelling EFT we choose amphibians because of the good data availability and the given responsibility of species protection for this group in Germany (see Henle and Gruttke 2004). It also allows for testing the approach and validating whether this indicator is reasonable within the framework of the project. To obtain an aggregate value over all species we build the ratio over all species but excluded species that are not distributed in the focal areas (federal state) (Table 6-6).

The results show that this indicator serves as a good supplement to the other indicators. The last column of table 6-6 shows the responsibility of German states for the conservation of the four selected species. The responsibility-indicator is independent of the other indicators, especially of the PAs, because it refers to the distribution area of species which is dependent on the environmental conditions. Hence, this indicator is able to display the effectiveness of species protection much better than the ones based on the area assigned to PAs. However, natural habitats for most of the species represented here are located in the southwest of Germany. For further analysis other species for which Germany bears a national conservation responsibility should be included to eliminate that bias of the current species selection.

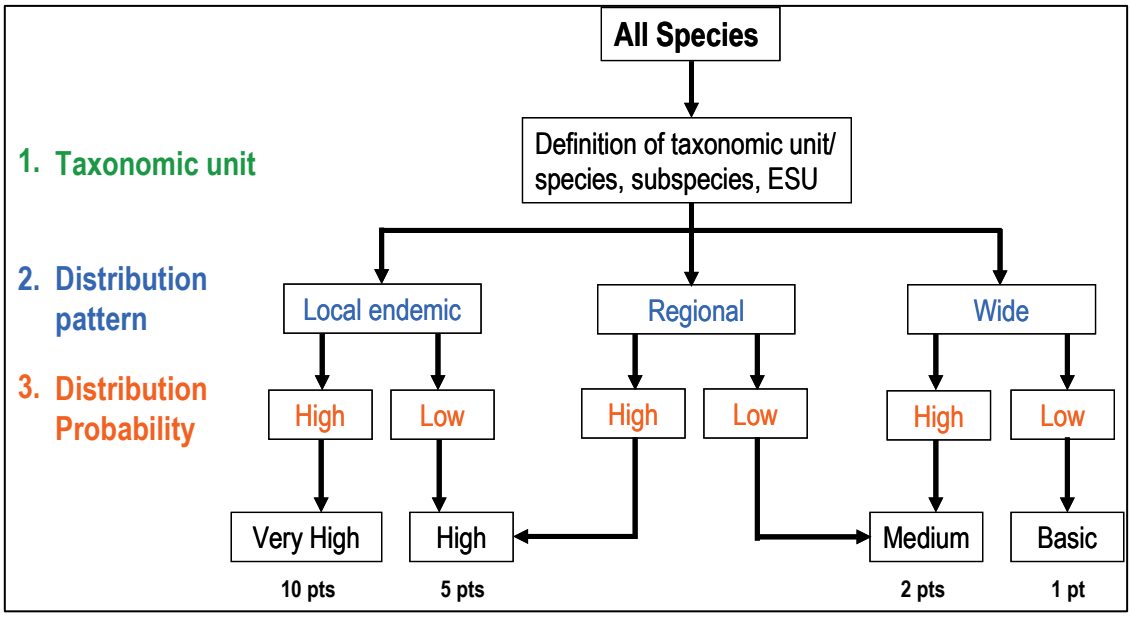

Figure 6-1: Overview of assessing responsibility-status of plant and animal species in Germany Source: adopted from Schmeller et al. (2008b)

Table 6-6: Conservation responsibilities for amphibians in the German federal states

State	Total area [sqkm]	Species 1 (Triturus alpestris)	Species 2 (Bombina variegata)	Species 3 (Bufo calamita)	Species 4 (Rana kl. esculenta)	State index
Baden-Wuerttemberg	35751.45	1.22	1.7	1	1	1.23
Bavaria	70549.97	1.22	1.64	1	1	1.22
Berlin	891.54	0	0	0	0	na
Brandenburg	29481.95	0.44	0	1	1	0.61
Bremen	404.28	0	0	0	0	na
Hamburg	755.16	1.22	0	1	1	0.81
Hesse	21114.91	1.22	1.7	1	1	1.23
Mecklenburg-Western Pomerania	23188.98	0.13	0	1	1	0.54
Lower Saxony	47634.98	1.15	0.54	1	1	0.93
North Rhine-Westphalia	34088.01	1.22	1.22	1	1	1.11
Rhineland-Palatinate	19853.58	1.22	1.7	1	1	1.23
Saarland	2568.66	1.22	1.7	1	1	1.23
Saxony	18419.7	1.22	0.29	1	1	0.88
Saxony Anhalt	20448.86	0.87	0.25	1	1	0.78
Schleswig-Holstein	15799.07	0.41	0	1	1	0.61
Thuringia	16172.41	1.22	1.7	1	1	1.23
Summa / Federal	357123.51					

Source: Own compilation

6.3.5 Sustainability indicator

According to the Federal Ministry of Environment the sustainability indicator is the most important indicator for nature conservation in the National Strategy on Biological Diversity and it is also part of the set of indicators in the National Sustainability Strategy (Bundesregierung 2002).

The sustainability indicator for species diversity (Achtziger et al. 2004; Achtziger et al. 2007) is a highly aggregated constitution indicator. It projects the quality of nature and landscape in Germany by describing the development of bird populations within their main habitats (Sukopp 2007). Thus, the calculation of the indicator is based on the growth of 59 selected bird populations that are surrogates for the most important landscapes and habitats as well as land-use types in Germany (farm land, forests, urban areas, inland waters, coasts and seas as well as the Alps). Therefore, size of the populations also reflects the suitability of the landscape as a habitat for the chosen bird species. Since other species also depend on diverse structured landscapes with intact and sustainably used habitats, this indicator also indirectly projects species diversity and the sustainability of land uses (Sukopp 2007).

The selected bird species for each landscape and habitat type as well as the recent development of the indicator for all of Germany are shown in Figure 6-2 below. As argued in section 5, this indicator (among the others of Germany's National Sustainability Strategy) would in theory comply with the requirements for indicators to be included into the fiscal equalisation mechanism. However, the main challenge for this to be realised is to assess the state-specific status of this indicator. So far no statistical data at state level is available, nor does a theoretical concept for building up a state-specific species-diversity-indicator exist. Although we believe this indicator to be a promising path for further research, we could not further consider it for our modelling of an ecological fiscal transfer scheme among the German States.

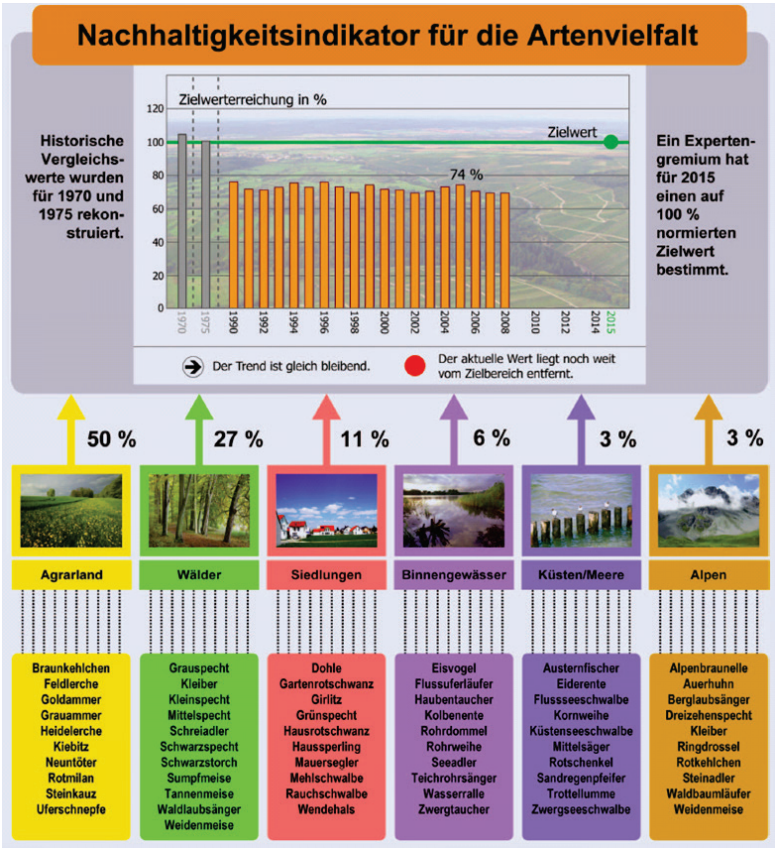

Figure 6-2: The composition of the sustainability indicator for biodiversity
Source: Achtziger et al. (2007)

6.4 A stepwise approach to build up indicator sets

To include these indicators into fiscal transfers we used a stepwise combination schemes to keep the whole process of indicator selection and integration into fiscal transfer as transparent and understandable as possible. The first three levels (1 to 3) only consider area-based indicators to determine the different nature conservation activities of the Länder. The following levels 4 and 5 are of increasing complexity because they are combining area-based and qualitative indicators.

Figure 6-3 shows the five-level structure of the different indicator combinations. In detail, level 1 encompasses Natura 2000-sites of the federal states, differentiated according to terrestrial sites only (level 1a) and the combination of terrestrial and marine sites (level 1b). Level 2 is based on the classification of 'nature and species conservation'-areas developed by the IÖR. In level 3 the 'nature and species conservation'-indicator and 'landscape protection'-indicator are combined. Level 4 combines level 3 with the indicator 'landscape fragmentation'. Lastly, level 5 extends the set by integrating the indicator of the national responsibility for species conservation.

In the next chapter, we use this stepwise combination of nature conservation indicators to model an EFT at national level in Germany.

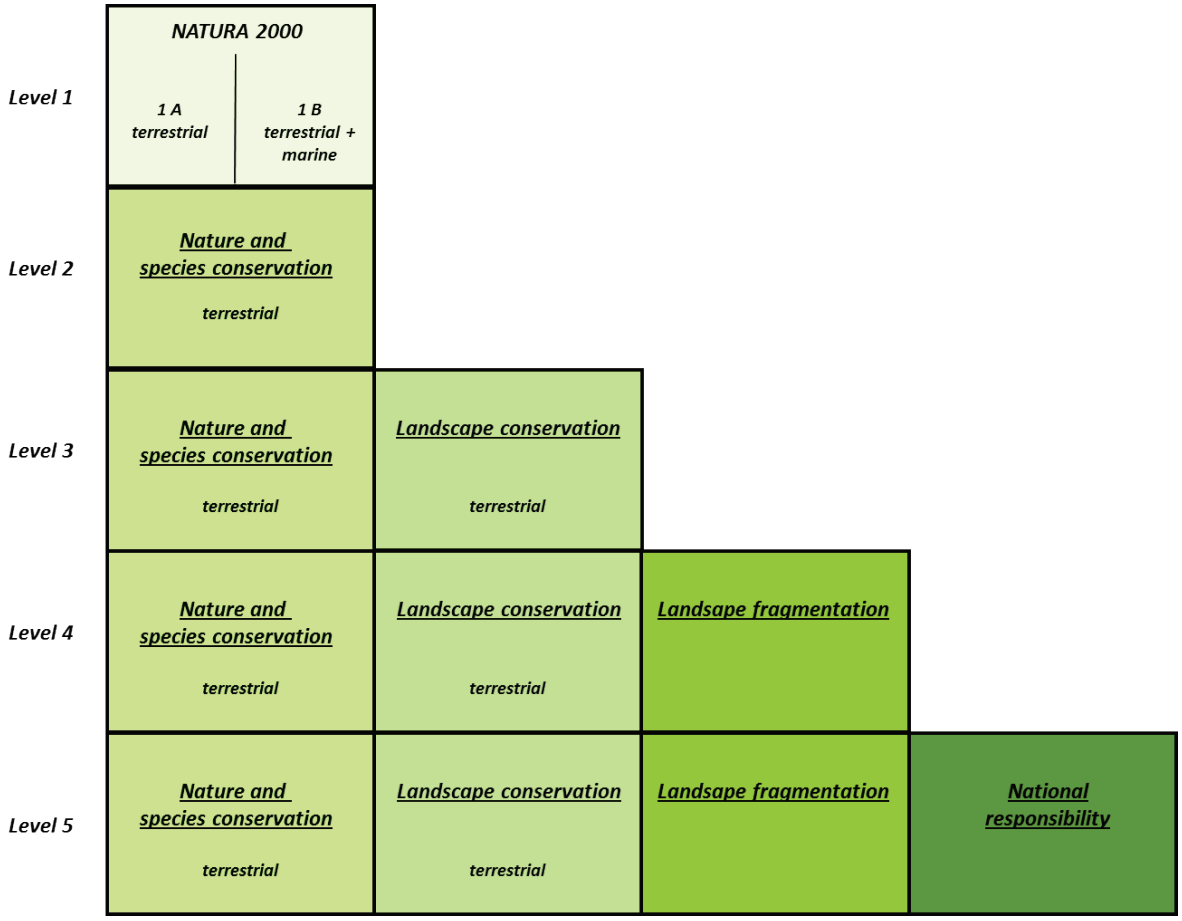

Figure 6-3: Stepwise combination of indicators to build up indicator sets
Source: Own representation

7 Simulation of Ecological Fiscal Transfers (EFT) in Germany

7.1 Moving from indicators to conservation factors

As was argued above in section 5, one preferable option to integrate ecological indicators into the fiscal equalisation mechanism is via a modification of the population numbers of the German states that is used to determine their abstract fiscal needs. German states with high nature conservation activities, i.e. those with a share of protected areas on their total area higher than the federal average, would get artificial supplementary population numbers. In turn, within the calculation of the scheme the fiscal needs of these states will rise, making them eligible for higher transfers. In contrast, for states with a share of protected areas on their total area lower than the federal average, population numbers would be artificially reduced, making them less eligible for transfers within the equalisation scheme.

Hence, there is a need to translate the above developed indicators to a conservation factor that helps to adapt calculatory population numbers of the German states with their nature conservation activity. We do this in a two step-approach. Firstly, we need to clarify how we derive state specific population factors based on the differences in nature conservation activities among the states. Secondly, we need to determine conservation factors that are used to modify population numbers within the calculations of the transfer scheme.

Regarding the first step, we follow the approach of the low density-population factor that was based on the extraordinary divergence of the population density from the federal average. In analogy, we assess the relative position of each state against the federal average of nature conservation activities. An example can be given by looking at Table 7-1. Here we present the share of terrestrial Natura 2000-sites on the total area of the states. Furthermore, the last column presents the relative position of each state from the federal average. The federal average is simply the share of all German terrestrial Natura 2000-sites on total area of Germany. For example, while Baden-Wuerttemberg has designated 17.7 per cent of its territory as Natura 2000-sites the federal average for Germany is 14.9 per cent. Hence, Baden-Wuerttemberg protects nearly 20 per cent more of its territory than the average of all German states. In contrast, Bavaria's Natura 2000-sites account for only 11.4 per cent of its territory and thus 23.5 per cent below the federal average.

As can be seen in the last column of table 7-1 the distances of states from the federal average range from 77 per cent above federal average for Brandenburg to 52 per cent below federal average for Schleswig-Holstein and Berlin. Simply translating this into a conservation factor to modify population numbers for the fiscal equalisation would result in unacceptable alteration of transfers. Hence, for the second step mentioned above, we considered only a tenth of the relative position of the states compared to the federal average. Looking at Table 7-2 this can be explained in more detail.

The last column of Table 7-2 shows the conservation factor that will be used to modify the calculatory population numbers of the state within the fiscal equalisation mechanism to derive the abstract fiscal needs of the states. Exemplarily, Baden-Wuerttemberg's share of Natura 2000-sites on total state area is 19.1 per cent above federal average; leading to a conservation factor of 1.019. This means, the population number of Baden-Wuerttemberg is increased by roughly 2 per cent for calculating its fiscal need. In contrary again, Schleswig-Holstein's relative position is 52 per cent below federal average; leading to a reduction of its population number for calculating its fiscal needs by roughly 5 per cent, i.e. the conservation factor is 0.948.

To summarise the deliberations above, the conservation factors used for modelling ecological fiscal transfers are derived by the following approach (see Formula 7.1):

(7.1) $$Conservation\ factor\ = 1 + \left(\frac{Performance\ of\ the\ state}{Performance\ of\ all\ states} - 1\right) * 0{,}1$$

Table 7-1: Relative position of the states in designated terrestrial Natura 2000-sites

State	Total area in sqkm	Share of total area of Germany	Area of terrestrial Natura 2000-sites	Share of terrestrial Natura 2000-sites on total area of state	relative position compared to the federal average
Baden-Wuerttemberg	35,751.45	10.01	6,332.11	17.71	19.15
Bavaria	70,549.97	19.76	8,021.83	11.37	-23.51
Berlin	891.54	0.25	63.23	7.09	-52.29
Brandenburg	29,481.95	8.26	7,779.65	26.39	77.51
Bremen	404.28	0.11	84.35	20.87	40.36
Hamburg	755.16	0.21	64.69	8.57	-42.37
Hesse	21,114.91	5.91	4,437.46	21.02	41.38
Mecklenburg-Western Pomerania	23,188.98	6.49	5,562.60	23.99	61.37
Lower Saxony	47,634.98	13.34	4,637.55	9.74	-34.51
North Rhine-Westphalia	34,088.01	9.55	2,869.52	8.42	-43.37
Rhineland-Palatinate	19,853.58	5.56	3,846.87	19.38	30.35
Saarland	2,568.66	0.72	299.44	11.66	-21.58
Saxony	18,419.70	5.16	2,927.28	15.89	6.91
Saxony Anhalt	20,448.86	5.73	2,320.13	11.35	-23.67
Schleswig-Holstein	15,799.07	4.42	1,118.35	7.08	-52.38
Thuringia	16,172.41	4.53	2,721.87	16.83	13.22
Summa / Federal	**357,123.51**	**100.00**	**53,086.95**	**14.87**	

Source: Own calculations

Table 7-2: Conservation factors derived from the relative position of the states in designated terrestrial Natura 2000-sites

State	Total area in sqkm	Share of total area of Germany	Area of terrestrial Natura 2000-sites	Share on total area of state	relative position compared to federal average	Conservation factor
Baden-Wuerttemberg	35,751.45	10.01	6,332.11	17.71	19.15	**1.019**
Bavaria	70,549.97	19.76	8,021.83	11.37	-23.51	**0.976**
Berlin	891.54	0.25	63.23	7.09	-52.29	**0.948**
Brandenburg	29,481.95	8.26	7,779.65	26.39	77.51	**1.078**
Bremen	404.28	0.11	84.35	20.87	40.36	**1.040**
Hamburg	755.16	0.21	64.69	8.57	-42.37	**0.958**
Hesse	21,114.91	5.91	4,437.46	21.02	41.38	**1.041**
Mecklenburg-Western Pomerania	23,188.98	6.49	5,562.60	23.99	61.37	**1.061**
Lower Saxony	47,634.98	13.34	4,637.55	9.74	-34.51	**0.965**
North Rhine-Westphalia	34,088.01	9.55	2,869.52	8.42	-43.37	**0.957**
Rhineland-Palatinate	19,853.58	5.56	3,846.87	19.38	30.35	**1.030**
Saarland	2,568.66	0.72	299.44	11.66	-21.58	**0.978**
Saxony	18,419.70	5.16	2,927.28	15.89	6.91	**1.007**
Saxony Anhalt	20,448.86	5.73	2,320.13	11.35	-23.67	**0.976**
Schleswig-Holstein	15,799.07	4.42	1,118.35	7.08	-52.38	**0.948**
Thuringia	16,172.41	4.53	2,721.87	16.83	13.22	**1.013**
Summa / Federal	**357,123.51**	**100.00**	**53,086.95**	**14.87**		

Source: Own calculations

Based on this approach, the following tables present the conservation factors for each of the indicators chosen in section 6. Table 7-3 shows the conservation factors if the sum of terrestrial and marine Natura 2000-sites is considered, Table 7-4 present the results for the nature and species conservation-indicator by IÖR (Step 2). Table 7-5 presents the factors resulting from the landscape protection-indicator, Table 7-6 those derived by the mesh-size and finally Table 7-7 those derived from the conservation responsibility approach.

Table 7-3: Conservation factor based on nature and species-conservation indicator by IÖR

State	Total area in sqkm	Share of total area of Germany in %	Area "Nature and species conservation" in sqkm	Share on total area	relative position compared to federal average	Conservation factor
Baden-Wuerttemberg	35,751.5	10.0	6,256.5	17.5	10.2	**1.010**
Bavaria	70,550.0	19.8	7,972.1	11.3	-28.8	**0.971**
Berlin	891.5	0.2	69.5	7.8	-50.9	**0.949**
Brandenburg	29,482.0	8.3	7,812.7	26.5	66.9	**1.067**
Bremen	404.3	0.1	86.5	21.4	34.8	**1.035**
Hamburg	755.2	0.2	78.5	10.4	-34.5	**0.965**
Hesse	21,114.9	5.9	4,476.4	21.2	33.5	**1.033**
Mecklenburg-Western Pome	23,189.0	6.5	6,956.7	30.0	88.9	**1.089**
Lower Saxony	47,635.0	13.3	5,430.4	11.4	-28.2	**0.972**
North Rhine-Westphalia	34,088.0	9.5	3,715.6	10.9	-31.4	**0.969**
Rhineland-Palatinate	19,853.6	5.6	3,811.9	19.2	20.9	**1.021**
Saarland	2,568.7	0.7	315.9	12.3	-22.5	**0.977**
Saxony	18,419.7	5.2	2,928.7	15.9	0.1	**1.000**
Saxony Anhalt	20,448.9	5.7	2,392.5	11.7	-26.3	**0.974**
Schleswig-Holstein	15,799.1	4.4	1,658.9	10.5	-33.9	**0.966**
Thuringia	16,172.4	4.5	2,749.3	17.0	7.1	**1.007**
Summa / Federal	**357,123.5**	**100.0**	**56,712.3**	**15.9**		

Source: Own calculations

Table 7-4: Conservation factor based on landscape protection indicator by IÖR

State	Total area in sqkm	Share of total area of Germany in %	"Landscape protection"-area in sqkm	Share on total area	relative position compared to federal average	Conservation factor
Baden-Wuerttemberg	35751.5	10.0	12477.3	34.9	37.1	**1.037**
Bavaria	70550.0	19.8	6631.7	9.4	-63.1	**0.937**
Berlin	891.5	0.2	230.0	25.8	1.3	**1.001**
Brandenburg	29482.0	8.3	2358.6	8.0	-68.6	**0.931**
Bremen	404.3	0.1	74.8	18.5	-27.3	**0.973**
Hamburg	755.2	0.2	255.2	33.8	32.7	**1.033**
Hesse	21114.9	5.9	2977.2	14.1	-44.6	**0.955**
Mecklenburg-Western Pome	23189.0	6.5	8000.2	34.5	35.5	**1.035**
Lower Saxony	47635.0	13.3	12385.1	26.0	2.1	**1.002**
North Rhine-Westphalia	34088.0	9.5	17521.2	51.4	101.9	**1.102**
Rhineland-Palatinate	19853.6	5.6	7584.1	38.2	50.0	**1.050**
Saarland	2568.7	0.7	1546.3	60.2	136.4	**1.136**
Saxony	18419.7	5.2	5157.5	28.0	10.0	**1.010**
Saxony Anhalt	20448.9	5.7	6400.5	31.3	22.9	**1.023**
Schleswig-Holstein	15799.1	4.4	3791.8	24.0	-5.7	**0.994**
Thuringia	16172.4	4.5	3541.8	21.9	-14.0	**0.986**
Summa / Federal	**357123.5**	**100.0**	**90933.2**	**25.5**		

Source: Own calculations

Table 7-5: Conservation factor based on mesh-size

State	Effective mesh-size	relative position compared to federal average	Conservation factor
Baden-Wuerttemberg	21.3	-35.0	**0.965**
Bavaria	33.8	3.3	**1.003**
Berlin	12.3	-62.3	**0.938**
Brandenburg	54.4	66.2	**1.066**
Bremen	43.5	33.0	**1.033**
Hamburg	0.0	-100.0	**0.900**
Hesse	20.1	-38.7	**0.961**
Mecklenburg-Western Pomerania	58.5	78.8	**1.079**
Lower Saxony	36.0	9.9	**1.010**
North Rhine-Westphalia	13.9	-57.5	**0.942**
Rhineland-Palatinate	18.3	-44.1	**0.956**
Saarland	14.3	-56.4	**0.944**
Saxony	20.3	-37.9	**0.962**
Saxony Anhalt	45.6	39.3	**1.039**
Schleswig-Holstein	44.7	36.6	**1.037**
Thuringia	32.1	-1.8	**0.998**
Summa / Federal	**32.7**		

Source: Own calculations

Table 7-6: Conservation factor based on nature conservation-responsibilities of the states

State	Total area in sqkm	Species 1 (Triturus alpestris)	Species 2 (Bombina variegata)	Species 3 (Bufo calamita)	Species 4 (Rana kl. esculenta)	State index	relative position compared to the federal average	Conservation factor
Baden-Wuerttemberg	35,751.48	1.21	1.69	1.00	1.00	122.6	22.6	**1.023**
Bavaria	70,551.57	1.21	1.64	1.00	1.00	121.1	21.1	**1.021**
Berlin	891.5	0.00	0.00	0.00	0.00	0.0	-100.0	**0.900**
Brandenburg	30,370.46	0.43	0.00	1.00	1.00	81.1	-18.9	**0.981**
Bremen	404.3	0.00	0.00	0.00	0.00	0.0	-100.0	**0.900**
Hamburg	755.27	1.21	0.00	1.00	1.00	107.0	7.0	**1.007**
Hesse	21,114.94	1.21	1.69	1.00	1.00	122.6	22.6	**1.023**
Mecklenburg-Western Pom	23,180.14	0.12	0.00	1.00	1.00	70.7	-29.3	**0.971**
Lower Saxony	48,054.13	1.15	0.53	1.00	1.00	92.0	-8.0	**0.992**
North Rhine-Westphalia	34,088.01	1.21	1.21	1.00	1.00	110.5	10.5	**1.011**
Rhineland-Palatinate	19,853.36	1.21	1.69	1.00	1.00	122.6	22.6	**1.023**
Saarland	2,568.70	1.21	1.69	1.00	1.00	122.6	22.6	**1.023**
Saxony	18,415.51	1.21	0.28	1.00	1.00	87.3	-12.7	**0.987**
Saxony Anhalt	20,446.31	0.86	0.24	1.00	1.00	77.7	-22.3	**0.978**
Schleswig-Holstein	15,799.83	0.40	0.00	1.00	1.00	80.1	-19.9	**0.980**
Thuringia	16,172.50	1.21	1.69	1.00	1.00	122.6	22.6	**1.023**
Summa / Federal	**358,418.03**							

Source: Own calculations

7.2 Weighting factors to combine conservation factors

As was described in section 6.4, the idea is to start out from simple but transparent area-based indicators (Level 1 to 3 of Figure 6-3), to move on to more complex compositions of merging quantitative approaches with qualitative indicators, such as mesh-size as a surrogate for landscape fragmentation (Level 4) and the concept of conservation responsibility (Level 5). Here the question arises, how the different indicators and thereby also the different conservation factors that are based on these indicators should be combined.

Table 7-7 presents a first idea on how this could be done, with the yellow columns presenting the final conservation factor to be used in modelling the ecological fiscal transfers. Clearly there is room for further refinement as well as the need to do some sort of sensitivity analysis to become clear about the influence of the weighting factors on the resulting financial flows of the ecological fiscal transfers.

The conservation factors for Level 1 and 2 are based on single indicators, thus there is no weighting of different inputs. Level 3 combines the area of the more strict protected areas for nature and species conservation by the more feeble conservation activities in protected areas subsumed under the label 'landscape protection'. Here we follow the initial approach by IÖR and weight landscape protection by 20 per cent while stricter protected nature and species conservation areas are weighted by 80 per cent. In Levels 4 and 5 further indicators are embraced; for our first modelling, we simply weight them at 10 per cent and diminished the other factors respectively.

Table 7-7: Weighting different conservation factors

State	EFT 1a: Natura 2000 terrestrial	EFT 1b: Natura 2000 terrestrial and marin	EFT 2: Nature and species conservation area	Landscape protection	EFT 3: EFT 2 + Landscape protection	Effective mesh-size	EFT 4: EFT 3 + effective mesh-size	National responsibility	EFT 5: EFT 4 + national responsibility
Baden-Wuerttemberg	**1.019**	**0.990**	**1.010**	1.037	**1.016**	0.965	**1.011**	1.023	**1.011**
Bavaria	**0.976**	**0.958**	**0.971**	0.937	**0.964**	1.003	**0.968**	1.021	**0.974**
Berlin	**0.948**	**0.936**	**0.949**	1.001	**0.960**	0.938	**0.957**	0.900	**0.951**
Brandenburg	**1.078**	**1.034**	**1.067**	0.931	**1.040**	1.066	**1.042**	0.981	**1.037**
Bremen	**1.040**	**1.027**	**1.035**	0.973	**1.022**	1.033	**1.023**	0.900	**1.011**
Hamburg	**0.958**	**1.036**	**0.965**	1.033	**0.979**	0.900	**0.971**	1.007	**0.974**
Hesse	**1.041**	**1.006**	**1.033**	0.955	**1.018**	0.961	**1.012**	1.023	**1.013**
Mecklenburg-Western Pomerania	**1.061**	**1.135**	**1.089**	1.035	**1.078**	1.079	**1.078**	0.971	**1.068**
Lower Saxony	**0.965**	**0.992**	**0.972**	1.002	**0.978**	1.010	**0.981**	0.992	**0.982**
North Rhine-Westphalia	**0.957**	**0.943**	**0.969**	1.102	**0.995**	0.942	**0.990**	1.011	**0.992**
Rhineland-Palatinate	**1.030**	**0.998**	**1.021**	1.050	**1.027**	0.956	**1.020**	1.023	**1.019**
Saarland	**0.978**	**0.959**	**0.977**	1.136	**1.009**	0.944	**1.003**	1.023	**1.004**
Saxony	**1.007**	**0.981**	**1.000**	1.010	**1.002**	0.962	**0.998**	0.987	**0.997**
Saxony Anhalt	**0.976**	**0.957**	**0.974**	1.023	**0.984**	1.039	**0.989**	0.978	**0.989**
Schleswig-Holstein	**0.948**	**1.195**	**0.966**	0.994	**0.972**	1.037	**0.978**	0.980	**0.979**
Thuringia	**1.013**	**0.985**	**1.007**	0.986	**1.003**	0.998	**1.002**	1.023	**1.004**
Kontrollwert = 1	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**

Basic Scenario	**Weighting Factors**	**EFT3**	**EFT 4**	**EFT 5**
	Nature and species conservation	0.8	0.72	0.64
	Landscape protection	0.2	0.18	0.16
	Effective mesh-size	0	0.1	0.1
	National responsibility	0	0	0.1
	Control = 1	**1.0**	**1.0**	**1.0**

Source: Own calculations

7.3 Integrating conservation factors into the existing transfer scheme

These conservation factors of the various German states that have been determined in the last section are then integrated into the German fiscal equalisation scheme. As an appropriate entry point stage 3 has been selected (see Figure 5-1), that is the actual horizontal fiscal equalisation among the Länder comparing fiscal capacities and fiscal needs.

Fiscal capacity includes the sum of tax revenues at the Länder level (German states share of joint taxes and tax revenues of the Länder) and 64 per cent of the sum of municipal tax revenues (Formula 7.2).

$$FCI_{Li} = \sum Taxes_{Li} + \sum 0.64 * Taxes_{Mi} \quad (7.2)$$

FCI_{Li}	Fiscal capacity index of Land i
$Taxes_{Li}$	Tax revenue at state level of Land i
$Taxes_{Mi}$	Tax revenue at municipal level of Land i

It is principally assumed that fiscal needs per inhabitant are the same in all German states. Therefore the population number is the abstract indicator for calculating the fiscal need of each Land. The equalisation index EI of Land i represents the sum of average tax revenue per capita at state level and average tax revenue per capita at the local level across Germany, and each of these terms is multiplied with the relevant population number of Land i to obtain its equalisation index (Formula 7.3). However, two exemptions are applied:

Firstly, for the city-states Berlin, Bremen and Hamburg the population number is fictitiously increased by 35 per cent due to higher financial requirements per inhabitant than the other German states as they represent both a state and a city. This population weighting in the form of the city-state factor of 1.35 is both carried out for the equalisation of state level tax revenue (§ 9 (2) Fiscal Equalisation Act) and the equalisation of municipal level tax revenue.

$$EI_{Li} = \frac{\sum_{i=1}^{16} Taxes_{Li}}{\sum_{i=1}^{16} Population_{Li}} * Population_{Li} + \frac{\sum_{i=1}^{n16} Taxes_{Mi}}{\sum_{i=1}^{16} Population_{Mi}} * Population_{Mi} \quad (7.3)$$

Equalisation of tax revenue at state level of Land i

Equalisation of tax revenue at municipal level in Land i

EI_{Li}	Equalisation index of Land i
$Population_{Li}$	Weighted population number of a Land i city-states are weighted with the city-states factor of 1.35 (§ 9 (2) Fiscal Equalisation Act)
$Population_{Mi}$	Weighted population number of a Land i city-states are weighted with the city-states factor 1.35 with low population density are weighted with the low population density factor: MV 1.05; BB 1.03; ST 1.02 (§ 9 (3) Fiscal Equalisation Act)

Secondly, the three sparsely populated Länder of Mecklenburg-Western Pomerania, Brandenburg, and Saxony-Anhalt have been recently acknowledged to have slightly higher fiscal needs due to their low population densities. Therefore, their population number is fictitiously increased by 5, 3, and 2 per cent respectively. This so-called low population density factor is only applied in the context of the equalisation of municipal tax revenues in Land i (§9 (3) Fiscal Equalisation Act).

It is exactly at this latter point, where we choose to integrate our conservation factors. This is due to the fact that with this low population density factor the legislator already acknowledged the cost-relevance of area for providing public goods and services. Population densities well below the average lead to higher costs of providing public goods and services. As Ring (2001) argued in the context of intergovernmental fiscal relations at the local level, the acknowledgement of the indicator area represents a first, although indirect step to acknowledge ecological public functions. We propose to acknowledge the higher provisioning costs of conservation-related goods and services directly with a relevant conservation factor. As the legislator chose to apply the low population density factor only to the equalisation of municipal tax revenues, we suggest introducing our suite of conservation factors exactly at the same stage of fiscal equalisation.

We fictitiously increase or decrease the population number of a Land in the context of equalising its municipal-level tax revenues based on the Land's above or below average performance regarding protected area coverage as determined in the last section. For our ex ante scenario modelling of ecological fiscal transfers in Germany we choose 2010 as our base year. So we use all relevant tax and inhabitant data as valid for the German fiscal equalisation system as of 2010 and introduce our conservation factors. An example of the aggregation of the various population-related factors is provided in Table 7-8 for selected Länder population numbers as of 2010.

Table 7-8: Determining the equalisation index based on weighting factors for city-states, low population density and conservation

	Bavaria	**Mecklenburg Western Pomerania**	**Hamburg**
Population as of 30.06.2010	17,850,560	1,646,539	1,779,140
Fiscal equalisation of state-level tax revenues			
City-states factor	0	0	1.35
Fictitious population for equalisation of state-level taxes	17,850,560	1,646,539	2,401,839
Fiscal equalisation of municipal-level tax revenues			
City-states factor	0	0	1.35
Low population density factor	0	1.05	
Conservation factor Level 2 (Nature and species conservation)	0.971	1.089	0.965
Aggregated weighting factor	0.971	1.139	1.315
Fictitious population for equalisation of municipal-level taxes	17,332,893	1,875,408	2,339,569

Source: Own calculations

Finally, the adjustment payment a Land receives or has to pay depends on the cover ratio of its fiscal capacity and needs, the latter being represented by the equalisation index. If its own fiscal capacity exceeds its equalisation index, then it is obliged to pay. If its fiscal capacity is below its fiscal needs represented by

the equalisation index, then the Land receives an adjustment payment. The exact size of adjustment payments of a Land depends on the amount by which its fiscal capacity per fictitious inhabitant falls below the average or exceeds the average fiscal capacity per inhabitant. Linear-progressive topping-up or skimming-off schedules are used to calculate the differences from the average and determine what poor Länder receive and rich Länder have to pay. In the next section, we present how much the integration of our suggested conservation factors changes the adjustment payments of the year 2010.

7.4 Modelling results

Using a computational model of the existing fiscal transfer regime, we ran several simulations of considering conservation factors for determining the equalisation index of the German Länder. First, we used the conservation factors that were based on the different sets of indicators outlined above. After that we undertook a sensitivity analysis of our results by changing the weighting factors in building up indicator sets level 3 to 5. The main results of our modelling are shown below: starting from Ecological Fiscal Transfers (EFT) considering area-based indicators only (cp. section 7.4.1) we move on to more complex conservation factors including also qualitative indicators (cp. section 7.4.2). Besides the numbers for all German states, we look in more detail on four specific states to highlight the potential effects of ecological fiscal transfers (cp. section 7.4.3). Finally, we present some of the highlights of the sensitivity analysis (cp. section 7.4.4). A discussion of the result is provided in section 7.5 further below.

7.4.1 Ecological fiscal transfers resulting from area-based conservation factors

The first simulation run comprised area-based conservation factors as proposed in section 6.3.1 and 6.3.2. As was presented above in section 6.3.5, we tested four different sets of area-based indicators: 'EFT stage 1a' building on terrestrial Natura 2000-sites, 'EFT stage 1b' building on terrestrial and marine Natura 2000-sites, 'EFT stage 2' considering a wider set of terrestrial areas dedicated for nature and species conservation (including Natura 2000-sites but also strictly protected national parks and nature reserves), and 'EFT stage 3' considering terrestrial areas dedicated for nature and species conservation as well as areas for landscape protection (including biosphere reserves, nature parks and landscape reserves) (see section 7.2).

The results of our simulation are presented below. We firstly provide a total overview of distribution to all German Länder and secondly, a comparison of transfers received by each state under the current scheme and the EFT alternatives.

Table 7-9: State's tax income per capita before fiscal transfers and after status quo fiscal transfers (as of 2010) and after EFT 1-3 (area-based indicators-only); FT – Fiscal Transfer; EFT – Ecological Fiscal Transfer

State	Tax income per capita											
	before FT	after FT status quo	win / loss by FT absolute	win / loss by FT relative	after EFT stage 1a	win / loss by EFT	after EFT stage 1b	win / loss by EFT	after EFT stage 2	win / loss by EFT	after EFT stage 3	win / loss by EFT
Baden-Wuerttemberg	3,441 €	3,282 €	- 159 €	-4.6%	3,291 €	- 150 €	3,283 €	- 158 €	3,288 €	- 153 €	3,289 €	- 151 €
Bavaria	3,611 €	3,331 €	- 280 €	-7.8%	3,321 €	- 290 €	3,317 €	- 294 €	3,320 €	- 291 €	3,317 €	- 294 €
Berlin	2,835 €	3,942 €	1,107 €	39.0%	3,922 €	1,087 €	3,919 €	1,083 €	3,922 €	1,087 €	3,924 €	1,089 €
Brandenburg	2,777 €	3,007 €	230 €	8.3%	3,053 €	276 €	3,032 €	256 €	3,047 €	270 €	3,030 €	253 €
Bremen	3,152 €	4,048 €	896 €	28.4%	4,076 €	924 €	4,072 €	920 €	4,072 €	921 €	4,064 €	912 €
Hamburg	4,377 €	4,340 €	- 37 €	-0.9%	4,331 €	- 46 €	4,355 €	- 22 €	4,333 €	- 44 €	4,335 €	- 42 €
Hesse	3,643 €	3,354 €	- 289 €	-7.9%	3,372 €	- 272 €	3,362 €	- 282 €	3,370 €	- 274 €	3,363 €	- 280 €
Mecklenburg-Western Pomerania	2,622 €	2,960 €	338 €	12.9%	2,998 €	375 €	3,038 €	416 €	3,012 €	389 €	3,003 €	381 €
Lower Saxony	3,018 €	3,067 €	49 €	1.6%	3,055 €	37 €	3,070 €	52 €	3,058 €	40 €	3,058 €	40 €
North Rhine-Westphalia	3,077 €	3,103 €	26 €	0.9%	3,088 €	11 €	3,085 €	8 €	3,093 €	16 €	3,103 €	26 €
Rhineland-Palatinate	2,953 €	3,055 €	102 €	3.5%	3,076 €	123 €	3,062 €	109 €	3,071 €	118 €	3,071 €	118 €
Saarland	2,908 €	3,041 €	133 €	4.6%	3,035 €	127 €	3,027 €	120 €	3,034 €	127 €	3,048 €	140 €
Saxony	2,664 €	2,954 €	290 €	10.9%	2,963 €	299 €	2,951 €	287 €	2,959 €	295 €	2,957 €	293 €
Saxony Anhalt	2,663 €	2,961 €	298 €	11.2%	2,954 €	291 €	2,947 €	284 €	2,953 €	290 €	2,955 €	292 €
Schleswig-Holstein	3,022 €	3,076 €	54 €	1.8%	3,056 €	33 €	3,183 €	161 €	3,064 €	42 €	3,064 €	42 €
Thuringia	2,647 €	2,944 €	297 €	11.2%	2,956 €	309 €	2,944 €	297 €	2,953 €	305 €	2,948 €	300 €

Source: Own calculations

Table 7-9 presents the results of the area-based EFTs on a per capita basis. Column 2 ('Total tax income before FT') shows the tax income per capita of German Länder after distribution of taxes but before fiscal transfers. Column 3 presents tax income per capita after fiscal transfers based on the existing allocation rules. Exemplarily, in the year 2010, Baden-Wuerttemberg loses € 159 per capita (-4.6 per cent) by the existing fiscal transfer scheme, while Brandenburg gains € 230 per capita (+8.3 per cent).

Column 6 et seq. show the tax income per capita after ecological fiscal transfers for each level of the conservation factors explained above. For example, for column 6 ('after EFT stage 1a'), EFT based on the share of terrestrial Natura 2000-sites (stage 1a), Baden-Wuerttemberg would now spend only € 150 per capita, while Brandenburg would gain € 276 per capita. These results indicate that both states have a share of terrestrial Natura 2000-sites on their total area higher than national average as both are better off with EFT stage 1a than without.

It is interesting to note that the effect on funds allocated of considering ecological indicators as proposed here is rather marginal. All states that receive transfers under the current scheme still receive funds under the EFT proposals. The strongest effect can be seen for EFT stage 1b (terrestrial and marine Natura 2000-sites). As especially marine Natura 2000-sites are unevenly distributed across the states, coastal states (e.g. Mecklenburg-Western Pomerania or Schleswig-Holstein) benefit in this special EFT-scenario. A marginal analysis of wins and losses by our proposed ecological fiscal transfers can be found in table 7-10 below.

Table 7-10: Marginal change by EFT stage 1 to 3 in state's tax income per capita

State	Marginal change of tax income per capita							
	EFT 1a vs status quo		EFT 1b vs status quo		EFT 2 vs status quo		EFT 3 vs status quo	
	absolute	relative	absolute	relative	absolute	relative	absolute	relative
Baden-Wuerttemberg	9 €	0.3%	1 €	0.0%	6 €	0.2%	8 €	0.2%
Bavaria	- 10 €	-0.3%	- 13 €	-0.4%	- 11 €	-0.3%	- 13 €	-0.4%
Berlin	- 20 €	-0.5%	- 23 €	-0.6%	- 20 €	-0.5%	- 18 €	-0.5%
Brandenburg	46 €	1.5%	25 €	0.8%	40 €	1.3%	23 €	0.8%
Bremen	28 €	0.7%	24 €	0.6%	25 €	0.6%	17 €	0.4%
Hamburg	- 9 €	-0.2%	15 €	0.4%	- 7 €	-0.2%	- 4 €	-0.1%
Hesse	17 €	0.5%	7 €	0.2%	15 €	0.5%	9 €	0.3%
Mecklenburg-Western Pomerania	37 €	1.3%	78 €	2.6%	51 €	1.7%	43 €	1.4%
Lower Saxony	- 12 €	-0.4%	3 €	0.1%	- 9 €	-0.3%	- 9 €	-0.3%
North Rhine-Westphalia	- 16 €	-0.5%	- 18 €	-0.6%	- 11 €	-0.3%	- 0 €	0.0%
Rhineland-Palatinate	21 €	0.7%	7 €	0.2%	15 €	0.5%	16 €	0.5%
Saarland	- 6 €	-0.2%	- 13 €	-0.4%	- 7 €	-0.2%	7 €	0.2%
Saxony	9 €	0.3%	- 2 €	-0.1%	5 €	0.2%	3 €	0.1%
Saxony Anhalt	- 7 €	-0.2%	- 14 €	-0.5%	- 9 €	-0.3%	- 6 €	-0.2%
Schleswig-Holstein	- 21 €	-0.7%	107 €	3.5%	- 12 €	-0.4%	- 12 €	-0.4%
Thuringia	12 €	0.4%	- 0 €	0.0%	9 €	0.3%	4 €	0.1%

Source: Own calculations

Table 7-10 presents the marginal change of tax income per capita of German Länder if area-based EFT would be introduced as proposed above. Again, exemplarily the results for Baden-Wuerttemberg (+9 euros per capita in EFT 1a vs. status quo) and Brandenburg (+46 euros per capita) show that both states have a share of Natura 2000-sites on their total area larger than the national average.

As shown above, allocation of funds is rather marginally changed by introducing the ecological indicators with Brandenburg and Mecklenburg-Western Pomerania being the states with the biggest additional transfers (+1.5 per cent and +1.3 per cent respectively), while Schleswig-Holstein would be the biggest loser in EFT stage 1a (-0.7 per cent). Again, when also marine Natura 2000-sites are considered, the picture for Schleswig-Holstein completely turns making the state by far the biggest winner (+3.5 per cent). We will follow up on this observation in the discussion section (see section 7.5 below).

Marginal changes in transferring funds tend to be smaller for later stages of EFT. For example, while the results for EFT 1a (terrestrial Natura 2000-sites) are very similar to that of EFT 2 (nature and species conservation areas), the latter is closer to the status quo distribution of transfers as of 2010 (except for Mecklenburg Western-Pomerania and Saxony Anhalt). This holds true for EFT 3 that is even closer to the status quo distribution than EFT 2. This meets our expectations that considering a broad range of protected area categories will lead to a more even distribution of funds. In total, size of protected areas among German states is quite evenly distributed, however, some states have more strictly regulated protected areas (that are thus deemed to be more effective for conservation) than other states. One can see this very nicely when looking at the data for North Rhine-Westphalia – while the state will lose transfers if only Natura 2000-sites are considered, losses will be reduced under EFT 2. Under EFT 3 the state will gain a neutral position, i.e. it receives the same funds as under the status quo transfer system.

Figure 7-1 below shows the results for EFT stage 2 (nature and species conservation) in graphical format.

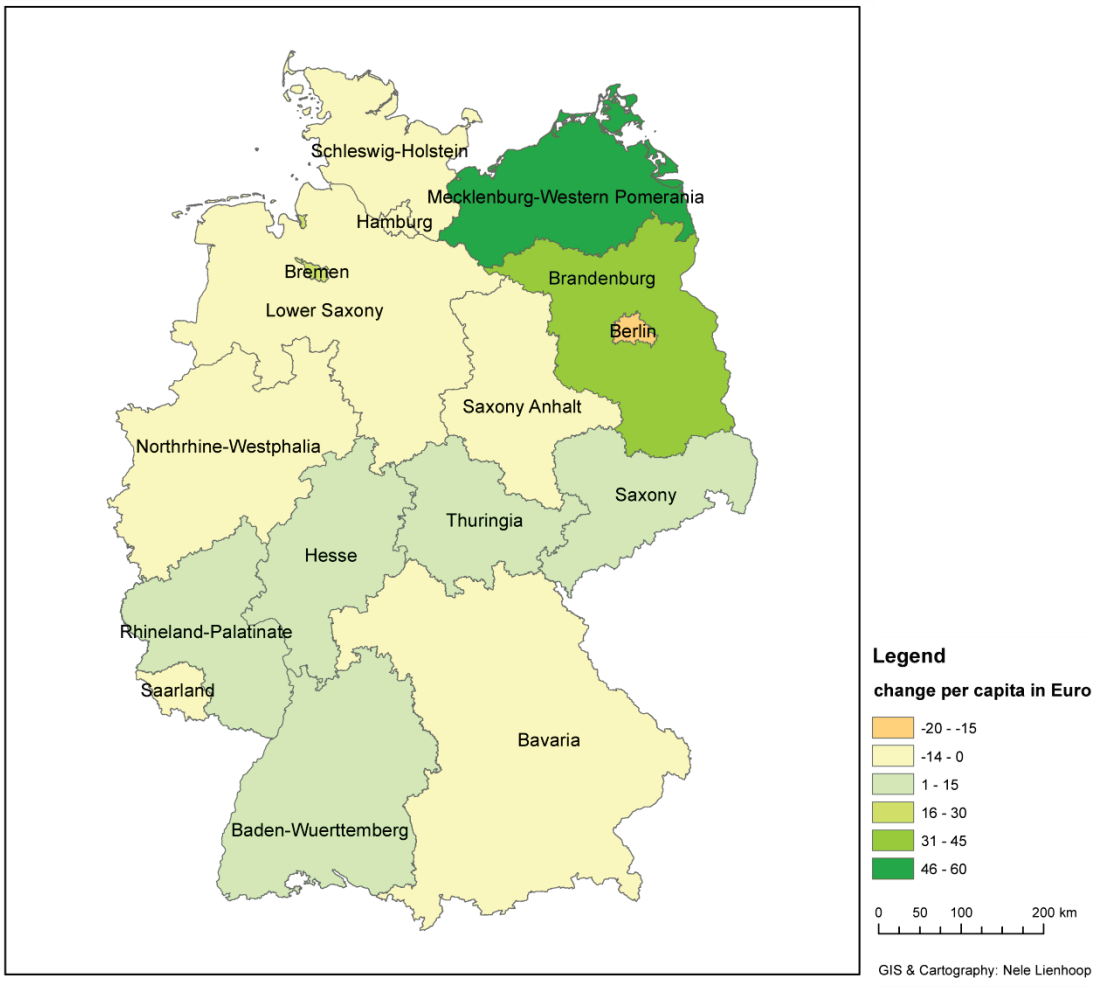

Figure 7-1: Marginal change by EFT stage 2 in state's tax income per capita
Source: Own calculations

Another angle on our modelling results is to look at the absolute changes in tax income the German Länder would face. Table 7-11 shows the absolute effects of area-based EFTs on the allocation of transfers to the Länder, table 7-12 below presents marginal changes of EFT compared with allocations induced by the existing allocation rules for fiscal transfers.

Table 7-11: Change of total tax income of the states via status quo transfers and via area-based-EFT

State	Total tax income in 1000 €											
	before FT	after FT status quo	win / loss by FT absolute	win / loss by FT relative	after EFT stage 1a	win / loss by EFT	after EFT stage 1b	win / loss by EFT	after EFT stage 2	win / loss by EFT	after EFT stage 3	win / loss by EFT
Baden-Wuerttemberg	36,987,929 €	35,279,093 €	- 1,708,837 €	-4.6%	35,380,296 €	- 1,607,633 €	35,288,504 €	- 1,699,425 €	35,348,090 €	- 1,639,839 €	35,359,787 €	- 1,628,142 €
Bavaria	45,206,394 €	41,695,261 €	- 3,511,134 €	-7.8%	41,572,334 €	- 3,634,060 €	41,530,901 €	- 3,675,493 €	41,561,629 €	- 3,644,766 €	41,526,764 €	- 3,679,631 €
Berlin	9,766,221 €	13,577,882 €	3,811,661 €	39.0%	13,508,871 €	3,742,650 €	13,498,026 €	3,731,805 €	13,509,915 €	3,743,694 €	13,515,717 €	3,749,497 €
Brandenburg	6,963,589 €	7,540,686 €	577,098 €	8.3%	7,655,122 €	691,534 €	7,604,371 €	640,783 €	7,640,392 €	676,803 €	7,597,576 €	633,987 €
Bremen	2,078,802 €	2,669,588 €	590,786 €	28.4%	2,688,266 €	609,464 €	2,685,722 €	606,920 €	2,686,034 €	607,232 €	2,680,646 €	601,844 €
Hamburg	7,787,198 €	7,720,891 €	- 66,307 €	-0.9%	7,704,935 €	- 82,263 €	7,748,182 €	- 39,016 €	7,709,104 €	- 78,093 €	7,712,894 €	- 74,304 €
Hesse	22,093,465 €	20,341,125 €	- 1,752,340 €	-7.9%	20,445,111 €	- 1,648,353 €	20,384,623 €	- 1,708,842 €	20,432,908 €	- 1,660,556 €	20,392,754 €	- 1,700,711 €
Mecklenburg-Western Pomerania	4,317,508 €	4,873,933 €	556,425 €	12.9%	4,935,677 €	618,169 €	5,002,898 €	685,390 €	4,958,635 €	641,127 €	4,944,180 €	626,672 €
Lower Saxony	23,941,170 €	24,327,746 €	386,576 €	1.6%	24,232,667 €	291,497 €	24,352,777 €	411,606 €	24,254,929 €	313,758 €	24,257,593 €	316,423 €
North Rhine-Westphalia	54,921,993 €	55,394,843 €	472,851 €	0.9%	55,117,020 €	195,027 €	55,071,508 €	149,516 €	55,204,798 €	282,806 €	55,390,184 €	468,191 €
Rhineland-Palatinate	11,831,128 €	12,241,828 €	410,700 €	3.5%	12,324,454 €	493,326 €	12,268,046 €	436,919 €	12,303,890 €	472,763 €	12,304,236 €	473,108 €
Saarland	2,965,256 €	3,100,993 €	135,737 €	4.6%	3,095,118 €	129,863 €	3,087,288 €	122,033 €	3,094,293 €	129,038 €	3,107,956 €	142,701 €
Saxony	11,065,729 €	12,269,656 €	1,203,927 €	10.9%	12,306,712 €	1,240,983 €	12,259,305 €	1,193,575 €	12,290,732 €	1,225,002 €	12,283,089 €	1,217,359 €
Saxony Anhalt	6,243,893 €	6,943,273 €	699,380 €	11.2%	6,927,253 €	683,360 €	6,909,657 €	665,764 €	6,923,266 €	679,373 €	6,928,519 €	684,626 €
Schleswig-Holstein	8,557,608 €	8,710,257 €	152,648 €	1.8%	8,651,249 €	93,641 €	9,012,557 €	454,949 €	8,676,275 €	118,667 €	8,676,662 €	119,053 €
Thuringia	5,933,429 €	6,598,008 €	664,578 €	11.2%	6,625,345 €	691,915 €	6,597,971 €	664,542 €	6,617,430 €	684,000 €	6,606,124 €	672,694 €

Source: own calculation

Table 7-11 shows that e.g. Baden-Wuerttemberg would have to provide € 1.7 million to the total transfer budget under the status quo and € 1.6 million if EFT 2 would be implemented, while Brandenburg would receive approximately € 0.6 million under the status quo and € 0.7 million if EFT 2 would be applied.

Table 7-12: Marginal change of total tax income of the states via area-based-EFT

State	Marginal change of total tax income in 1000 €							
	EFT 1a vs status quo		EFT 1b vs status quo		EFT 2 vs status quo		EFT 3 vs status quo	
	absolute	relative	absolute	relative	absolute	relative	absolute	relative
Baden-Wuerttemberg	101,203 €	0.3%	9,412 €	0.0%	68,997 €	0.2%	80,694 €	0.2%
Bavaria	- 122,926 €	-0.3%	- 164,359 €	-0.4%	- 133,632 €	-0.3%	- 168,497 €	-0.4%
Berlin	- 69,011 €	-0.5%	- 79,856 €	-0.6%	- 67,967 €	-0.5%	- 62,164 €	-0.5%
Brandenburg	114,436 €	1.5%	63,685 €	0.8%	99,706 €	1.3%	56,889 €	0.8%
Bremen	18,678 €	0.7%	16,134 €	0.6%	16,446 €	0.6%	11,058 €	0.4%
Hamburg	- 15,956 €	-0.2%	27,291 €	0.4%	- 11,786 €	-0.2%	- 7,997 €	-0.1%
Hesse	103,986 €	0.5%	43,498 €	0.2%	91,783 €	0.5%	51,629 €	0.3%
Mecklenburg-Western Pomerania	61,744 €	1.3%	128,965 €	2.6%	84,702 €	1.7%	70,247 €	1.4%
Lower Saxony	- 95,079 €	-0.4%	25,030 €	0.1%	- 72,818 €	-0.3%	- 70,153 €	-0.3%
North Rhine-Westphalia	- 277,824 €	-0.5%	- 323,335 €	-0.6%	- 190,045 €	-0.3%	- 4,659 €	0.0%
Rhineland-Palatinate	82,626 €	0.7%	26,219 €	0.2%	62,063 €	0.5%	62,408 €	0.5%
Saarland	- 5,875 €	-0.2%	- 13,705 €	-0.4%	- 6,700 €	-0.2%	6,963 €	0.2%
Saxony	37,056 €	0.3%	- 10,351 €	-0.1%	21,076 €	0.2%	13,433 €	0.1%
Saxony Anhalt	- 16,020 €	-0.2%	- 33,616 €	-0.5%	- 20,007 €	-0.3%	- 14,754 €	-0.2%
Schleswig-Holstein	- 59,007 €	-0.7%	302,300 €	3.5%	- 33,982 €	-0.4%	- 33,595 €	-0.4%
Thuringia	27,337 €	0.4%	- 36 €	0.0%	19,422 €	0.3%	8,116 €	0.1%

Source: own calculation

Table 7-12 above shows the marginal changes of the different EFT scenarios compared to the status quo. Exemplarily, Baden-Wuerttemberg, Brandenburg and Hesse would gain more than € 100 million per year each if EFT based on terrestrial Natura 2000-sites would be introduced. On the other side, North Rhine Westphalia, a receiving state under the current transfer scheme, would become a net giver and would lose around € 277 million per year through EFT stage 1a. Again, recognising marine Natura 2000-sites (EFT stage 1b) significantly benefits coastal states, such as Mecklenburg-Western Pomerania, which would receive twice the amount of transfers under EFT stage 1b compared to stage 1a. Schleswig Holstein would be better off with EFT stage 1b than in the current system or any other EFT scheme. Moreover, what can also be seen in this table, the more types of protected areas recognised (moving from left to right) the more evenly the distribution becomes.

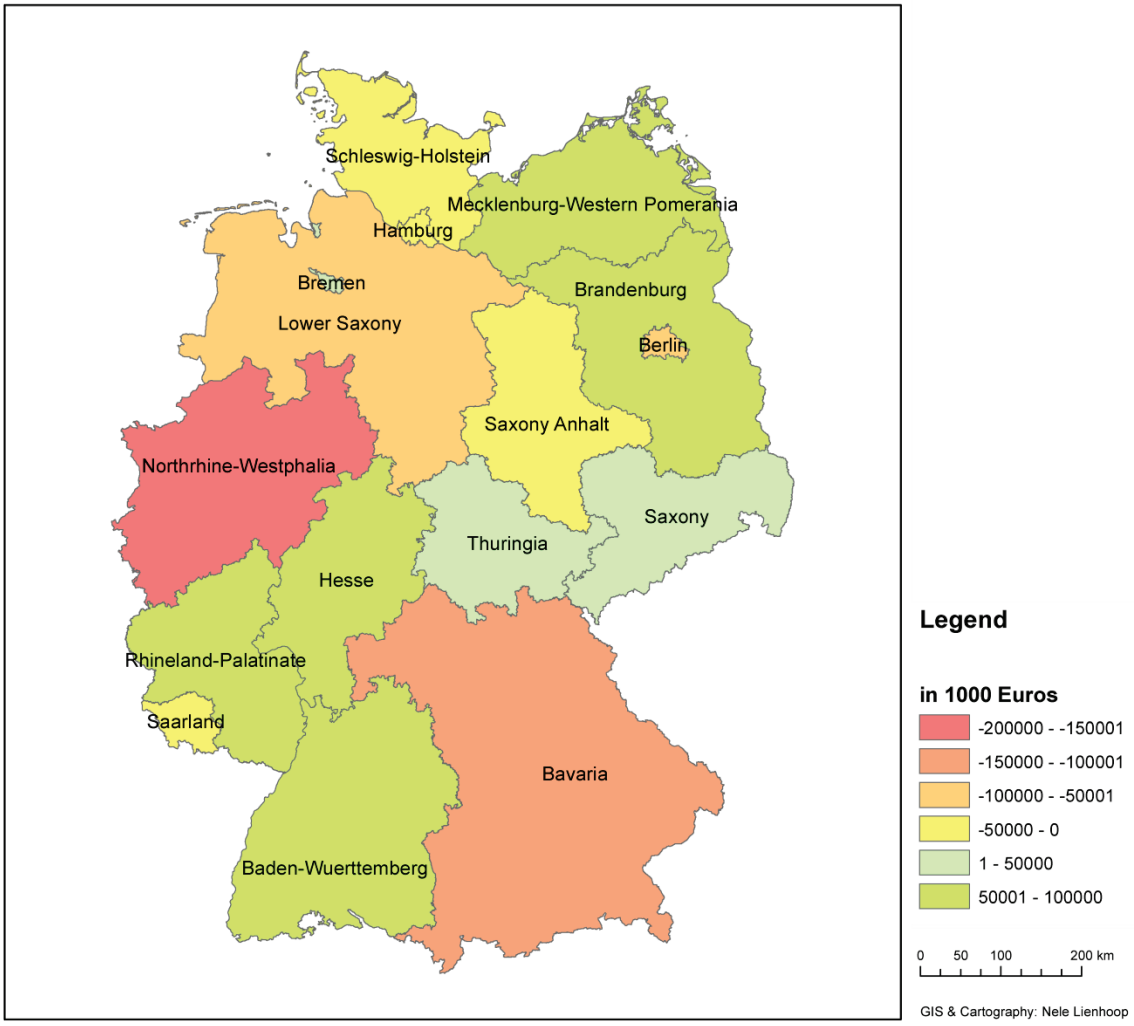

Figure 7-2: Marginal change of total tax income of the states via EFT
Source: own calculation

Figure 7-2 shows the results for EFT stage 2 in graphical form.

7.4.2 Ecological fiscal transfers resulting from complex conservation factors

For the second simulation run we added qualitative conservation factors as proposed in section 6.3.3 and 6.3.4. As was presented above in section 6.3.5, we tested two different sets of these complex conservation factors. 'EFT stage 4' building on 'EFT stage 3', i.e. the index based on terrestrial areas dedicated for nature and species conservation as well as areas for landscape protection and added in an index of landscape fragmentation. However, the index of landscape fragmentation is weighted at 0.1; while nature and species conservation is weighted at 0.72 and landscape protection at 0.18 respectively (see section 7.2). Finally, for 'EFT stage 5' we also considered the responsibility of each of the states in protecting habitats critical for species for which Germany holds specific conservation responsibility. Again this indicator was weighted at 0.1, the same as for the index of landscape fragmentation. Consequently, the weight for nature and landscape conservation (0.64) and landscape protection (0.16) is reduced.

The results of our simulation are presented below in the same order as in the previous section: we firstly provide a total overview of distribution to all German Länder and secondly, a comparison of transfers received by each state under the current scheme and the EFT alternatives.

Table 7-13: State's tax income per capita before fiscal transfers, after status quo fiscal transfers (as of 2010) and after EFT 4-5 (complex indicators)

State	Tax income per capita							
	before FT	after FT status quo	win / loss by FT absolute	win / loss by FT relative	after EFT stage 4	win / loss by EFT	after EFT stage 5	win / loss by EFT
Baden-Wuerttemberg	3,441 €	3,282 €	- 159 €	-4.6%	3,288 €	- 153 €	3,288 €	- 153 €
Bavaria	3,611 €	3,331 €	- 280 €	-7.8%	3,319 €	- 292 €	3,321 €	- 290 €
Berlin	2,835 €	3,942 €	1,107 €	39.0%	3,924 €	1,089 €	3,921 €	1,086 €
Brandenburg	2,777 €	3,007 €	230 €	8.3%	3,032 €	255 €	3,029 €	253 €
Bremen	3,152 €	4,048 €	896 €	28.4%	4,066 €	914 €	4,060 €	908 €
Hamburg	4,377 €	4,340 €	- 37 €	-0.9%	4,334 €	- 43 €	4,334 €	- 43 €
Hesse	3,643 €	3,354 €	- 289 €	-7.9%	3,361 €	- 282 €	3,361 €	- 282 €
Mecklenburg-Western Pomerania	2,622 €	2,960 €	338 €	12.9%	3,004 €	382 €	2,999 €	377 €
Lower Saxony	3,018 €	3,067 €	49 €	1.6%	3,060 €	42 €	3,061 €	43 €
North Rhine-Westphalia	3,077 €	3,103 €	26 €	0.9%	3,101 €	24 €	3,102 €	25 €
Rhineland-Palatinate	2,953 €	3,055 €	102 €	3.5%	3,068 €	115 €	3,067 €	115 €
Saarland	2,908 €	3,041 €	133 €	4.6%	3,045 €	137 €	3,045 €	138 €
Saxony	2,664 €	2,954 €	290 €	10.9%	2,956 €	292 €	2,955 €	291 €
Saxony Anhalt	2,663 €	2,961 €	298 €	11.2%	2,959 €	296 €	2,958 €	295 €
Schleswig-Holstein	3,022 €	3,076 €	54 €	1.8%	3,069 €	46 €	3,069 €	46 €
Thuringia	2,647 €	2,944 €	297 €	11.2%	2,948 €	301 €	2,949 €	301 €

Source: Own calculations

Table 7-14: Marginal change by EFT stage 4 to 5 in state's tax income per capita

State	Marginal change of tax income per capita			
	EFT 4 vs status quo		EFT 5 vs status quo	
	absolute	relative	absolute	relative
Baden-Wuerttemberg	6 €	0.2%	6 €	0.2%
Bavaria	- 11 €	-0.3%	- 9 €	-0.3%
Berlin	- 18 €	-0.5%	- 21 €	-0.5%
Brandenburg	25 €	0.8%	22 €	0.7%
Bremen	18 €	0.4%	13 €	0.3%
Hamburg	- 6 €	-0.1%	- 6 €	-0.1%
Hesse	7 €	0.2%	7 €	0.2%
Mecklenburg-Western Pomerania	44 €	1.5%	39 €	1.3%
Lower Saxony	- 6 €	-0.2%	- 6 €	-0.2%
North Rhine-Westphalia	- 2 €	-0.1%	- 2 €	-0.1%
Rhineland-Palatinate	13 €	0.4%	12 €	0.4%
Saarland	4 €	0.1%	5 €	0.2%
Saxony	2 €	0.1%	1 €	0.0%
Saxony Anhalt	- 3 €	-0.1%	- 3 €	-0.1%
Schleswig-Holstein	- 8 €	-0.3%	- 8 €	-0.3%
Thuringia	4 €	0.1%	5 €	0.2%

Source: Own calculations

Tables 7-13 and 7-14 above provide an overview of the changes in tax income per capita if EFT with complex nature conservation factors would be introduced. It can be seen that the changes induced by EFT compared to the transfers under the current scheme are small and even smaller as the changes induced by the area-based EFT in stages 2 and 3. Still, Mecklenburg-Western Pomerania would be the main beneficiary of EFT (+1.3 per cent) while the city-state of Berlin would be the biggest loser (-0.5 per cent). It is important to note, that for this calculation fragmentation (in EFT 4 and 5) and the index for the national responsibility (in EFT 5 only) were considered with a rather low weight (0.1 each, see Table 7-7 on page 60), leaving the area-based indicators still at a high share of the total conservation factor. Variations of the weights for the indicators on landscape fragmentation can be found in section 7.4.4 below.

Table 7-15 below provides the effects of EFT stages 4 and 5 on the total tax income of the states, while thereafter table 7-16 shows the marginal change of total tax income of the states compared to the current fiscal transfer scheme.

Table 7-15: Change of total tax income of the states via status quo transfers (as of 2010) and via complex EFT stage 4-5

State	Total tax income in 1000 €							
	before FT	after FT status quo	win / loss by FT absolute	win / loss by FT relative	after EFT stage 4	win / loss by EFT	after EFT stage 5	win / loss by EFT
Baden-Wuerttemberg	36,987,929 €	35,279,093 €	- 1,708,837 €	-4.6%	35,344,795 €	- 1,643,134 €	35,344,947 €	- 1,642,982 €
Bavaria	45,206,394 €	41,695,261 €	- 3,511,134 €	-7.8%	41,553,340 €	- 3,653,054 €	41,579,756 €	- 3,626,638 €
Berlin	9,766,221 €	13,577,882 €	3,811,661 €	39.0%	13,515,834 €	3,749,613 €	13,506,100 €	3,739,880 €
Brandenburg	6,963,589 €	7,540,686 €	577,098 €	8.3%	7,603,375 €	639,787 €	7,596,853 €	633,264 €
Bremen	2,078,802 €	2,669,588 €	590,786 €	28.4%	2,681,568 €	602,766 €	2,678,006 €	599,203 €
Hamburg	7,787,198 €	7,720,891 €	- 66,307 €	-0.9%	7,709,947 €	- 77,251 €	7,710,904 €	- 76,294 €
Hesse	22,093,465 €	20,341,125 €	- 1,752,340 €	-7.9%	20,382,053 €	- 1,711,411 €	20,381,749 €	- 1,711,716 €
Mecklenburg-Western Pomerania	4,317,508 €	4,873,933 €	556,425 €	12.9%	4,945,879 €	628,372 €	4,938,278 €	620,770 €
Lower Saxony	23,941,170 €	24,327,746 €	386,576 €	1.6%	24,276,694 €	335,524 €	24,279,343 €	338,173 €
North Rhine-Westphalia	54,921,993 €	55,394,843 €	472,851 €	0.9%	55,359,022 €	437,029 €	55,365,791 €	443,798 €
Rhineland-Palatinate	11,831,128 €	12,241,828 €	410,700 €	3.5%	12,293,461 €	462,333 €	12,291,071 €	459,943 €
Saarland	2,965,256 €	3,100,993 €	135,737 €	4.6%	3,105,447 €	140,192 €	3,105,661 €	140,406 €
Saxony	11,065,729 €	12,269,656 €	1,203,927 €	10.9%	12,278,217 €	1,212,488 €	12,273,437 €	1,207,708 €
Saxony Anhalt	6,243,893 €	6,943,273 €	699,380 €	11.2%	6,937,368 €	693,475 €	6,935,738 €	691,845 €
Schleswig-Holstein	8,557,608 €	8,710,257 €	152,648 €	1.8%	8,688,055 €	130,447 €	8,688,193 €	130,585 €
Thuringia	5,933,429 €	6,598,008 €	664,578 €	11.2%	6,607,588 €	674,158 €	6,609,000 €	675,571 €

Source: own calculation

Table 7-16: Marginal change of total tax income of the states via complex EFT stage 4-5

State	Marginal change of total tax income in 1000 €			
	EFT 4 vs status quo		EFT 5 vs status quo	
	absolute	relative	absolute	relative
Baden-Wuerttemberg	65,702 €	0.2%	65,855 €	0.2%
Bavaria	- 141,920 €	-0.3%	- 115,505 €	-0.3%
Berlin	- 62,048 €	-0.5%	- 71,781 €	-0.5%
Brandenburg	62,689 €	0.8%	56,167 €	0.7%
Bremen	11,980 €	0.4%	8,417 €	0.3%
Hamburg	- 10,944 €	-0.1%	- 9,987 €	-0.1%
Hesse	40,929 €	0.2%	40,624 €	0.2%
Mecklenburg-Western Pomerania	71,947 €	1.5%	64,345 €	1.3%
Lower Saxony	- 51,052 €	-0.2%	- 48,403 €	-0.2%
North Rhine-Westphalia	- 35,821 €	-0.1%	- 29,052 €	-0.1%
Rhineland-Palatinate	51,633 €	0.4%	49,243 €	0.4%
Saarland	4,454 €	0.1%	4,668 €	0.2%
Saxony	8,561 €	0.1%	3,781 €	0.0%
Saxony Anhalt	- 5,905 €	-0.1%	- 7,535 €	-0.1%
Schleswig-Holstein	- 22,202 €	-0.3%	- 22,064 €	-0.3%
Thuringia	9,580 €	0.1%	10,992 €	0.2%

Source: own calculation

As was stated above for the per capita results, the complex EFT schemes (EFT stages 4 to 5) tend to be more leveled across all states and closer to the distribution of transfers under the current scheme than were the area-based approaches (EFT stages 1 to 3). In absolute terms Mecklenburg Western-Pomerania benefits the most under EFT stage 4, as it would additionally receive around € 72 million per year. Under EFT stage 5, Baden-Wuerttemberg would gain even more than Mecklenburg, as the state would have to pay € 65 million less per year to the total transfer fund.

7.4.3 Detailed observation on the distributive effects of the proposed EFT options

As was seen above, the effect of integrating ecological indicators into the existing fiscal transfer scheme in Germany is rather small with the highest increase in tax income of 3.5 per cent per annum for Schleswig Holstein (stage 1b – considering terrestrial and marine Natura 2000-sites). Hence, it is important to stress again that fiscal transfers is a multi-purpose instrument not specifically focused on providing resources for nature conservation but to endow states with the funds necessary to fulfil their responsibilities. Nature conservation is but one of those responsibilities and other needs of citizens, such as education, infrastructure development or social care are competing issues.

In order to look at the effects of the different EFT options in this broader context, this section picks out four states with special characteristics (population density, size of the state, status quo of nature conservation activities) that are representative for all of the states. We think it to be sensible to distinguish between states with high and low population density (which is a precursor for the opportunity costs but also for the locally captured benefits of area-based nature conservation activities) and the current nature conservation activities (which is a precursor for the marginal benefits of additional nature conservation activities). However, we left out city states (Berlin, Hamburg and Bremen) from our sample as they are so special in terms of their institutional set-up and also in terms of the assessment of their fiscal needs (leading to a calculatory 35 per cent surcharge on the number of inhabitants) in the existing transfer scheme. Hence we chose the below sample from the 16 states, including Hesse, Mecklenburg-Western Pomerania, North Rhine-Westphalia and Saxony Anhalt:

Table 7-17: Sample of selected states for fine grain analysis

		Population density	
		high	low
Current level of nature conservation activity	high	Hesse	Mecklenburg-Western Pomerania
	low	North Rhine-Westphalia	Saxony Anhalt

Source: own calculation

To assess the changes to the distribution of fiscal transfers we firstly take a look at the current position of the above mentioned states in the transfer regime. Hesse is among the three wealthiest and densely populated states in Germany thus their tax income is far above average. This in turn implies that Hesse is among the donor states in the transfer system, with a contribution of more than € 1.7 billion in total or € 289 per capita in 2010 making it the largest donor in per capita terms. In contrast, Mecklenburg-Western Pomerania is the sparsely populated state in Germany and among the economically less developed. In 2010 it received more than € 500 million in total or € 338 per capita from fiscal transfers making it the largest recipient. Both Mecklenburg-Western Pomerania and Hesse are already providing huge contributions towards nature protection goals, as they are ranking first and fourth respectively in the nature and species conservation index (see also Table 7-7).

North Rhine-Westphalia is among the densely populated states in Germany and home of the industrial center "Ruhrgebiet" but is facing strong problems of economic change from the former coal and steel industries towards logistics and service industries. It is among the marginal states in the transfer systems, i.e. in 2010 though it received around € 470 million in total this translated in transfers of only € 26 per capita. Saxony Anhalt, a state of former East Germany, is dominated by agricultural landscapes and mostly

rural communities. It is among the economically less developed states with a transfer inflow of € 700 million in total or € 298 per capita making it the second largest receiver in the transfer system. Both Saxony Anhalt and North Rhine-Westphalia are currently among the least active states in nature conservation – at least judged from their ranking (10th and 14th) in the nature and species conservation index (see Table 7-7).

Figure 7-3 below depicts the current transfers of these four states with the potential transfers that would result from the EFT options proposed above. As one can see, both Hesse and Mecklenburg-Western Pomerania would be better off in any of the proposed EFT options due to their high level of current nature conservation activities. This also implies that though Hesse is among the wealthiest states in Germany it would have to spend a considerable amount less under EFT than under the current transfer scheme. Mecklenburg-Western Pomerania would benefit from EFT by a higher available public budget that could be used in any way the state decides, e.g. for promoting economic development, advancing infrastructure facilities or even further improving nature conservation activities.

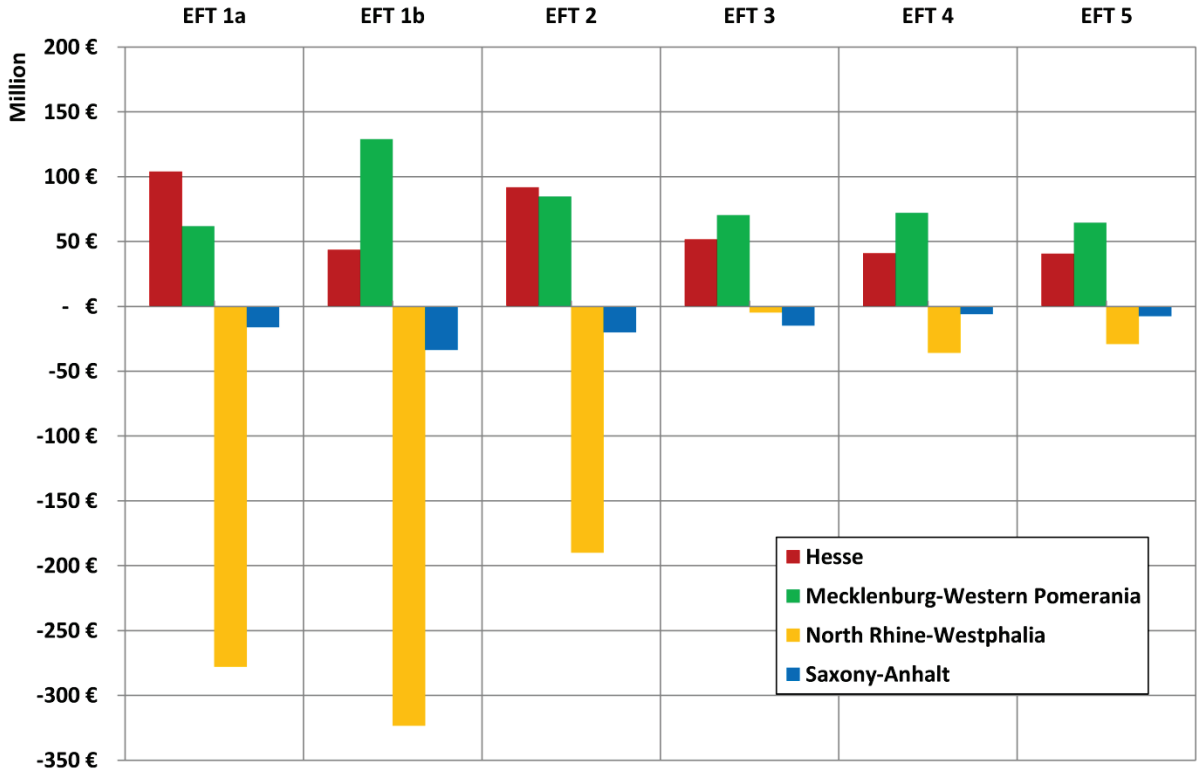

Figure 7-3: Change of transfers incurred by selected states under different EFT scenarios
Source: own representation

On the other hand, North Rhine-Westphalia and Saxony Anhalt would receive less under all proposed EFT schemes due to their current (low) level of nature conservation activity. Especially in the case of North Rhine-Westphalia this would result in a cut back in total available budget of up to € 320 million annually (under the EFT 1b scenario). Saxony Anhalt would still have to deal with a cut back in transfers of around € 30 million per year (under EFT 1b scenario).

Looking at the full picture it is also nicely illustrated that the more complex nature conservation factors that embrace a range of area-based and qualitative indicators tend to distribute funds more closely to the current distribution.

7.4.4 Sensitivity analysis

Clearly, the results presented above rely on the way the ecological indicators are combined to become an eco-index to be integrated into the fiscal transfer mechanism. This holds specifically true for the different weighting factors that are applied to the more complex indexes that integrate two or more indicators (EFT stages 3 to 5). To test some of the effects resulting from applying different weightings we performed several additional simulation runs with different weights. The different modifications are shown in table 7-18 below.

Table 7-18: Weights of indicators in sensitivity analysis scenarios

	Indicator Weights											
Stage	*Basic Scenario (80 / 20)*		*Basic Scenario / High Fragmentation*		*High Protection (90 / 10)*		*High Protection / High Fragmentation*		*Strongest Protection (100 / 0)*		*Strongest Protection / High Fragmentation*	
	Weight	Indicator	Weight	Indicator	Weight	Indicator	Weight	Indicator	Weight	Indicator	Weight	Indicator
EFT 3	80	Nature and species conservation			90	Nature and species conservation			100	Nature and species conservation		
	20	Landscape protection			10	Landscape protection			0	Landscape protection		
EFT 4	72	Nature and species conservation	48	Nature and species conservation	81	Nature and species conservation	54	Nature and species conservation	90	Nature and species conservation	60	Nature and species conservation
	18	Landscape protection	12	Landscape protection	9	Landscape protection	6	Landscape protection	0	Landscape protection	0	Landscape Protection
	10	Fragmentation	40	Fragmentation	10	Fragmentation	40	Fragmentation	10	Fragmentation	40	Fragmentation
EFT 5	64	Nature and species conservation	43	Nature and species conservation	72	Nature and species conservation	49	Nature and species conservation	80	Nature and species conservation	54	Nature and species conservation
	16	Landscape protection	11	Landscape protection	8	Landscape protection	5	Landscape protection	0	Landscape protection	0	Landscape Protection
	10	Fragmentation	36	Fragmentation	10	Fragmentation	36	Fragmentation	10	Fragmentation	36	Fragmentation
	10	Responsibility	10	Responsibility	10	Responsibility	10	Responsibility	10	Responsibility	10	Responsibility

Source: own representation

Starting from the basic scenario modeled above, we developed two further scenarios, one called 'High Protection' and the second one 'Strongest Protection'. Compared to the basic scenario we stepwise increased the weight of the strict protected areas, such as Natura 2000-sites, national parks and nature protection sites while reducing the weight of the less strict protected areas subsumed under the indicator 'Landscape protection'. We thought this to be reasonable because biodiversity conservation effectiveness of landscape protection sites is deemed to be low and there are merely any land-use restrictions resulting out of a site being dedicated to such a protected area. Hence, for the scenario 'High Protection' the weight for nature conservation was increased to 90 per cent (cp. to 80 per cent in the basic scenario) whiles the weight for landscape protection was reduced to 10 per cent (cp. to 20 per cent in the basic scenario). For the scenario 'Strongest Protection' we completely took off landscape protection, i.e. the weight was reduced to 0 (cp. 20 per cent in the basic scenario) while taking landscape protection as the only area-based indicator to be part of the conservation factor.

Furthermore, we thought it to be sensible to explore the effects of a stronger focus on the area outside the protected sites. The indicator representing landscape connectivity in our set was landscape fragmentation. We therefore built up sub-scenarios to all of our conservation factors (Basic, High Protection, Strongest Protection), where we increased the weight of this indicator to 40 per cent (cp. to 10 per cent in the basic scenario).

So in total we explored five different sensitivity scenarios for our data set. Tables 7-19 to 7-21 show the per capita results of our sensitivity analysis. Table 7-19 covers the results for EFT stage 3, i.e. the conservation factor covering the nature and species conservation-index and the landscape protection index. As this stage does not include any qualitative index there are no results for the 'High Fragmentation' scenarios, so the table comprises only two scenarios.

Table 7-19: Per capita results of sensitivity analysis EFT stage 3

State	Tax income per capita in EFT stage 3				
	Basic scenario (80/20)	High Protection (90/10)	Change vs. basic scenario	Strongest Protection (100/0)	Change vs. basic scenario
Baden-Wuerttemberg	3,289 €	3,289 €	-0.02%	3,288 €	-0.03%
Bavaria	3,317 €	3,318 €	0.04%	3,320 €	0.08%
Berlin	3,924 €	3,923 €	-0.02%	3,922 €	-0.04%
Brandenburg	3,030 €	3,038 €	0.28%	3,047 €	0.56%
Bremen	4,064 €	4,068 €	0.10%	4,072 €	0.20%
Hamburg	4,335 €	4,334 €	-0.02%	4,333 €	-0.05%
Hesse	3,363 €	3,366 €	0.10%	3,370 €	0.20%
Mecklenburg-Western Pomerania	3,003 €	3,007 €	0.15%	3,012 €	0.29%
Lower Saxony	3,058 €	3,058 €	-0.01%	3,058 €	-0.01%
North Rhine-Westphalia	3,103 €	3,098 €	-0.17%	3,093 €	-0.33%
Rhineland-Palatinate	3,071 €	3,071 €	0.00%	3,071 €	0.00%
Saarland	3,048 €	3,041 €	-0.22%	3,034 €	-0.44%
Saxony	2,957 €	2,958 €	0.03%	2,959 €	0.06%
Saxony Anhalt	2,955 €	2,954 €	-0.04%	2,953 €	-0.08%
Schleswig-Holstein	3,064 €	3,064 €	0.00%	3,064 €	0.00%
Thuringia	2,948 €	2,950 €	0.09%	2,953 €	0.17%

Source: own calculation

Table 7-20: Per capita results of sensitivity analysis EFT stage 4

State	Tax income per capita in EFT stage 4										
	Basic scenario (80/20)	Basic scenario / High Fragmentation	Change vs. basic scenario	High Protection (90/10)	Change vs. basic scenario	High Protection / High Fragmentation	Change vs. basic scenario	Strongest Protection (100/0)	Change vs. basic scenario	Strongest Protection / High Fragmentation	Change vs. basic scenario
Baden-Wuerttemberg	3,288 €	3,284 €	0.03%	3,287 €	-0.01%	3,283 €	-0.14%	3,287 €	-0.03%	3,283 €	-0.15%
Bavaria	3,319 €	3,326 €	0.19%	3,320 €	0.04%	3,326 €	0.22%	3,322 €	0.08%	3,327 €	0.24%
Berlin	3,924 €	3,924 €	0.00%	3,923 €	-0.02%	3,924 €	-0.01%	3,922 €	-0.04%	3,923 €	-0.02%
Brandenburg	3,032 €	3,039 €	0.23%	3,040 €	0.25%	3,044 €	0.40%	3,047 €	0.51%	3,049 €	0.57%
Bremen	4,066 €	4,070 €	0.10%	4,069 €	0.09%	4,072 €	0.16%	4,073 €	0.18%	4,075 €	0.23%
Hamburg	4,334 €	4,328 €	-0.12%	4,333 €	-0.02%	4,328 €	-0.13%	4,332 €	-0.05%	4,327 €	-0.15%
Hesse	3,361 €	3,356 €	-0.16%	3,364 €	0.09%	3,358 €	-0.10%	3,367 €	0.18%	3,360 €	-0.04%
Mecklenburg-Western Pomerania	3,004 €	3,007 €	0.10%	3,008 €	0.13%	3,010 €	0.19%	3,012 €	0.26%	3,012 €	0.28%
Lower Saxony	3,060 €	3,068 €	0.24%	3,060 €	0.00%	3,068 €	0.24%	3,060 €	-0.01%	3,068 €	0.23%
North Rhine-Westphalia	3,101 €	3,096 €	-0.17%	3,097 €	-0.15%	3,093 €	-0.27%	3,092 €	-0.30%	3,090 €	-0.37%
Rhineland-Palatinate	3,068 €	3,060 €	-0.26%	3,068 €	0.00%	3,060 €	-0.27%	3,068 €	0.00%	3,060 €	-0.27%
Saarland	3,045 €	3,038 €	-0.24%	3,039 €	-0.20%	3,034 €	-0.38%	3,033 €	-0.40%	3,030 €	-0.51%
Saxony	2,956 €	2,952 €	-0.12%	2,957 €	0.03%	2,953 €	-0.10%	2,958 €	0.06%	2,954 €	-0.08%
Saxony Anhalt	2,959 €	2,970 €	0.39%	2,958 €	-0.03%	2,970 €	0.36%	2,957 €	-0.07%	2,969 €	0.34%
Schleswig-Holstein	3,069 €	3,081 €	0.40%	3,068 €	0.00%	3,081 €	0.40%	3,068 €	0.00%	3,081 €	0.40%
Thuringia	2,948 €	2,950 €	0.07%	2,951 €	0.08%	2,952 €	0.12%	2,953 €	0.15%	2,953 €	0.17%

Source: own representation

Table 7-21: Per capita results of sensitivity analysis EFT stage 5

State	Tax income per capita in EFT stage 5										
	Basic scenario (80/20)	Basic scenario / High Fragmentation	Change vs. basic scenario	High Protection (90/10)	Change vs. basic scenario	High Protection / High Fragmentation	Change vs. basic scenario	Strongest Protection (100/0)	Change vs. basic scenario	Strongest Protection / High Fragmentation	Change vs. basic scenario
Baden-Wuerttemberg	3,288 €	3,284 €	0.03%	3,287 €	-0.01%	3,284 €	-0.12%	3,287 €	-0.03%	3,284 €	-0.13%
Bavaria	3,321 €	3,327 €	0.17%	3,322 €	0.03%	3,328 €	0.19%	3,324 €	0.07%	3,328 €	0.21%
Berlin	3,921 €	3,921 €	0.00%	3,920 €	-0.02%	3,921 €	-0.01%	3,920 €	-0.04%	3,920 €	-0.02%
Brandenburg	3,029 €	3,036 €	0.21%	3,036 €	0.23%	3,040 €	0.36%	3,044 €	0.46%	3,045 €	0.52%
Bremen	4,060 €	4,064 €	0.09%	4,064 €	0.08%	4,066 €	0.14%	4,067 €	0.16%	4,068 €	0.20%
Hamburg	4,334 €	4,330 €	-0.10%	4,333 €	-0.02%	4,329 €	-0.11%	4,332 €	-0.04%	4,328 €	-0.13%
Hesse	3,361 €	3,356 €	-0.14%	3,364 €	0.08%	3,358 €	-0.09%	3,366 €	0.16%	3,360 €	-0.03%
Mecklenburg-Western Pomerania	2,999 €	3,002 €	0.09%	3,003 €	0.12%	3,004 €	0.17%	3,006 €	0.24%	3,007 €	0.25%
Lower Saxony	3,061 €	3,067 €	0.21%	3,061 €	0.00%	3,067 €	0.20%	3,061 €	-0.01%	3,067 €	0.20%
North Rhine-Westphalia	3,102 €	3,097 €	-0.15%	3,097 €	-0.13%	3,094 €	-0.24%	3,093 €	-0.27%	3,091 €	-0.33%
Rhineland-Palatinate	3,067 €	3,060 €	-0.23%	3,067 €	0.00%	3,060 €	-0.23%	3,067 €	0.00%	3,060 €	-0.23%
Saarland	3,045 €	3,039 €	-0.22%	3,040 €	-0.18%	3,035 €	-0.34%	3,034 €	-0.37%	3,031 €	-0.47%
Saxony	2,955 €	2,952 €	-0.10%	2,956 €	0.02%	2,952 €	-0.09%	2,956 €	0.05%	2,953 €	-0.07%
Saxony Anhalt	2,958 €	2,968 €	0.33%	2,957 €	-0.03%	2,967 €	0.31%	2,956 €	-0.06%	2,967 €	0.29%
Schleswig-Holstein	3,069 €	3,079 €	0.34%	3,069 €	0.00%	3,079 €	0.34%	3,068 €	0.00%	3,079 €	0.34%
Thuringia	2,949 €	2,951 €	0.06%	2,951 €	0.07%	2,952 €	0.10%	2,953 €	0.14%	2,953 €	0.15%

Source: own representation

Overall, distribution is changing only marginally when we changed the weights of the different conservation factors, i.e. the results are stable even if we change the composition and weights of the individual nature conservation indicators within the conservation factors used for calculation EFT. The strongest change is a 0.57 per cent increase in transfers received for Brandenburg if EFT stage 4 would use the weights of the scenario 'Strongest Protection / High Fragmentation' (see table 7-20). Increasing the weight of the fragmentation-index has in most cases stronger effects than altering the mix of nature and species conservation and landscape protection.

8 Evaluating the role of ecological fiscal transfers in the German policy mix for biodiversity conservation

8.1 Characteristics and performance of ecological fiscal transfers in Germany

8.1.1 Why introducing ecological fiscal transfers in the German policy mix?

Although the instrument box for biodiversity conservation seems to be well equipped, sufficient funding of nature conservation activities is still lacking and drivers of biodiversity loss and ecosystem degradation are persistent and often further spurred by other sectoral policies. This holds true for private conservation activities, e.g. by farmers or foresters, but even more so for public policy makers in charge of landscape and conservation planning. Hence, the German case study looks at two promising instruments to complement the policy mix for biodiversity and forest conservation. Firstly, we explored from an ex ante-perspective the potential of integrating ecological indicators in intergovernmental fiscal transfers at federal level in Germany as part of this report; and secondly, as part of the upcoming POLICYMIX fine grain report, we will study in depth the conditions for incentivizing farmers by PES for afforestation to contribute to the state's aim of increasing forest cover in Saxony, a German state with a particularly low share of forests on total land cover.

Despite advances in implementing instruments that reward conservation at the private level in Germany (e.g., PES to landowners), there are few instruments addressing public actors. This might lead to an underprovision of the public good biodiversity conservation, since in such context subnational governments do not have incentives to take conservation benefits into account, especially those affecting other jurisdictions beyond their own boundaries. Ecological fiscal transfer (EFT) is an instrument that has potential to address this issue by distributing money from higher to lower levels of government based on ecological indicators.

So far, only Brazil, Portugal and to a certain extent France have adopted ecological fiscal transfers (Ring et al. 2011a). While ecological fiscal transfers are an innovative approach to German federalism, fiscal equalisation as such is not. There is an extensive field of regulation covering the relationship between federal level, states (so-called Länder) and municipalities. The constitutional rules for the distribution of legislative power and responsibilities among these governmental levels are mirrored by a complex mechanism of distributing public revenues in order to provide governments with the funds necessary to fulfil their responsibilities.

Ecological fiscal transfers share some characteristics with payments for ecosystem services (PES) as they incentivize decision-makers to change their behaviour in an environmentally friendly way. However, it is important to note, that fiscal transfers are first and foremost a distributive instrument, i.e. aiming at levelling off differences in the available public budgets per capita at the respective governmental levels. Hence, when ecological indicators are introduced without increasing the overall amount of money available, there will always be winners and losers and thus some states will receive less with ecological fiscal transfers than under the status quo. This is due to the fact that these states underperform or are below average in the sense of the relevant nature conservation activities. Furthermore, intergovernmental fiscal transfers from the national to the state level are lump-sum transfers, and the recipients can use the funds in any way they wish. Thus, the effectiveness and the incentive effect of ecological fiscal transfers mainly depend upon the choice and design of ecological indicators.

These facts have consequences for evaluating the performance of ecological fiscal transfers at state level in Germany against the criteria developed in the POLICYMIX guidelines of work packages 3 to 6 (Rusch et al. 2011; Brouwer et al. 2011; Grieg-Gran et al. 2011; Primmer et al. 2011). Effectiveness and efficiency of

ecological fiscal transfers for biodiversity conservation cannot be evaluated in a rigorous way. Our main research questions regarding the performance of ecological fiscal transfers focus on

- WP3 – Economic instrument effectiveness: the creation of sound ecological indicators capable of representing the differences in conservation activities among the states. What should an indicator for measuring the different levels of conservation activities look like? In defining potential indicators, we built on existing experience with ecological fiscal transfers in Brazil and Portugal, and developed a series of protected area-based indicators for integration into the fiscal transfer system. What can be said in terms of ecological effectiveness about our suggested indicators?
- WP4 – Economic instrument costs and benefits: What can be said in relation to the costs and benefits of biodiversity conservation at different governmental levels? And what are the costs and benefits of ecological fiscal transfers themselves?
- WP5 – Economic instrument equity and legitimacy: What are the distributive objectives of fiscal transfers in Germany? And how do ecological fiscal transfers impact upon distributive equity?
- WP6 – Institutional opportunities and constraints: What are the legal options and constraints our suggested approach would face? How shall indicators be designed to adequately reflect nature conservation activities and their effectiveness (see questions raised in WP3) but simultaneously match the legal requirements imposed by financial constitutions and fiscal transfer legislation? Finally, is there a policy window for introducing such an innovative instrument in Germany, and what would be further design options?

In our ex ante scenario analysis presented in previous chapters we simulated ecological fiscal transfers to showcase potential distribution results as an input for further discussion with stakeholders about the potential role of ecological fiscal transfers in the German conservation policy mix (WPs 3 to 6, see section 8.2).

8.1.2 Economic instrument effectiveness

Ecological fiscal transfers aim at public actors and provide incentives to public actors. If protected areas/area-related conservation indicators are integrated into intergovernmental fiscal relations, there is an explicit consideration of these conservation areas in terms of increasing the fiscal needs of the relevant state government. This offers a new perspective on the development-conservation trade-off: protected areas would be no longer seen as mere obstacles to economic development but as public goods that provide (spillover) benefits with the costs of providing these goods being eligible for fiscal transfers. Moreover, existing protected areas are considered in a spatially explicit way and weighted according to conservation value and land-use restrictions associated with them. Introducing ecological fiscal transfers might have two effects on conservation efforts: Länder could designate new protected areas, and Länder could upgrade their existing protected areas to stricter protection categories to receive a higher weighting factor. However, the incentive effect for future conservation is not spatially explicit. In this way, it is not possible to evaluate the ecological effectiveness of ecological fiscal transfers in a rigorous way. Regarding competing land uses at state or municipal levels, ecological fiscal transfers will most probably change land-use patterns in the long term as on average protected areas are valued higher and do provide monetary benefits to state or municipal budgets. Depending on the ecological indicator chosen, one may evaluate the change of this indicator in the long run.

8.1.3 Economic instrument costs and benefits

The conservation and sustainable use of biodiversity is closely linked to land-use patterns and the type of management at landscape levels performed by public jurisdictions and private land users Ring (2008c). Yet, there are few incentives for local actors to encourage conservation activities when ecological benefits cross local boundaries (Perrings and Gadgil 2003). Spatial externalities or spillovers exist that – if not adequately compensated – lead to an underprovision of the public goods and services concerned. This is the case for a number of conservation activities, such as establishing and maintaining nature reserves or the conservation of endangered wildlife. Decisions on the designation of protected areas or species protection are often made by institutions above the local level, whereas the concrete consequences in terms of restrictions in land use or the damages caused by wildlife are born by local actors, often without any or sufficient compensation. This might lead to an underprovision of the public good biodiversity conservation, since in such context subnational governments do not have incentives to take conservation benefits into account, especially those affecting other jurisdictions beyond their own boundaries. Ecological fiscal transfer (EFT) is an instrument that has potential to address this issue by distributing money from higher to lower levels of government based on ecological indicators. In this way, spillover benefits of biodiversity conservation are internalised, and the local costs of biodiversity conservation for public actors at state or municipal levels are compensated, at least to a certain extent.

As mentioned above, the distributive aim of fiscal transfers makes it hardly possible to rigorously assess the costs and benefits associated with integrating ecological indicators. In a puristic way, one could even argue that ecological fiscal transfers may be inefficient, as the public actors addressed have to comply with the existing law, e.g. PA regulation, in any case. However, leaving a static position of analysis, this argument fails and at least some qualitative judgements regarding cost-effectiveness of ecological fiscal transfers can be made. Firstly, by acknowledging conservation efforts as a public responsibility eligible for fiscal transfers, public actors are incentivised to rethink their long-term development strategies that are nowadays singularly focused on tax-creating land uses (attracting more inhabitants and businesses, agricultural land uses, settlements, construction and housing). In this respect, the recent size and spatial structure of the PA network can be seen as a result of a bargaining process among the decision-makers at different governmental level (federal, state and municipal) as well as with societal groups, NGOs etc. that is distorted by the insufficient internalization of the spillover benefits of PAs mentioned above. By factoring in these benefits into the fiscal transfer regime, acceptance of nature conservation activities among decision-makers will be raised and in turn, the underprovision of the public good 'nature conservation' will be at least incrementally reduced. Moreover, as fiscal transfers address public actors that create the framework for decisions by private land users, e.g. via land-use planning, the long term and indirect effects of introducing ecological fiscal transfers might be higher than supposed if judged from the size of transfers alone. Secondly, transaction costs of ecological fiscal transfers will be moderately low, since all necessary regulation for intergovernmental fiscal transfers is in place, ecological indicators chosen are mostly based on available data and only the basis for calculating size and direction of transfers is modified.

8.1.4 Economic instrument equity and legitimacy

On the one hand, ecological fiscal transfers can provide a counterbalance in relation to existing, often adverse incentives for land use, such as attracting more inhabitants and businesses, intensifying agricultural production, settlements, construction and housing. On the other hand, intergovernmental fiscal transfers are not primarily targeted at biodiversity conservation but strive towards levelling off substantial differences in available tax revenues per capita. In this way, fiscal transfers are per se a redistributive instrument, accounting for fiscal needs in relation to the fiscal capacities of relevant jurisdictions. Financial constitutions (in Germany part of the Basic Law) and fiscal transfer laws thus represent the result of a

complex bargaining process between the federal level and the states of what is considered fair and legitimate in a certain period of time. As these laws are always a result of political majorities, bargaining continues for law changes, especially of those states that pay more than they receive. If ecological indicators are integrated, the relative weight of other criteria in the distribution formulas is reduced. As the number of inhabitants is the agreed abstract indicator for representing fiscal needs of various inhabitant-related public functions, e.g. infrastructure needs for housing and transport, social security and health care, education and cultural activities, states that have to deal with less transfers with an ecological fiscal transfer scheme than under the status quo will have less money to spend on other public functions. The actual impact of changes in available budgets cannot be assessed generally as it clearly depends on how states deal with the new budget. This holds true irrespectively of whether states receive extra funds via ecological fiscal transfers or if their transfers are reduced by introducing ecological indicators. Beside some qualitative judgements it is beyond the scope of the POLICYMIX study to assess the welfare effects of this shift in the necessary detail.

8.1.5 Institutional opportunities and constraints for introduction and design of ecological fiscal transfers in Germany

In terms of addressees, ecological fiscal transfers clearly address public actors. As intergovernmental fiscal transfers are well-established instruments for distributing tax revenues from higher to lower levels of government, and constitute a major source of public budgets at decentralised governmental levels, the indicators chosen for redistributing taxes usually provide strong incentives for public actors. Not least, this can be seen from the permanent and strong interest of state governments to change the rules of financial equalisation at federal level (rich states and thus donors do want to spend less, poor states and thus receivers are interested in keeping or increasing the transfers received), as well as strong interests of local governments and their associations in lobbying for their preferred design of financial equalisation to the local level.

At the federal level, a policy window presently opens up for a restructuring of financial equalisation due to the end of the Solidarity Pact II between the West German and Eastern German Länder. Introduced after the German reunification, the Solidarity Pact provides extra financial resources for infrastructure development in East Germany to catch up with living standards in the West (see section 4.1.2). These special-need supplementary federal grants (about € 10 billion in 2008) are currently phased out until the year 2019 and will stop being paid in 2020. For this reason, politicians of all parties discuss options for redesigning financial equalisation in Germany, including options for considering ecological fiscal transfers (Bündnis 90/Die Grünen 2012).

We have presented one specific way of integrating ecological indicators into the German fiscal transfer system at state level; however, there are several further options for the design of ecological fiscal transfers in Germany. We chose to integrate a conservation factor at the stage of horizontal equalisation (stage 3 of the German fiscal transfer system, see Figure 4-1), i.e. where fiscal needs and fiscal capacities of the states are compared and levelled off. Within this stage, we chose as a very first step to include our conservation factor only in the equalisation of tax revenue at municipal level (see section 7.2). This was due to the fact that already now, higher fiscal needs of states with very low population densities (which can be understood as an area-related indicator) are considered at this particular stage. In this way, conservation efforts are “translated” into additional inhabitants and thereby into higher fiscal needs.

As a next step and expanded scenario it is also conceivable to include conservation factors in the equalisation of state tax revenues (the first term of equation 7.3). This would increase the impact of ecological indicators on the overall results considerably, as municipal taxes are only considered up to 64 per cent in the equalisation of municipal tax revenues, whereas state taxes are considered fully at 100 per cent. An-

other option would be to put conservation-related indicators side by side to population-based indicators, and avoid translating the ecological indicator into “fictitious population numbers”.

Moreover, as our preliminary simulation has shown, marine protected areas should be considered in a separate form. As our chosen indicator relates the protected area of a state to its overall area, the large size of marine protected areas in relation to the land size of the relevant states (such as Schleswig-Holstein) highly distorts the results. Furthermore, marine protected areas are associated with considerably different opportunity and management costs than their terrestrial counterparts, leading to a strong bias in favour of coastal states.

8.2 Integrated policy mix assessment: Interaction of ecological fiscal transfers with other instruments

Building on the ex-ante analysis of the potential performance of ecological fiscal transfers (see section 8.1) this section takes a closer look at the potential impact of introducing ecological fiscal transfers into the existing policy mix for biodiversity conservation in Germany. In other words, what is the value added of ecological fiscal transfers? What are the potential changes in existing policies that influence biodiversity conservation and ecosystem service provision? Figure 8-1 provides a graphical overview of policy instruments and the involved governmental levels from EU over national to state and local levels of government.

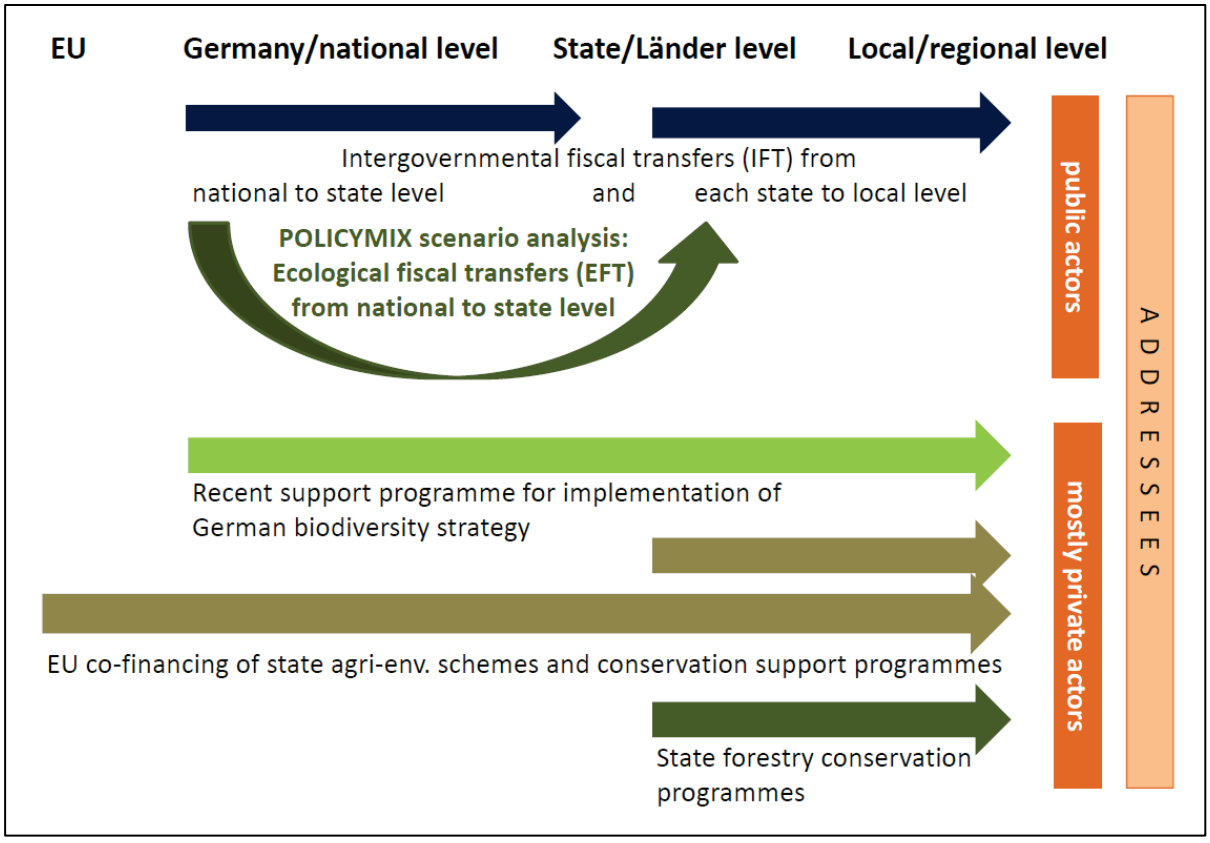

Figure 8-1: Ecological fiscal transfers from national to state level in the context of other policy instruments in Germany
Source: own representation

Ecological fiscal transfers as proposed above build on existing protected area regulation in that they use officially designated protected areas as an indicator to allocate fiscal transfers. Hence, they synergistically complement conservation law with an economic incentive that accounts for state conservation costs and spillover benefits related to these protected areas (Ring et al. 2011a: 115). Depending on the indicators chosen, ecological fiscal transfers may also facilitate indirect conservation measures such as avoiding further fragmentation of landscapes by traffic infrastructure development or patchy settlement expansion.

Furthermore, ecological fiscal transfers may provide the funds necessary to equip support programmes for conservation activities by private land users. From an institutional perspective it is also important to note that implementing ecological fiscal transfers at state level may also provide an impetus for introducing ecological indicators at other levels of intergovernmental transfers, e.g. fiscal equalisation at municipal level, thereby boosting impacts resulting from ecological fiscal transfers at state level.

As was noted above (see section 2) many of the drivers of biodiversity loss and ecosystem degradation are facilitated by adverse financial incentives either targeted at private land users, such as low property taxes, generous commuting allowances or substantial support for energy crops, or at public decision-makers at state and municipal level, such as the dependency of public budgets on the number of inhabitants or more directly via infrastructure subsidies or tax allowances. Hence, although the policy mix analysis is primarily targeted at policy instruments that have evolved to influence the quantity and quality of biodiversity conservation and ecosystem service provision in public and private sectors (Ring and Schröter-Schlaack 2011b), other sector policies outside biodiversity policies have to be taken into account when assessing the potential impact of integrating ecological fiscal transfers into the policy mix for biodiversity conservation.

In doing so, table 8-1 provides some thoughts about the impacts of introducing ecological fiscal transfers in Germany. The yellow line describes the main characteristics of the instrument in focus of our analysis, i.e. ecological fiscal transfers as discussed above in sections 8.1.2 to 8.1.5. The lines above are exemplarily picking up some instruments that are currently in conflict with the goal of biodiversity conservation; the lines below showcase some examples of policies and instruments that are synergistically targeted at biodiversity conservation and the sustainable use of ecosystem services. For each of the overarching policies and policy goals (e.g. 'Economic development in rural areas') (see column 2) we chose a relevant policy instrument (e.g. 'State development plans') (see column 4) and assessed how the impacts of these instruments on biodiversity conservation would change if ecological fiscal transfers were introduced. We clustered potential changes in the selected existing policies and instruments according to the work package structure of the POLICYMIX project: conservation effectiveness (WP3 – see column 5), cost-effectiveness (WP4 – see column 6), fairness, equity and social impacts (WP5 – see column 6) as well as institutional fit (WP6 – see column 7).

Exemplarily, in its current design, transport and mobility policies might have negative effects on biodiversity as new traffic infrastructures lead to further fragmentation of landscapes and habitats and commuting allowances for private actors facilitate urban sprawl and an automobile-dependent modal split. If ecological fiscal transfers were introduced the following changes could be expected:

- Traffic infrastructure planning would take nature conservation areas more seriously into account as these are now influencing public plans and the public budget available. This may lead to alternative routing of new roads or a clustering of train paths and motorways etc. thereby reducing further fragmentation and preserving undissected areas (effectiveness – WP3). However this might come at the expense of higher investment costs for alternative routes (cost-effectiveness – WP4) and a less densely developed road network that raise commuting time of people living in rural areas (social impacts – WP5). However, traffic infrastructure planning might also become more sustainable, as nature conservation plays a larger role in trading off different goals in the planning process (institutional fit – WP6).

- Commuting allowances might be reduced or abolished as they can be seen as a perverse subsidy facilitating urban sprawl. This might lead to short-term changes in commuting practices and in the long term to denser settlement structures (effectiveness – WP3). Reduced spending on commuting allowances would free up public monies for other purposes (cost-effectiveness – WP4). Depending on the perspective, abolishment of commuting allowances could be seen as legitimate and just or as unfair (social impacts – WP5): On the one side, people living in rural areas but working in urban centres would no longer get any support for their commuting expenses, which they used to get, which clearly seems to be unfair. On the other side, commuting allowances have made rural housing on large building lots attractive, thereby leading to sprawling settlement patterns in rural areas as well as population decline, infrastructure collapse and social disaggregation in urban residential quarters and a domination of individual forms of transport. Altogether, this development leads to habitat destruction in suburban and rural areas and increasing fragmentation of landscapes. Hence, reducing this type of perverse incentives could be judged as fair and just and in fact a necessary correction of incentives for private actors from an institutional perspective (institutional fit – WP6).

Another example is the synergistic interaction between a potential EFT scheme and the existing policy goal of preserving the natural heritage of Germany by way of a protected area network. We would expect the following changes here:

- Ecological fiscal transfers might incentivize public actors to increase the area covered by PAs as well as upgrade existing conservation areas to a stricter PA category in order to get higher transfers (effectiveness – WP3). By internalizing the (spillover) benefits of PAs via ecological fiscal transfers, the potential underprovision of PAs is reduced (cost-effectiveness – WP4, see also section 8.1.3). The spatial distribution of PAs and thus the associated opportunity costs would be increasingly perceived as fair, as these costs are now eligible for fiscal transfers like other public responsibilities (social impacts – WP5). Finally, as acceptance of PAs raises the opposition against new PAs, e.g. Natura 2000 areas or national parks, is very likely to decrease (institutional fit – WP6).

Table 8-1: Ecological Fiscal Transfers (EFT) and their interaction with existing instruments for biodiversity conservation in Germany. Last four columns (WP3-6) indicate potential changes in selected existing policies if EFT at statel level were introduced

Interaction	Selected policies and policy goals	Actors Addressed	Selected Instruments	Ecological Effectiveness (WP3)	Cost-Effectiveness (WP4)	Fairness, Equity and Social Impacts (WP5)	Institutional Fit (WP6)
Conflicting in terms of biodiversity conservation	Economic Development (in particular in rural areas)	Public	State Development Plans	Better recognition of biodiversity concerns and ecosystem services in steering development	Internalization of spillover benefits reaching beyond state boundaries leads to increased efficiency.	Depends on concrete design of related state policies and instruments	Formal institution: no change Informal institution: increases weight for conservation in trade-offs
	Transport and mobility	Public	Traffic Infrastructure Planning	Better recognition of biodiversity concerns in infrastructure plans, e.g. avoiding further fragmentation	In the short term, potentially higher costs of traffic infrastructure projects	Less dense traffic infrastructure in rural areas: impacts depend on perspective of analysis	Through recognition of conservation benefits more sustainable infrastructure planning
		Private	Commuting allowances	Questioning of scope and level – reduction or abolishment may lead to different settlement structures in the long term	Reduction of public expenses for commuting – freeing up resources for other purposes	Commuting becomes more expensive – equity considerations depend on actor groups in focus and perspective of analysis	Reduction or abolishment of commuting allowances: reducing perverse incentives leading to urban sprawl today
	„Energiewende“ - increasing renewables in energy mix	Private	Support programmes for energy crops	Potential change of spatial areas eligible for support (e.g., areas close to PAs)	Minor influence of EFT on cost-effectiveness of bioenergy policies due to reduced eligible areas	Reducing partly perverse subsidies; depending on perspective of analysis	Partly changes spatial areas and farmers eligible for support
Instrument in Focus	***Mainstreaming biodiversity conservation***	***Public decision-makers at state level (Länder)***	***Ecological Fiscal Transfers***	***Depending on indicators chosen – increase in quality and quantity of PAs likely***	***Internalization of spillover conservation benefits reaching beyond state boundaries leads to more efficient land-use patterns; Low transaction costs as it builds on existing fiscal transfer scheme***	***Mixed impact – increases fairness towards those states performing above average as biodiversity conservation activities are rewarded, but less budget available for other concerns***	***High – builds on existing transfer scheme***

Interaction	Selected policies and policy goals	Actors Addressed	Selected Instruments	Ecological Effectiveness (WP3)	Cost-Effectiveness (WP4)	Fairness, Equity and Social Impacts (WP5)	Institutional Fit (WP6)
Instrument in Focus	***Mainstreaming biodiversity conservation***	***Public decision-makers at state level (Länder)***	***Ecological Fiscal Transfers***	***Depending on indicators chosen – increase in quality and quantity of PAs likely***	***Internalization of spillover conservation benefits reaching beyond state boundaries leads to more efficient land-use patterns; Low transaction costs as it builds on existing fiscal transfer scheme***	***Mixed impact – increases fairness towards those states performing above average as biodiversity conservation activities are rewarded, but less budget available for other concerns***	***High – builds on existing transfer scheme***
Synergistic	Protecting Natural Heritage: Habitat and species conservation	Public actors at state level	Protected Areas	Increase in quantity of PAs likely, incentives to better manage existing PAs or to upgrade to a stricter PA category	Internalization of spillover benefits reduces potential of underprovision of PAs	PA are perceived less as an obstacle to development	Reduction in opposition to new PAs, e.g. Natura 2000 areas or national parks very likely
		Private and public actors at local level	Protected Areas	Increase in quantity of PAs lead to land-use restrictions and management obligations	If quantity and quality of PAs increase, then possibly higher land-use restrictions/opportunity costs and potentially management costs	Farmers and local public actors should participate / partially benefit from increased transfers, e.g., via PES or EFT to local level	Informal institutions: If farmers are not partially compensated for their additional costs, then their opposition towards PAs increases
	Conservation, sustainable use and restoration of nature	Mostly private, partly local public actors	Conservation Support Programmes	Potential increase in funding due to EFT may help to increase area where conservation measures are carried out resp. the quality of measures	Potential increase in funding available	Potentially more actors eligible for support	Introduction of EFT at state level paves the way for more and better conservation programmes resp. EFT at the local level
	Sustainable land use	Private	Agri-environmental and forestry schemes (PES)	Potential increase in funding due to EFT may help to increase area managed sustainably	Potential increase in funding available	Potentially more actors eligible for support	Introduction of EFT at state level paves the way for more and better PES at the local level

Source: Own representation based on Schröter-Schlaack and Ring (2011), Angelsen (2009) and Ring et al. (2011b)

9 Outlook

This German national case study report (Deliverable 7.2.1) addressed and modelled the integration of ecological indicators into intergovernmental fiscal transfers from the national to the state, i.e. Länder level in Germany, and assessed the role of ecological fiscal transfers in the overall German policy mix. The fine grain analysis in Germany will cover two major topics:

1. Building on the coarse grain report on ecological fiscal transfers, detailed fine grain studies on different aspects of integrating ecological indicators in the German fiscal transfer system are pursued such as the development of appropriate conservation indicators, the detailed discussion of ex ante scenario modelling results, or the legal and institutional options and constraints for introducing ecological fiscal transfers. A substantial part of the fine grain analysis related to ecological fiscal transfers is already covered in the national case study report. Fine grain analysis on ecological fiscal transfers will be continued, resulting mainly in journal publications that will be integrated in the upcoming fine grain report.
2. As Germany is a federal country with its states being responsible for implementing nature and forest conservation policies, a second major focus of the German fine grain analysis relates to the topic of afforestation and related ecosystem services in the Free State of Saxony. Here, the local level analysis investigates economic incentives for afforestation in Western Saxony and discusses the role of these instruments in the Saxon policy mix. This second topic will be a major focus of Deliverable 7.2.2 – Assessment of existing and proposed policy instruments for biodiversity conservation at state and local level.

10 References

Achtziger, R., Stickroth, H., Zieschank, R., 2004. Nachhaltigkeitsindikator für die Artenvielfalt – ein Indikator für den Zustand von Natur und Landschaft in Deutschland. Angewandte Landschaftsökologie 63. Bundesamt für Naturschutz, Bonn-Bad Godesberg.

Achtziger, R., Stickroth, H., Zieschank, R., Wolter, C., Schlumprecht, H., 2007. F+E-Projekt „Nachhaltigkeitsindikator für den Naturschutzbereich" – Phase 2. Endbericht Teil A: Nachhaltigkeitsindikator für die Artenvielfalt. – Unveröff. Forschungsbericht im Auftrag des BfN (FKZ 804 86 010). Bundesamt für Naturschutz, Bonn-Bad Godesberg.

Angelsen, A. with Brockhaus, M., Kanninen, M., Sills, E., Sunderlin, W. D. and Wertz-Kanounnikoff, S. (Eds.): 2009 Realising REDD+: National strategy and policy options. CIFOR, Bogor, Indonesia.

Apel, D., Henckel, D., Bunzel, A., Floeting, H., Henkel, M.J., Kühn, G., Lehmborck, M., Sander, R., 1995. Flächen sparen, Verkehr reduzieren: Möglichkeiten zur Steuerung der Siedlungs- und Verkehrsentwicklung. Deutsches Institut für Urbanistik, Berlin.

ARL, 1999. Flächenhaushaltspolitik: Feststellungen und Empfehlungen für eine zukunftsfähige Raum- und Siedlungsentwicklung, Forschungs- und Sitzungsberichte der ARL, Band 208. Akademie für Raumforschung und Landesplanung, Hannover.

Aßmann, T. and Härdtle, W., 2002. Naturschutzbiologie. In: Härdtle, W. (Ed.) Studium der Umweltwissenschaften. Springer, Berlin, Heidelberg: 113-223.

Bauer, S., Abresch, J.-P., Steuernagel, M., 1996. Gesamtinstrumentarium zur Erreichung einer umweltverträglichen Raumnutzung. Metzler-Poeschel, Stuttgart.

Beck, S., Born, W., Dziock, S., Görg, C., Hansjürgens, B., Jax, K., Köck, W., Neßhöver, C., Rauschmayer, F., Ring, I., Schmidt-Loske, K., Unnerstall, H., Wittmer, H., 2006. Die Relevanz des Millennium Ecosystem Assessment für Deutschland, UFZ-Bericht Nr. 02/2006. UFZ Umweltforschungszentrum, Leipzig.

Bergmann, E., 1999. Lenkung der Flächenausweisung über Zuweisungen? Informationen zur Raumentwicklung, 555-564.

Bizer, K., 1997. Marktanaloge Instrumente im Natur- und Landschaftsschutz: eine ökonomische Analyse des deutschen Naturschutzrechts. Analytica, Berlin.

Borie, M., Mathevet, R., Letourneau, A., Thompson, J., Ring, I., Marty, P., 2012. Exploring the contribution of fiscal transfers to protected area policy in France. in preparation.

Bräuer, I., Müssner, R., Marsden, K., Oosterhuis, F., Rayment, M., Miller, C., Dodoková, A., 2006. The use of market incentives to preserve biodiversity - Final Report. Ecologic, Berlin.

Brouwer, R., Oosterhuis, F., Ansink, E., Barton, D.N., Lienhoop, N., 2011. Draft guidelines valuation of the economic benefits associated with the use of economic instruments in a mix of policy instruments for biodiversity conservation. Norwegian Institute for Nature Research, Olso.

Brueckner, J.K., Kim, H.-A., 2003. Urban sprawl and the property tax International Tax and Public Finance 10, 5-23.

Bundesamt für Bauwesen und Raumordnung, 2005. Raumordnungsbericht 2005. BBR, Bonn.

Bundesamt für Naturschutz, 2007. Keine Entwarnung für gefährdete Lebensräume in Deutschland, Hintergrundpapier des BfN.

Bundesregierung, 2002. Perspektiven für Deutschland: Unsere Strategie für eine nachhaltige Entwicklung. Bundesregierung. Presse- und Informationsamt, Berlin.

Bundesregierung, 2008. Fortschrittsbericht Nachhaltigkeitsstrategie. Presse- und Informationsamt, Berlin.

Bündnis 90/Die Grünen Bundestagsfraktion, 2012. Biodiversität 2020. Das grüne Handlungskonzept zum Schutz der biologischen Vielfalt, Berlin.

Council of the European Union, 2005. Council Regulation (EC) No. 1698/2005 on support for rural development by the Agricultural Fund for Rural Development (EAFRD). Official Journal of the European Union L 277, 1-40.

Czybulka, D., Luttmann, M., 2005. Die Berücksichtigung von Leistungen der Länder für das Naturerbe im Finanzausgleichssystem des Bundes. Natur und Recht 27, 79-86.

Deutsches Nationalkomitee für das UNESCO Programm: Der Mensch und die Biosphäre, 1996. Kriterien für die Anerkennung und Überprüfung von Biosphärenreservaten der UNESCO in Deutschland. Bundesamt für Naturschutz, Bonn.

Dolzer, R., Kahl, W., Waldhoff, C., Graßhof, K. (Ed.), 2011. Bonner Kommentar zum Grundgesetz, 154. Lfg. C.F. Müller, Heidelberg.

European Commission, 1998. Communication from the commission to the council and the European parliament on a European Community Biodiversity Strategy. COM/98/0042.

European Commission, 2010. The Common Agricultural Policy Explained. European Commission, DG Agriculture and Rural Development, Brussels.

European Commission, 2011. Life country fact sheet: Germany. European Comission, DG Environment, http://ec.europa.eu/environment/life/countries/documents/germany_en_jun11.pdf (last access 2012-04-22).

EEA – European Environment Agency, 2006. Using the market for cost-effective environmental policy: Market-based instruments in Europe. EEA, Copenhagen.

EEA – European Envionment Ageny, 2011. Landscape fragmentation in Europe. EEA, Copenhagen.

EEA – European Environment Agency, 2012. Streamlining European biodiversity indicators 2020: Building a future on lessons learntfrom the SEBI 2010 process. EEA, Copenhagen.

Ewers, H.-J., Rehbinder, E., Wiggering, H., 1997. Umweltbezogene Erweiterung des Finanzausgleichs. Zeitschrift für Gesetzgebung 12, 135-147.

Federal Agency for Nature Conservation, 2008. Nature Data 2008. Federal Agency for Nature Conservation (BfN), Bonn.

Federal Agency for Nature Conservation, 2012a. Biosphere Reserves. http://www.bfn.de/0308_bios+M52087573ab0.html (last access 2012-04-21).

Federal Agency for Nature Conservation, 2012b. Landscape Protection Areas. http://www.bfn.de/0308_lsg+M52087573ab0.html (last access 2012-04-21).

Federal Agency for Nature Conservation, 2012c. Large-Scale Conservation Projects. http://www.bfn.de/0203_grossprojekte+M52087573ab0.html (last access 2012-04-21).

Federal Agency for Nature Conservation, 2012d. National Parks. http://www.bfn.de/0308_nlp+M52087573ab0.html (last access 2012-04-21).

Federal Agency for Nature Conservation, 2012e. Nature Conservation Areas. http://www.bfn.de/0308_nsg+M52087573ab0.html (last access 2012-04-21).

Federal Agency for Nature Conservation, 2012f. Nature Parks. http://www.bfn.de/0308_np+M52087573ab0.html (last access 2012-04-21).

Federal Agency for Nature Conservation, 2012g. Testing and Development Projects. http://www.bfn.de/0202_eue+M52087573ab0.html (last access 2012-04-21).

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2007. National Strategy on Biological Diversity. BMU, Berlin.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2008. National Strategy for the Sustainable Use and Protection of the Seas. BMU, Berlin.

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2010a. Germany's Fourth National Report under the Convention on Biological Diversity.

Federal Ministry For The Environment, Nature Conservation and Nuclear Safety, 2010b. The New Federal Nature Conservation Act. Cohesive and close to citizens. BMU, Berlin.

Federal Ministry of Finance, 2010. Federation/Länder financial relations on the basis of constitutional financial provisions, Berlin, 88 p.

Federal Ministry of Finance, 2012. The Federal Financial Equalisation System in Germany. Available at http://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Oeffentliche_Finanzen/Foederale_Finanzbeziehungen/Laenderfinanzausgleich/laenderfinanzausgleich.html, accessed 20 January 2012.

Federal Ministry of Food, Agriculture and Consumer Protection, 2009a. Results of the Forest Condition Survey 2009.

Federal Ministry of Food, Agriculture and Consumer Protection, 2009b. Waldbericht der Bundesregierung 2009.

Federal Ministry of Food, Agriculture and Consumer Protection, 2010. Conservation of Agricultural Biodiversity, Development and Sustainable Use of its Potentials in Agriculture, Forestry and Fisheries. BMELV, Bonn.

Federal Office for Agriculture and Food, 2009. Zukunft auf dem Land gestalten. BLE, Bonn.

Federal Statistical Office of Germany, 2012a. Sustainable Development in Germany: Indicator Report 2012. https://www.destatis.de/EN/Publications/Specialized/EnvironmentalEconomicAccounting/Indicators2012.pdf?__blob=publicationFile

Federal Statistical Office of Germany, 2012b. Land-use statistics.

Gantioler, S., Rayment, M., Bassi, S., Kettunen, M., McConville, A., Landgrebe, R., Gerdes, H., ten Brink, P., 2010. Costs and Socio-Economic Benefits associated with 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.

Grieg-Gran, M., Svarstad, H., Muhammad, I., Ludwig, G., Porras, I.T., Paloniemi, R., 2011. Guidelines for assessing social impacts and legitimacy in conservation. Norwegian Institute for Nature Research, Olso.

Grodzinska-Jurczak, M., Cent, J., 2011. Expansion of Nature Conservation Areas: Problems with Natura 2000 Implementation in Poland? Environmental Management 47, 11-27.

Gruttke, H., 2004. Ermittlung der Verantwortlichkeit für die Erhaltung mitteleuropäischer Arten. Naturschutz und Biologische Vielfalt, 8. BfN, Bonn-Bad Godesberg.

Gunningham, N., Sinclair, D., Grabosky, P., 1998. Smart regulation: designing environmental policy. Clarendon, Oxford.

Håkonsen, L., 2009. Statlig styring og finansiering av kommunale miljøvernoppgaver. Prinsipper og vurderinger av egnede virkemidler. TF-notat nr. 25/2009. Telemarksforskning.

Håkonsen, L. and T. E. Lunder, 2009. Miljøoppgaver i kommunenes utgiftsutjevning. Tentative beregninger. Notat nr. 24/2009, Telemarksforskning.

Henger, R., Bizer, K., 2010. Tradable planning permits for land-use control in Germany. Land Use Policy 27, 843-852.

Henle, K., Streit, B., 1990. Kritische Beobachtungen zum Artenrückgang bei Amphibien und Reptilien und zu dessen Ursachen. Natur und Landschaft 65, 347–361.

Henle. K., Gruttke, H., 2004. Verantwortlichkeit Deutschlands für die Erhaltung von Amphibien- und Reptilienarten: Methodendiskussion und 1. Überarbeitung. In: H. Gruttke (Ed.), Ermittlung der Verantwortlichkeit für die Erhaltung mitteleuropäischer Arten. Naturschutz und Biologische Vielfalt. BfN (Bundesamt für Naturschutz), Bonn-Bad Godesberg.

Hidien, J.W., 1999. Handbuch Länderfinanzausgleich. Nomos, Baden-Baden.

IÖR-Monitor 2011 - IÖR (Leibniz Institute of Ecological Urban and Regional Development), Der Monitor der Siedlungs- und Freiraumentwicklung, http://www.ioer-monitor.de/indikatoren/landschafts-und-naturschutz/.

Jaeger, J.A.G., 2000. Landscape division, splitting index, and effective mesh size: new measures of landscape fragmentation. Landscape Ecology 15, 115-130.

Jäger, J., 1999. Landschaftszerschneidung. In: W. Konold, Böcker, R., Hampicke, U. (Ed.), Handbuch Naturschutz und Landschaftspflege. Wiley, Weinheim.

Josten, R., 2000. Die Bodenwertsteuer – eine praxisorientierte Untersuchung zur Reform der Grundsteuer. Kohlhammer, Stuttgart.

Kistenmacher, H., 1996. Umweltvorsorge durch die Regional- und Landesplanung und ihre Bedeutung für die Flächennutzungsplanung. Zeitschrift für angewandte Umweltforschung 9, 15-35.

Kirchhof, P., 1982. Der Verfassungsauftrag zum Länderfinanzausgleich als Ergänzung fehlender und als Garant vorhandener Finanzautonomie. Deubner, Köln.

Koch, H.J., Hendler, R., 2001. Baurecht, Raumordnungs- und Landesplanungsrecht, 3rd edition ed. Boorberg, Stuttgart et al.

Köllner, T., Schelske, O., Seidl, I., 2002. Integrating biodiversity into intergovernmental fiscal transfers based on cantonal benchmarking: a Swiss case study. Basic and Applied Ecology 3, 381-391.

Korioth, S., 1997. Der Finanzausgleich zwischen Bund und Ländern. Mohr Siebeck, Tübingen.

Kumar, S., Managi, S., 2009. Compensation for environmental services and intergovernmental fiscal transfers: The case of India. Ecological Economics 68, 3052-3059.

Lassen, D., 1979. Unzerschnittene verkehrsarme Räume in Deutschland. Natur und Landschaft 54, 333-334.

List, J.A., Bulte, E.H., Shogren, J.F., 2002. Beggar thy neighbour: Testing for free riding in state level endangered species expenditures. Public Choice 111, 303-315.

Löhr, D., 2004. Umgestaltung der Grundsteuer im Rahmen einer effizienten Flächenhaushaltspolitik. Zeitschrift für Umweltpolitik und Umweltrecht 27, 587-606.

Losch, S., Nake, R., 1990. Landschaftsverbrauch durch linienhafte technische Infrastruktur. Informationen zur Raumentwicklung 1990, 689-714.

Madsen, B., Carroll, N., Moore Brands, K., 2010. State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide. Ecosystem Marketplace, Washington, DC.

Marggraf, R., 2003. Naturschutz aus ökonomischer Sicht. In: Oldiges, M. (Ed.). Perspektiven des Naturschutzes. Nomos, Baden-Baden, pp. 145-155.

May, P.H., Veiga Neto, F., Denardin, V., Loureiro, W., 2002. Using fiscal instruments to encourage conservation: Municipal responses to the 'ecological' value-added tax in Paraná and Minas Gerais, Brazil, in: Pagiola, S., Bishop, J., Landell-Mills, N. (Eds.), Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development. Earthscan, London, pp. 173-199.

Millennium Ecosystem Assessment, 2005. Ecosystems and human well-being: Synthesis. Island Press, Washington, DC.

Möckel, S. (2013). Berücksichtigung von Umwelt- und Naturschutzaufgaben bei der Verteilung von Staatsfinanzen zwischen Bund und Ländern – Erfordernisse und Möglichkeiten im Rahmen des Finanzausgleich, der Bundesauftrags- und bundeseigener Verwaltung oder den Gemeinschaftsaufgaben. Zeitschrift für Europäisches Umwelt- und Planungsrecht (EurUP), in press.

Möckel, S., 2010. Bewirtschaftung von Bundeswasserstraßen gemäß der Wasserrahmenrichtlinie - Anpassungsbedarf beim Bundeswasserstraßengesetz. Deutsches Verwaltungsblatt 2010, pp. 618-625.

Möckel, S., 2008. Schutz und Entwicklung von Natura 2000-Gebieten – Rechtliche Anforderungen an die Landwirtschaft. In: Zeitschrift für Europäisches Umwelt- und Planungsrecht 2008 (4), 169 - 174.

Musgrave, R.M., 1959. The Theory of Public Finance. McGraw-Hill, New York.

Nuissl, H., Schröter-Schlaack, C., 2009. On the economic approach to the containment of land consumption. Environmental Science & Policy 12, 270-280.

Oates, W.E., 1972. Fiscal Federalism. Harcourt Brace Jovanovich, New York.

Olson, M.J., 1969. The Principle of "Fiscal Equivalence": The Division of Responsibilities among Different Levels of Government. The American Economic Review 59, 479-487.

Ossenbühl, F., 1984. Verfassungsrechtliche Grundfragen des Länderfinanzausgleichs gem. Art. 107 II GG, Nomos, Baden-Baden.

Perner, A., Thöne, M., 2005. Naturschutz im Finanzausgleich. Erweiterung des naturschutzpolitischen Instrumentariums um finanzielle Anreize für Gebietskörperschaften. FiFo-Berichte 3. Finanzwissenschaftliches Forschungsinstitut an der Universität zu Köln, Köln.

Perner, A., Thöne, M., 2007. Naturschutz im kommunalen Finanzausgleich - Anreize für eine nachhaltige Flächennutzung. Bundesamt für Naturschutz, Bonn, Bad Godesberg.

Perrings, C., Gadgil, M., 2003. Conserving biodiversity: Reconciling local and global public benefits in: Kaul, I., Conceição, P., le Goulven, K., Mendoza, R.U. (Eds.), Providing global public goods: Managing globalization. Oxford University Press, Oxford, pp. 532-556

Phoenix, G.K., Hicks, W.K., Cinderby, S., Kuylenstierna, J.C.I., Stock, W.D., Dentener, F.J., Giller, K.E., Austin, A.T., Lefroy, R.D.B., Gimeno, B.S., Ashmore, M.R., Ineson, P., 2006. Atmospheric nitrogen deposition in world biodiversity hotspots: the need for a greater global perspective in assessing N deposition impacts. Global Change Biology 12, 470-476.

Polley, H., 2009. Wald in Schutzgebieten - Ein Überblick. Landbauforschung - vTI Agriculture and Forestry Research Sonderheft 327, 75-82.

Potter, S., Enoch, M., Rye, T., Black, C., Ubbels, B., 2006. Tax Treatment of Employer Commuting Support: An International Review. Transport Reviews 26, 221-237.

Primmer, E., Similä, J., Barton, D.N., Schröter-Schlaack, C., 2011. Guidelines for the analysis of institutions shaping biodiversity policy instruments applicability. Norwegian Institute for Nature Research, Olso.

Raths, U., Balzer, S., Ersfeld, M., Euler, U., 2006. Deutsche Natura-2000-Gebiete in Zahlen. Natur und Landschaft 81, 68-80.

Reidenbach, M., 1999. Die reformierte Grundsteuer - Ein neues Instrument für die kommunale Bodenpolitik? Informationen zur Raumentwicklung 1999, 565-576.

Riecken, U., Ries, U., Ssymank, A., 1994. Rote Liste der gefährdeten Biotoptypen in der Bundesrepublik Deutschland. Bundesamt für Naturschutz, Bonn.

Ring, I., 2001. Ökologische Aufgaben und ihre Berücksichtigung im kommunalen Finanzausgleich. Zeitschrift für angewandte Umweltforschung, 236-249

Ring, I., 2002. Ecological public functions and fiscal equalisation at the local level in Germany. Ecological Economics 42, 415-427.

Ring, I., 2004. Naturschutz in der föderalen Aufgabenteilung: Zur Notwendigkeit einer Bundeskompetenz aus ökonomischer Perspektive. Natur und Landschaft 79, 494-500.

Ring, I., 2008a. Integrating local ecological services into intergovernmental fiscal transfers: The case of the ecological ICMS in Brazil. Land Use Policy 25, 485-497.

Ring, I., 2008b. Compensating Municipalities for Protected Areas: Fiscal Transfers for Biodiversity Conservation in Saxony, Germany. GAIA - Ecological Perspectives for Science and Society 17, 143-151.

Ring, I., 2008c. Biodiversity governance: Adjusting local costs and global benefits, in: Sikor, T. (Ed.), Public and Private in Natural Resource Governance: a False Dichotomy? Earthscan, London, pp. 107-126.

Ring, I., May, P.H., Loureiro, W., Santos, R., Antunes, P., Clemente, P., 2011. Ecological fiscal transfers, in: Ring, I., Schröter-Schlaack, C. (Eds.), Instrument Mixes for Biodiversity Policies. POLICYMIX Report Issue No. 2/2011. Helmholtz Centre for Environmental Research-UFZ, Leipzig, pp. 99-118.

Ring, I., May, P.H., Loureiro, W., Santos, R., Antunes, P., Clemente, P., 2011a. Ecological Fiscal Transfers, in: Ring, I., Schröter-Schlaack, C. (Eds.), Instrument Mixes for Biodiversity Policies. POLICYMIX Report Issue No. 2/2011. Helmholtz Centre for Environmental Research - UFZ, Leipzig, pp. 98-118.

Ring, I., Schröter-Schlaack, C., 2011a. Instrument Mixes for Biodiversity Policies. Helmholtz Centre for Environmental Research - UFZ, Leipzig.

Ring, I., Schröter-Schlaack, C., 2011b. Justifying and assessing policy mixes for biodiversity and ecosystem governance, in: Ring, I., Schröter-Schlaack, C. (Eds.), Instrument Mixes for Biodiversity Policies. Helmholtz Centre for Environmental Research - UFZ, Leipzig.

Ring, I., Schröter-Schlaack, C., Barton, D.N., Santos, R., May, P.H., 2011b. Recommendations for assessing instruments in policy mixes for biodiversity and ecosystem governance, http://policymix.nina.no/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=869&PortalId=51&TabId=3736 (last access: 2012-04-22).

Rose, M.T., 1999. Überlegungen zur Berücksichtigung der ökologischen Ausgleichsfunktion ländlicher Räume im kommunalen Finanzausgleich – dargestellt am Beispiel des Landes Nordrhein-Westfalen. Zeitschrift für angewandte Umweltforschung 12, 267-279.

Rusch, G.M., DeClerck, F.A.J., Vivan, J.L., Blumentrath, S., Barton, D.N., Punttila, P., Klenke, R., Sobrinho, R.P., 2011. Policy outcomes: A guideline to assess biodiversity conservation and ESS provision gains. Norwegian Institute for Nature Research, Olso.

Sachs, M. (Ed.), 2009. Grundgesetz – Kommentar. Beck, München.

Santos, R., Ring, I., Antunes, P., Clemente, P., 2012. Fiscal transfers for biodiversity conservation: The Portuguese Local Finances Law. Land Use Policy 29, 261-273.

Saunders, D.A., Hobbs, R.J., Margules, C.R., 1991. Biological Consequences of Ecosystem Fragmentation: A Review. Conservation Biology 5, 18-32.

Schaefer, M., 2005. Problems and prospects of the conservation of biodiversity in Germany, in: Markussen, M., Garrelts, H., Menzel, S., Buse, R., Mánez Costa, M., Marggraf, R. (Eds.), Valuation and Conservation of Biodiversity: Interdisciplinary Perspectives on the Convention. Springer, Berlin, pp. 107-131.

Schmeller, D., Gruber, B., Bauch, B., Lanno, K., Budrys, E., Babij, V., Juskaitis, R., Sammul, M., Varga, Z., Henle, K., 2008. Determination of national conservation responsibilities for species conservation in regions with multiple political jurisdictions. Biodiversity and Conservation 17(14), 3607-3622.

Schmeller, D., Gruber, B., Budrys, E., Framsted, E., Lengyel, S., Henle, K., 2008. National responsibilities in European species conservation: A methodological review. Conservation Biology 22(3), 593-601.

Schmidt, M., Ewald, J., Fischer, A., von Oheimb, G., Kriebitzsch, W.-U., Schmidt, W., Ellenberg, H., 2003. Liste der Waldgefäßpflanzen Deutschlands. Bundesforschungsanstalt für Forst- und Holzwirtschaft, Hamburg.

Schröter, C., Ring, I., 2006. Internationale Erfahrungen zu ökologischem Finanzausgleich und handelbaren Zertifikaten, in: Meyer, C., Schweppe-Kraft, B. (Eds.), Integration ökologischer Aspekte in die Finanzpolitik, pp. 64-80.

Schröter-Schlaack, C., 2011. Transferable Permits in Spatial Planning: US Experiences and Lessons to Learn for Germany, in: Hansjürgens, B., Antes, R., Strunz, M. (Eds.), Permit Trading in Different Applications. Routledge, London, New York, pp. 133-156.

Schröter-Schlaack, C., Ring, I., 2011. Towards a framework for assessing instruments in policy mixes for biodiversity and ecosystem governance, in: Ring, I., Schröter-Schlaack, C. (Eds.), Instrument Mixes for Biodiversity Policies. Helmholtz Centre for Environmental Research - UFZ, Leipzig, pp. 175-208.

Selmer, P., 1993. Grundsätze der Finanzverfassung des vereinigten Deutschlands, Veröffentlichungen der Vereinigung der Deutschen Staatsrechtslehrer (52), pp. 11-70.

Seitz, H., 2001. Kurze Stellungnahme zur Frage von Naturschutz und Länderfinanzausgleich (LFA). Im Auftrag des Bundesamtes für Naturschutz, Berlin, p. 8.

SRU (Der Rat von Sachverständigen für Umweltfragen), 1996. Konzepte einer dauerhaft-umweltgerechten Nutzung ländlicher Räume. Sondergutachten. Metzler-Poeschel, Stuttgart.

SRU (Der Rat von Sachverständigen für Umweltfragen), 2007. Sondergutachten: Umweltverwaltungen unter Reformdruck. Erich Schmidt Verlag, Berlin.

Ssymank, A., Balzer, S., Biewald, G., Ellwanger, G., Hauke, U., Kehrein, A., Petersen, B., Raths, U., Rost, S., 2003. Die gemeinschaftliche Bewertung der deutschen FFH-Gebietsvorschläge für das Netz Natura 2000 und der Stand der Umsetzung. Natur und Landschaft 78, 268-279.

Steer, U., Scherfose, V., Balzer, S., 2008. Ausgewählte Aspekte des deutschen Schutzgebietssystems. Natur und Landschaft 83, 93-100.

Sukopp, H. 2007. Der Nachhaltigkeitsindikator für die Artenvielfalt Ein Indikator für den Zustand von Natur und Landschaft, URL: http://www.bfn.de/fileadmin/MDB/documents/themen/monitoring/Sukopp_2007_Nachhaltigkeitsindikator_Bericht-2_Brutvoegel_Deutschland.pdf.

TEEB, 2008. The Economics of Ecosystems and Biodiversity: An interim report, http://www.teebweb.org/LinkClick.aspx?fileticket=u2fMSQoWJf0%3d&tabid=1278&language=en-US.

TEEB, 2010a. The Economics of Ecosystems and Biodiversity - Mainstreaming the economics of nature: A synthesis of the approach, conclusions and recommendations of TEEB, http://www.teebweb.org/LinkClick.aspx?fileticket=bYhDohL_TuM%3d&tabid=924&mid=1813.

TEEB, 2010b. The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations. Edited by Pushpam Kumar. Earthscan, London.

TEEB, 2011a. The Economics of Ecosystems and Biodiversity in Business and Enterprise. Edited by Joshua Bishop. Earthscan, London.

TEEB, 2011b. The Economics of Ecosystems and Biodiversity in National and International Policy Making. Edited by Patrick ten Brink. Earthscan, London.

TEEB, 2012. The Economics of Ecosystems and Biodiversity in Local and Regional Policy. Edited by Heidi Wittmer and Hariprya Gundimeda. Earthscan, London.

Theobald, D.M., Miller, J.R., Hobbs, T.N., 1997. Estimating the cumulative effects of development on wildlife habitat. Landscape and Urban Planning 39, 25-36.

Unnerstall, H., 2004. Rechtliche Grundlagen gegenwärtiger und zukünftiger ökonomischer Instrumente im Naturschutz und in der Flächenhaushaltspolitik, in: Döring, R., Rühs, M. (Eds.), Ökonomische Rationalität und praktische Vernunft - Gerechtigkeit, Ökologische Ökonomie und Naturschutz. Königshausen & Neumann, Würzburg, pp. 249-274.

Umweltbundesamt, 2005. Determinanten der Verkehrsentstehung, UBA-Texte 26/2005. Umweltbundesamt, Berlin.

Urfei, G., 2002. Regionale Verteilung von Schutzgebieten in Deutschland – Eine empirisch gestützte Bewertung der räumlichen Implikationen des Natur- und Landschaftsschutzes per Ordnungsrecht. Agrarwirtschaft. Zeitschrift für Betriebswirtschaft, Marktforschung und Agrarpolitik 51, 249-258.

von Münch, I. (Ed.), 1996. Grundgesetzkommentar, Band 33, Bd. 3. Beck, München.

Walz, U., Schumacher, U., 2010. Bundesweiter Indikator zum Natur- und Artenschutz sowie zum Landschaftsschutz. Naturschutz und Landschaftsplanung 42, 205-211.

Wätzold, F., 2004. SO_2 emissions in Germany: Regulations to fight "Waldsterben", in: Harrington, W., Morgenstern, R.D., Sterner, T. (Eds.), Choosing environmental policy: Comparing instruments and outcomes in the United States and Europe. Resources for the Future, Washington, DC, pp. 23-40.