D 1.2

SPIRAL is an inter-disciplinary research project funded under the 7th Framework Programma, contract number: 244035

SPIRAL

Science-Policy Interfaces for Biodiversity: Research, Action and Learning

Study on Landscape of Science-Policy Interfaces

Johannes Timaeus, Ulrich Heink, Carsten Neßhöver & the SPIRAL Team

SEVENTH FRAMEWORK PROGRAMME

SPIRAL
Interfacing Biodiversity and Policy

Study on landscape of science-policy interfaces

1 Executive Summary

Interactions between biodiversity-related science and policy-making are still poorly understood. To enrich decision-making and research on biodiversity it is therefore necessary to examine how processes of exchange and construction of knowledge between scientists, policy-makers and other actors or stakeholders work. As a first step towards the understanding of such science-policy interfaces, it is necessary to find out which science-policy interfaces exist and how they can be distinguished.

To gain an overview of the range of existing science-policy interfaces (SPIs) a comprehensive mapping of SPIs was carried out. Specific aims of the mapping were to get an overview of the SPI landscape by assembling a database of SPIs for biodiversity for selected EU-member states, the EU and the global level and by developing a typology of SPIs, to get a structured overview of the SPI landscape.

A short literature review revealed that there is to date no SPI typology across different political levels (from subnational to global) which is able to capture the broad diversity of institutionalised SPIs. Therefore, based on a combined theoretical and empirical approach we identified SPI types based on institutional parameters to structure the vast SPI landscape and to get an overview of the range of different institutional forms. We distinguished four generic SPI types reflecting their institutionalisation: (1) interest group, (2) research project, (3) expert group, and (4) state agency or institute.

This mapping exercise resulted in a database of 150 SPIs for biodiversity. SPIs at different levels were collected including selected EU-member states, the EU and the global level.

The mapping results suggest that there is a great diversity of institutionalized SPIs. A possible explanation is that biodiversity knowledge is produced in very different institutional contexts and used in very different institutional contexts, which may require SPIs that are adapted to these specific situations. However, this may also result in the challenge to coordinate SPIs across different social contexts.

While a number of methodical shortcomings to the mapping approach were detected, the current SPI mapping and SPI types can be the starting point for a more representative or exhaustive comparative analysis of organizational SPIs, for example to detect gaps and redundancies or to compare in a qualitative manner the differences in the SPI landscapes between EU member states and the EU. The typology and the selected attributes of SPIs offer a basis for the selection of case studies and for the evaluation of SPIs.

In the mapping we determined attributes crucial for the characterization of SPIs. For the case studies it is important to investigate the way in which these attributes are connected (e.g. functional and institutional attributes). The case study design should also emphasize the links between institutionalization and functions and processes. The mapping did not allow us to gain profound information on the objectives of SPIs, to what extent the objectives are achieved and the factors which support or hinder the achievement of these objectives. For an in-depth assessment of SPIs in the case studies it will thus be important to gain information on these aspects.

2 Introduction

For the conservation and sustainable use of biodiversity, more effective interfaces between science and policy-making are needed in order to support biodiversity policy, connect scientific and political institutions and change the behaviour of different actors in biodiversity policy. According to van den Hove (2007: 815) these science-policy interfaces (SPIs) are "social processes which encompass relations between scientists and other actors in the policy process, and which allow for exchanges, co-evolution, and joint construction of knowledge". Here, the defining criterion for SPIs is that some interaction between scientists and policy-makers takes place. These interactions might take a broad range of different forms from informal consultations of scientists by policy-makers based on personal contacts and networks to institutionalised committees or expert groups. Only institutionalised SPIs are in the scope of this mapping study.

To gain insight into how biodiversity research is connected to policy-making processes a first step is to identify existing SPIs. This will, in turn, allow the contextualisation of the case studies in WP1 within the wider SPI landscape. For this purpose we developed a mapping and stocktaking procedure for biodiversity SPIs taking into account their different functions and structures and the different scales and contexts in which they operate.

Specific aims of the mapping were to develop an overview of the SPI landscape by:

- Assembling a database of SPIs for biodiversity for selected EU-member states, the EU and the global level.
- Developing a typology of SPIs, to get a structured overview of the SPI landscape.

The database and the SPI typology are not only useful tools for better understanding biodiversity SPIs, but are an essential step in the context of the SPIRAL project to help contextualize the assessment of specific case studies in the SPIRAL project by considering the organizational and functional context. Further, the typology can be used as a framework for the work on instruments enabling an exchange of knowledge between scientists and policy-makers and as a basis to assess the performance of science-policy interfaces.

3 A short overview of SPI typologies

We first conducted a literature search to check existing SPI typologies that could be used for the mapping.

One way to develop a typology is to start with SPI functions. The Concept Note on Common Framework for Case Study Analysis (SPIRAL 2010) and van den Hove and Chabason (2009) present lists of functions SPIs can fulfil. As these lists are very comprehensive, they are useful to elaborate a compilation of functions. The challenge here is to derive systematically different functional types and functions belonging to these types.

Such a systematic list of functions is given by Funtowicz and Ravetz (1993) by categorizing them according to problem-solving strategies which may be applied in SPIs. As problem-solving strategies they mention applied science, professional consultancy and post-normal science. Funtowicz and Ravetz (1993: 747) explain professional consultancy as "personal judgments depending on higher level skills". In contrast, applied research and postnormal science produce new scientific knowledge. Applied research is done mainly by scientists while in the case of post-normal science, scientists from various disciplines and non-scientists may be contributing in different ways to the research process, in particular through transdisciplinary endeavours, e.g. for problem framing or scenario building, or through what Funtowicz and Ravetz (1993) have called "extended peer review" processes. The concept note for case studies (SPIRAL 2010) refers to this mode of research mainly by addressing the legitimacy[1] of SPI processes in the analysis of case studies.

The Funtowicz and Ravetz (1993) model provides a normative yardstick for problem solving. According to the authors, applied science is an adequate strategy when uncertainty about the impacts of decisions and decision stakes are low. Post-normal science is the right strategy when uncertainty or decision stakes are high and professional consultancy applies to issues in between. The different problem solving strategies are complementary approaches, each suited for different circumstances (Funtowicz and Ravetz 1993; Funtowicz and Strand 2007). In the approach of Funtowicz and Ravetz (1993) the double role of science is clearly emphasized: on the one hand as a generator of knowledge (in applied science) and on the other hand in its role of disseminating and translating knowledge for the political domain. For example it will be important to both understand and disseminate conceptual models based upon the theory of systems ecology (Vadineanu 2001) for decision-making.

However, the approach suggested by Funtowicz and Ravetz (1993) covers only science-related problem-solving strategies, seemingly ignoring more policy-oriented or practical problems (funding, dissemination etc) that may be addressed in SPIs without research or formal consultancy. Moreover, while focusing on interactions between scientists and policy-makers during the research process, science-policy processes before the arrangement or after the finalization of a research project is neglected.

[1] Legitimacy refers to the (perceived) fairness and balance of the SPI processes. For further explanations see concept note on common framework for case study analysis (SPIRAL 2010).

Closely related to functions is the notion of roles. Persons or institutions which exert a function hold a role in an SPI. Most notably, Pielke (2007) depicts a model of four idealized roles for scientists in decision-making: pure scientist, science arbiter, issue advocate and honest broker. The pure scientist focuses on research without consideration of the utility of scientific results for decision-making. His research is mainly curiosity-driven, but it may become relevant for policy, e.g. when a new issue is discovered. The science arbiter seeks to answer question by decision-makers that require a principally value-free judgment of experts. The issue advocate focuses on the implications of scientific research for a certain political agenda. The honest broker clarifies and expands the scope in decision-making by opening possible policy alternatives. Each of these roles has its legitimation in research or policy processes depending on the policy issue. For example, the role of the honest broker is feasible mainly when the scope of choice is ambiguous, value conflicts exist between different groups and scientific data possess a high degree of uncertainty. Both Pielke´s (2007) and Funtowicz and Ravetz' (1993) approaches emphasize the dependence of roles or problem-solving strategies on to the issue at stake. For example, decision-making on the basis of uncertain data and conflicting values would endorse the role of the honest broker and the problem-solving strategy of "post-normal science". These approaches give a rather general overview of possible roles of scientists or strategies which may be separable in reality. For example, a pure scientist may want to increase funds for his line of research. For strategic reasons he emphasizes policy relevance in his research proposals but is perhaps not really interested in enriching policy-making. Here, the role of science arbiter and pure scientist conflate.

Some authors present a typology of SPI functions that are related to certain stages of the policy cycle (Engels 2005; Weingart and Lentsch 2008). The Engels (2005) list comprises the functions of scientific warning and awareness creation, problem definition, ex ante impact assessment of policy options, ex post evaluation of policy choices and monitoring of implementation of policies. These monitoring results can further influence awareness creation or definition of environmental problems. The policy cycle conceptualizes policy-making as a rational or systematic process of problem solving (Howlett and Ramesh 2003; Jann and Wegrich 2003) and SPI functions can be thought of as supporting rational policy-making throughout the policy cycle by providing important knowledge to solve problems. We present a typology of SPI functions in the policy cycle in Figure 1.

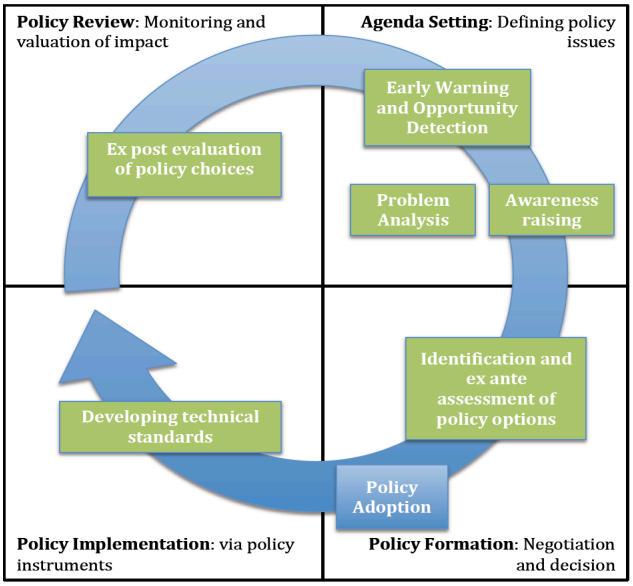

Figure 1 SPI functions in the policy cycle. The stages of the policy cycle follow Anderson (1975, cited by Jann and Wegrich 2003; see also Howlett and Ramesh). The associated SPI functions (green boxes) are inspired by Weingart and Lentsch (2008) and Engels (2005). Policy-adoption is carried out by political bodies.

The advantage of this model is that the impact of an SPI can be analysed in each step of the policy process, which might be a good basis for the evaluation of the impact or outcome of SPIs in the policy process. Kropp and Wagner (2010) use the policy cycle in an empirical study to analyse different styles of policy advice and its influence on policy-making. If certain SPIs such as mandated expert groups are set up by political bodies for the specific purpose of feeding policy options or recommendations into a legislative process they are linked mainly to one stage in the policy-cycle. Examples of such expert groups are the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the Convention on Biological Diversity (CBD), or Ad Hoc technical Expert Groups of the CBD. These SPIs might than be contrasted with other SPIs that have a broader mandate which allows them to deliver input in multiple policy stages. One might also take the perspective of identifying which SPIs cover several policy stages, such as agenda setting, policy formulation and implementation but fail to deliver input to the final policy stage, i.e. policy review. However, for many SPIs it seems unlikely that they operate at only one policy stage since the influence of science on policy-making is in general manifold and complex (Rudd 2011). Hence, it is in most cases rather difficult to assign SPIs exclusively to one or two functions in the policy-cycle. Consequently, it seems unlikely that SPIs can be systematized by their influence on a particular policy stage. The functions in the policy cycle can however be resumed in the case studies in task 1.2, for example by looking at how a single SPI organisation influences policy-making along the different stages of policy-making.

Cash et al. (2003) found that communication, translation and mediation are the most important functions to mediate between knowledge and action in ways that simultaneously enhance the salience, credibility, and legitimacy of the information certain SPIs produce. In their opinion active, iterative, and inclusive communication between experts and decision-makers proves more effective than one-way communication. Furthermore, translation is important since for scientific knowledge to

be useful to decision-making, participants in the debate about a policy need to understand each other and understand the knowledge that is brought to the table (be it scientific or policy-oriented). Lastly, mediation of conflicts appears to be most important in reinforcing the legitimacy of knowledge used for decision-making. However, a description of communication, translation and mediation and how it is done in individual SPIs requires an in-depth investigation which is not feasible for a large scale mapping.

Instead of a typology of SPIs focusing on functional attributes, a typology based on institutionalization seems feasible. The study by Weingart and Lentsch (2008) on German policy advice organizations is one of the few approaches we found which considers institutional as well as functional attributes. In this study the authors distinguish between ministerial advisory boards („Ressortgebundene Beiräte"), expert commissions for the management of risk and safety issues („Sachverständigenkommissionen im Risiko- und Sicherheitsmanagement), thematic expert commissions („Politikfeldbezogene Sachverständigenräte"), ad hoc commissions („Expertenkommissionen"), enquête commissions ("Enquête-Kommissionen") and Ministerial Research Institutes or agencies („Politikberatende Ressortforschungseinrichtungen").

These policy advice bodies are integral parts in the work of the German parliament or ministries. Therefore, they can also be defined by their specific functions for these political bodies. For example, the function of ministerial advisory boards is a continuing assessment and control of the work of the ministries. To fulfil their functions, the policy advice bodies possess certain organizational features. For example, ministerial advisory boards are mostly autonomous from the ministries in the recruitment of their members, in the choice of issues they deal with and in publishing their findings. Moreover, the lifetime of ministerial advisory boards is in principle not limited.

The model developed by Weingart and Lentsch (2008) is specifically designed for the provision of scientific advice in the Federal German politics landscape. It is thus mainly applicable on a national level and in the specific German context. Nevertheless, it seems promising to further elaborate the typology of Weingart and Lentsch (2008) for a mapping of the SPI landscape. For example, different types of expert groups and commissions in the specific German political context determined by Weingart and Lentsch (2008) can easily be transferred to the SPI context as a general "expert group" type which can be juxtaposed to a "state agency or institute" type.

Another interesting concept is the mapping framework developed by UNEP for their project to map assessments globally: the Prototype Environmental Assessment and Reporting Landscape (PEARL)[2]. PEARL collects data worldwide about environmental assessments and categorizes these assessments. The assessments are categorized for example by the lead institution, by assessment process (e.g. Global Environmental Outlook (GEO), Millennium Ecosystem Assessment) and by assessment sub-processes (e.g. GEO global, GEO regional, GEO national). While this framework might be applied across multiple political levels it is very narrow in focus by concentrating on assessments alone, neglecting the diversity of institutional forms that SPIs can have. However, since these assessments are carried out by experts that summarize existing knowledge and prepare it for decision-processes they might also be grouped into an SPI "expert group" type in the context of the SPIRAL mapping.

The EU has also developed a database including a typology for expert groups[3]. An expert group is defined as a body set up by the European Commission or its departments to provide it with advice

[2] http://www.unep.org/pearl/About/About_02.aspx

[3] http://ec.europa.eu/transparency/regexpert/

and expertise, comprising at least six public and/or private-sector members and meeting more than once. There are two types of expert groups, namely formal expert groups set up by a Commission decision and informal expert groups set up by an individual Commission department. As the typology focuses on expert groups it only covers a small part of the large variety of SPIs. Therefore, as a basis for an broad institutional typology of SPIs this approach is to narrow.

Conclusion

Based on the current literature we were unable to find a typology of SPIs that could a) be applied across multiple political levels (from subnational to global) and b) capture the broad diversity of possible institutional forms of SPIs.

Furthermore, the discussion of SPI functions showed that there are different ways of systematizing and categorizing SPI functions. Their usefulness depends strongly on perspective and application context, e.g. whether one is interested in procedural aspects of managing an SPI (communication, translation, mediation), normative guidance for the role of scientists (the honest broker versus issue advocate) or whether one wants to analyse the impact of an SPI within the policy-cycle (functions in the policy cycle).

Analogously the typology of science-policy interfaces developed here and also the attributes of SPIs addressed in the mapping should be tailored to the aims of the mapping task. These aims are first to design the SPI types in a way that allows SPIs to be easily and unambiguously assigned to one type. An assignment of an SPI to two or more types should be ruled out as far as possible. We favour an institutional rather than functional typology. As most of SPIs possess several functions, a functional typology does not allow for an unambiguous assignment of SPIs to one type. Second, information on SPIs in the mapping should be obtained reasonably easily, which means that we mainly rely on webpages of SPIs to gain the required information. Thus, in-depth information for example on stakeholder participation cannot be taken up in our mapping. The use of an attribute such as "participation procedure" therefore would be unfeasible. The selection of attributes in turn affects the design of the SPI typology, as the typology is developed from a combination of attribute values. Third, the typology and the selected attributes of SPIs should offer a basis for the selection of case studies and for the evaluation of SPIs. Therefore, the SPI typology should help us find adequate units for case studies (Yin 2009) and for the evaluation of the performance of SPIs. Here an organizational typology is more useful than a functional, as organizations are relatively closed systems which can be evaluated while functional attributes offer some good criteria for their evaluation, but not for their categorization. It seems for example more feasible to compare and evaluate different functions of science projects (as an institutional type) than to compare early warning SPIs (as a functional type) with SPIs involved in the assessment of policy options.

So far we could not find a typology of SPI functions based on easily available data that is able to clearly differentiate between different institutionalised SPI types. Therefore, the suitability of existing schemes of SPI functions to map SPIs for the purpose of this project is limited. Building on the above review and the mapping aims we present a framework for the mapping of SPIs in the next chapter.

4 Institutional and functional variables addressed in the mapping

The SPI typology we describe in this section is in part derived from the review of SPI typologies and in part from an inductive approach in which we adapted preliminary SPI typologies during the collection of data about SPIs. First we describe the institutional and functional dimensions of SPIs before describing the combined SPI typology.

4.1 Institutional variables

In this section we describe the institutional variables, which we used to characterize SPI organizations throughout the mapping and to develop SPI types. The institutional variables presented here focus mainly on SPI structures rather than SPI processes.

Formal political mandate: A formal political mandate is a decision by a political body to set up the SPI. A certain organization, e.g. a state agency, can be endowed with a mandate. The political bodies giving the mandate can be inter alia governments, ministries or parliaments. A mandate can for example be given in the form of a law, governmental decision, COP decision of international conventions, ministerial orders or directives. As in most cases the mandate also specifies the task which should be fulfilled by the mandated organization it encompasses also functional aspects. However, here we focus only on structural aspects.

A political mandate often implies a high degree of participation (consultation, interactive participation, self-mobilization (Pretty 1995), which potentially enhances legitimacy (Svarstad et al. 2011). But a legitimation from the political side does not necessarily entail legitimacy from the viewpoint of other stakeholders. A political mandate may also increase the relevance of the SPI for decision-making, as in general the mandate is given with the purpose of feeding into policy-processes. However, although a political mandate favours relevance it is certainly not sufficient to guarantee relevance.

Organisational structure: The organisational structure reflects the relation of the SPIs to the most important institutions (interest groups, science institutions and political or administrative bodies) interacting at the science-policy boundary.

We identified the following types of organizational association and location of SPIs:

a) **Expert groups** consist of experts recruited from different institutions, for instance research institutions, political bodies or interest groups. Therefore, the participants cannot be considered as personnel affiliated mainly to the expert group (in the sense of being employed by this SPI institution). However, personnel may be employed to coordinate the expert group, e.g. secretary staff. This may especially be the case for complex expert groups such as intergovernmental panels (e.g. IPCC).
   This category encompasses all the different expert groups distinguished by Weingart and Lentsch (2008).

b) **State agencies or institutes** are separate organizations, i.e. they are not part of a larger institution and the majority of their staff has a dedicated affiliation to this institution (i.e. not

recruited from other institutions). This category is equivalent to Weingart and Lentsch's (2008) ministerial research institutes and agencies.

c) **SPIs of research projects**. In this case a science organization coordinates a project that engages in science-policy interfacing. Therefore, the project is not an independent organisation, rather it is a part of another or several organizations in which it is embedded. The SPI may either be realized through a transdisciplinary research process or it connects a more conventional research process (applied research, interdisciplinary research) with policy-making, e.g. as work packages of EU projects that deal with outreach and dissemination.

d) **Interest groups** are organizations that represent interests of certain civil groups (NGOs) or of science (learned societies). They try to influence policy on biodiversity conservation or science policy (e.g. defining research priorities for funding). Many of these interest groups are involved in research.

Composition of expert groups: The composition of expert groups takes into account the experts' affiliations. We can distinguish between biased expert groups, which consist mainly of scientists or mainly of policy-makers, or interest groups which are more or less balanced between these groups. The composition of expert groups can influence how closely related to policy or science an expert group is and in turn influences credibility, relevance and legitimacy of SPIs.

This attribute is only applicable to expert groups. It is irrelevant for example for interest groups as people involved are representatives of a certain academic discipline and/or advocates for a certain policy and thus there is no need for a balanced composition in the group.

Lifetime: We define "lifetime" as the time span an SPI is intended to function. Institutions by definition are more enduring and guarantee 'solidity' across time and space (Giddens 1984). Vatn (2005: 60) states that institutions "provide expectations, stability and meaning essential to human existence and coordination. Institutions regularize life, support values and produce and protect interests". This also implies a certain temporal stability since only stable rules can provide expectations and regularize life. Therefore, lifetime is an important measure of the degree of institutionalization. This applies also to organizations, which can be considered as a special kind of institutions[4] for the purposes of mapping institutionalized SPIs.

For the sake of simplicity, we distinguished between SPIs which are designed for a limited lifetime (five years or less) and a permanent lifetime (over five years). We chose the five year threshold because on the one hand most one-off projects end within five years. On the other hand, even those SPIs which are established without an expiry date do not operate infinitely. There might be some SPIs which were initiated only recently and thus could not surpass the threshold. Here, the time span for which the SPI is planned to operate is crucial. For example, as soon as IPBES starts working it will possibly be an SPI with permanent lifetime.

4.2 SPI functions

When referring to SPI functions, we distinguish between the stated objectives and function types.

Stated objectives are statements about the aims of the SPI as defined by itself or an external mandate. Stated objectives were included in the mapping so that the user of the database could get a

[4] Stanford Ecyclopedia of Philosophy, http://plato.stanford.edu/entries/social-institutions, Accessed Juli 2011.

more detailed picture on the aims and mode of operation of a SPI. We retrieved the stated objectives mostly from websites of the SPIs.

We develop functional types connected to SPI institutions and assign stated objectives to these functional types. Since the functional types found in the literature are only insufficiently applicable for a broad comparative approach of SPI organizations we develop functional typologies based on our empirical findings. We use this typology together with organizational attributes to model the SPI landscape and to develop SPI types. Furthermore, we use them to analyse the stated objectives. In the following paragraphs we describe the developed function types.

Knowledge functions

Knowledge functions[5] are processes of producing knowledge or using this knowledge in decision-making. While non-scientific knowledge forms may be important for SPIs (van den Hove 2007; Hulme et al. 2011), scientific knowledge is a constitutive element of SPIs[6]. We distinguish three knowledge functions:

1. **Assessment of existing scientific knowledge**: Scientific knowledge on a biodiversity topic can be complete or incomplete. Knowledge can be relevant for policy-making or useful in the development of practices and technologies which again might influence decision options. Such assessments of existing knowledge with the aim of supporting decision-making are an important function of SPIs. These assessments underlie formal procedures or the judgement of experts or stakeholders.
2. **Supporting the production of new relevant scientific knowledge:** This entails the identification of knowledge needs and gaps, the formulation of research strategies and distribution of funding. This function is similar to the concept of reconciling the supply and demand of scientific knowledge of Sarewitz and Pielke (2007).
3. **Production of new scientific knowledge:** This is the creation of new scientific knowledge through research. While this could be considered outside the boundaries of SPIs, it is important to distinguish between distinct modes of research, i.e. non-cross disciplinary, multidisciplinary, interdisciplinary and transdisciplinary[7] research. Part of the activities involved in transdisciplinary

[5] In this and the following sections we address functional types. For reasons of linguistic simplicity we do not use the term “type” for each functional type, e.g., talk of “knowledge functions” or “linking functions” instead of “knowledge function types” or “linking function types”

[6] If scientific knowledge is not the focus and if different types of knowledge are treated equally one may rather speak of knowledge-policy interfaces.

[7] Evely et al. (2010) divide research up into non cross-disciplinary, multidisciplinary, interdisciplinary and transdisciplinary research. Non cross-disciplinary studies take place within the bounds of a single, academic discipline. Research is focused on answering a specific research question. Multidisciplinary studies involve several different academic disciplines, researching one theme with multiple disciplinary goals. Participants exchange knowledge. The research process progresses as parallel disciplinary efforts without integration, but usually with the aim to compare results. Interdisciplinary studies involve several unrelated academic disciplines of contrasting research paradigms in a way that forces them to cross subject boundaries, to create new knowledge and theories, and solve a common research goal. According to Evely et al. (2010) unrelated academic disciplines are characterized by contrasting research paradigms. Transdisciplinary studies integrate academic researchers from disciplines with contrasting research paradigms as well as non-academic participants (such as the public) to research a common goal and create new knowledge and theories. Transdisciplinarity combines interdisciplinarity with a participatory approach.

research may be considered to be part of the SPI. Many science-policy processes which are addressed in the Concept Note focus on transdisciplinary activities (e.g. by integrating stakeholder knowledge). While interdisciplinary or disciplinary research remains within academic boundaries, they might be coupled with outreach activities in a science-policy interface.

Linking Functions

A constitutive element of science-policy interfaces is that they establish a link between science and policy-making or between scientists and policy-makers. Van den Hove (2007) emphasizes this by stating that SPIs are "social processes which encompass relations between scientists and other actors in the policy process". Subordinate linking functions can then be formulated with respect to processes that are important to establish these links. The linking function is achieved mainly through communication processes which encompass for example informal networking or formal participation procedures.

5 Cross-level SPI typology

Based on the institutional attributes and function types presented above we build a typology of SPI organizations to structure the diverse and vast SPI landscape across different political levels.

We distinguish four generic SPI types: State agencies or institutes, expert groups, interest groups and SPIs of research projects. Within these generic types we differentiate between SPIs as follows:

1. Interest groups: NGOs and learned societies

2. SPI of research project: SPIs of science projects and SPIs of supporting projects

3. Expert groups: mandated expert groups and non-mandated expert groups

4. State agencies or institutes

The combination of functions and organizational attributes allows a relatively clear distinction between different SPIs. We present this typology in Figure 2 and expand in the following paragraphs.

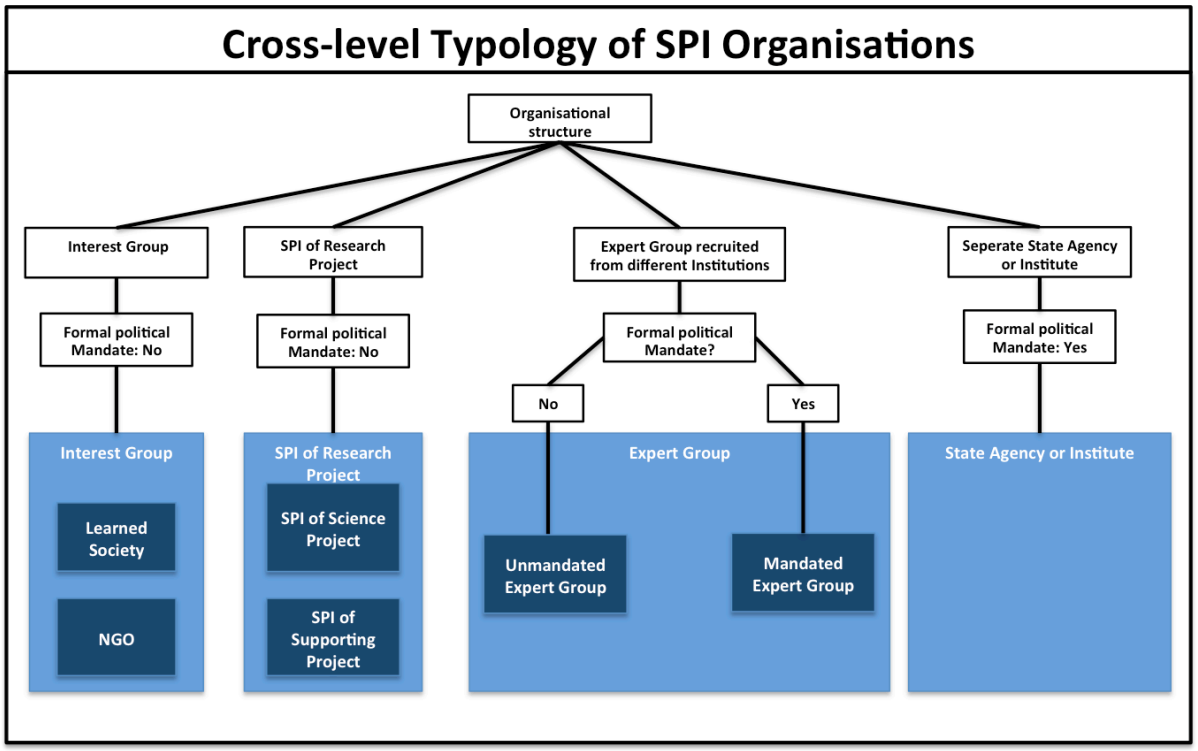

Figure 2 A cross-level typology of SPI organizations. Light blue boxes show the four generic categories of SPI institutions. Dark blue boxes shows SPI categories that can be distinguished within the generic SPI categories.

1. **Interest groups** are institutions that represent interests of certain civil groups (NGOs, including private sector organisations) or science (learned societies). They can either promote research which feeds into a specific policy agenda or – in the case of learned societies – they call for the support of research which is in line with a certain research agenda. Further, these groups can also be involved in synthesis and communication of research results and in policy development. They have no formal political mandate. In general, interest groups have a relatively long lifetime compared to research projects and ad hoc expert groups.

   Within interest groups we distinguish between NGOs and learned societies.

NGOs are civil initiatives by parts of society that value biodiversity or certain aspects of nature. They engage in lobbying and commenting on policy. Moreover they produce scientific knowledge on biodiversity in various ways.

Learned societies are organizations that promote an academic discipline or group of disciplines and engage in biodiversity-related issues. They also support the production of scientific knowledge, e.g. by organizing conferences and commenting on policy.

2. **SPIs of research projects** are embedded in, i.e. they are located in or carried out by, one or more research institutions as one part (mostly work package) of the project. Therefore, they are not separate and independent organisations as state agencies or interest groups.

   Furthermore, projects have a limited lifetime due to restricted funding. Therefore, temporal continuity as an important aspect of institutions is missing. Consequently, if science-policy processes need continuous input over a long period it potentially unfavourable to restrict the operation of an SPI to the lifetime of a project

   Nevertheless, projects possess a clear structure comparable to a division of work in organizations. Roles are assigned specifically to research partners and the projects are divided into different work packages.[8] However, SPIs of research projects represent a very weak form of institutionalization for SPIs. Furthermore, these SPIs rarely have a formal political mandate.

   Within science projects we distinguished between **SPIs of science projects** and **SPIs of supporting projects.** SPIs of science projects aim to link a specific science project to policy-making. Supporting projects do not carry out actual research but aim to increase collaboration within the science community or develop research infrastructure (e.g. Alter-Net). Some of these supporting projects also engage either in part or entirely focus on activities that link science and policy-making such as Alter-Net, KNEU, and projects that are linked within the SPI-Water Cluster[9].

3. **Expert groups** recruit their participants from different institutions.

   As with research projects some expert groups such as ad hoc expert groups with a very limited lifetime (for instance the Ad hoc Technical Expert Groups of the CBD) may be borderline cases considering their institutional status. However, they qualify as organisations by formally assigning roles with specific tasks (e.g. a chairperson etc). Some expert groups qualify very well as organizations and have a relatively long actual (IPCC, ICES) or intended (IPBES) lifetime.

   The main function of these expert groups is not to produce new scientific knowledge but to assess existing scientific knowledge. They may also contribute to the identification of research needs and gaps.

   Mandated expert groups have a formal political mandate, e.g. through Conventions, the European Commission, EU DGs, national parliaments or governments. **Non-mandated expert groups** lack such a formal political mandate.

---

[8] Harre (1979 cited in Stanford Encyclopedia of Philosophy) stated that: „An institution was defined as an interlocking double-structure of persons-as-role-holders or office-bearers and the like, and of social practices".

[9] www.spi-water.eu/

Within both mandated and non-mandated expert groups we distinguish expert groups composed primarily of policy-makers, expert groups composed primarily of scientists and balanced expert groups.

4. **State agencies or institutes** are separate organisations, (i.e. they are not embedded in other organisations such as projects), in general have professional staff (i.e. personnel is not recruited from other institutions) and are legitimated by a formal political mandate, as they are based on law or accountable to ministries.

   State agencies and institutes qualify very well as institutions as opposed to ad hoc expert groups or short-lived research or supporting projects due to their relatively long lifetime. Nevertheless, state agencies may also be created and dissolved depending on the political agenda.

   State agencies or institutes have the political mandate to:

   - Conduct or fund applied research mostly to fulfil the knowledge needs of specific policy fields or knowledge needs of ministries.
   - Conduct or fund assessments of existing knowledge and give policy advice, e.g. for preparation of legislation processes.
   - Have regulatory responsibilities that require scientific knowledge, i.e. implementing and enforcing existing law (e.g. CITES certification).

   Therefore, state agencies and institutes are both part of the political-administrative system and of the science system. Consequently, this SPI type links science and policy-making. Generally the proportion of research, policy advice and administrative responsibilities may vary considerably between individual state agencies or institutes.

   Some state agencies or institutes may also fund external research thereby linking intimately research and decision-making.

6 Data collection

The attributes of SPIs contained in the mapping typology were used to develop a mapping template for data collection purposes. The template included political mandate, the organizational association or location, the personnel composition of expert groups and lifetime. We supplemented the template with some further important aspects i.e. stated objectives, the area of biodiversity addressed and data on sources for more in-depth information on the SPI (website and contact, SPIRAL partner that contributed the information).

The template was subsequently filled with data from different sources. The data were collected from websites of SPIs, an online database[10], policy documents, UNEP studies (UNEP 2009; UNEP 2010; WCMC 2010). The mapping template was distributed to all SPIRAL partners who were requested to add SPIs and information about them. We only included institutionalized SPIs for the mapping and hence excluded, for example, face-to-face communication between scientists and policy-makers. The compilation of SPIs are available as an excel file and access database, currently only on the internal WIKI-website of the SPIRAL project.

Some types of SPIs are included in our mapping as representative examples of SPIs. For example, while we acknowledge there is a large number of European Framework Programme research projects with an SPI, in our database we only addressed those which were selected by the SPIRAL partners. The landscape is so diverse, different SPIs can be nested within one organization and SPI processes may be intertwined. Thus, the mapping of science-policy interfaces is not exhaustive and will be an on-going task.

[10] http://ec.europa.eu/transparency/regexpert/

7 Overview of the SPI landscape based on the cross-level typology

In this section we give an overview on the SPIs we collected (see Section 6). First, we delineate how many SPIs we found on different political levels and for different SPI types. Second, we present examples of SPIs which represent specific SPI types or attributes and comment on cases which cross over different SPI types.

7.1 Quantitative overview of sampled SPIs

Overall, we compiled 150 SPIs including 71 expert groups, 20 state agencies or institutes, 18 interest groups and 30 SPIs of research projects. 11 SPIs could not be assigned to any of these types because they fulfilled criteria of different SPI types.

At the global level we found 36 SPIs including 23 expert groups, one state agencies or institutes, five interest groups and three SPIs of research projects. 20 expert groups had a formal political mandate. Three SPIs could not be assigned to any of these types.

At the EU level we sampled 52 SPIs including 22 expert groups, two state agencies or institutes, five interest groups and 17 SPIs of research projects. 13 expert groups had a formal political mandate. Six SPIs could not be assigned to any of these types.

On the Member State level we sampled 62 SPIs including 26 expert groups, 16 state agencies or institutes, eight interest groups and 10 SPIs of research projects. 22 expert groups had a formal political mandate. Six SPIs could not be assigned to any of these types. These results are compiled in Figure 3.

Examples for SPIs that fall in the "other" category since they could not be assigned to any SPI type include the Science and Technology Options Assessment (STOA), which is a service for the European Parliament and is therefore both an integral part of the political administrative system (as state agencies) but also not an independent organization (as state agencies). A national counterpart of such an SPI is the German Scientific Service of the Federal Parliament.

The SPI database is provided in the appendix of this deliverable. It is based on an access data base.

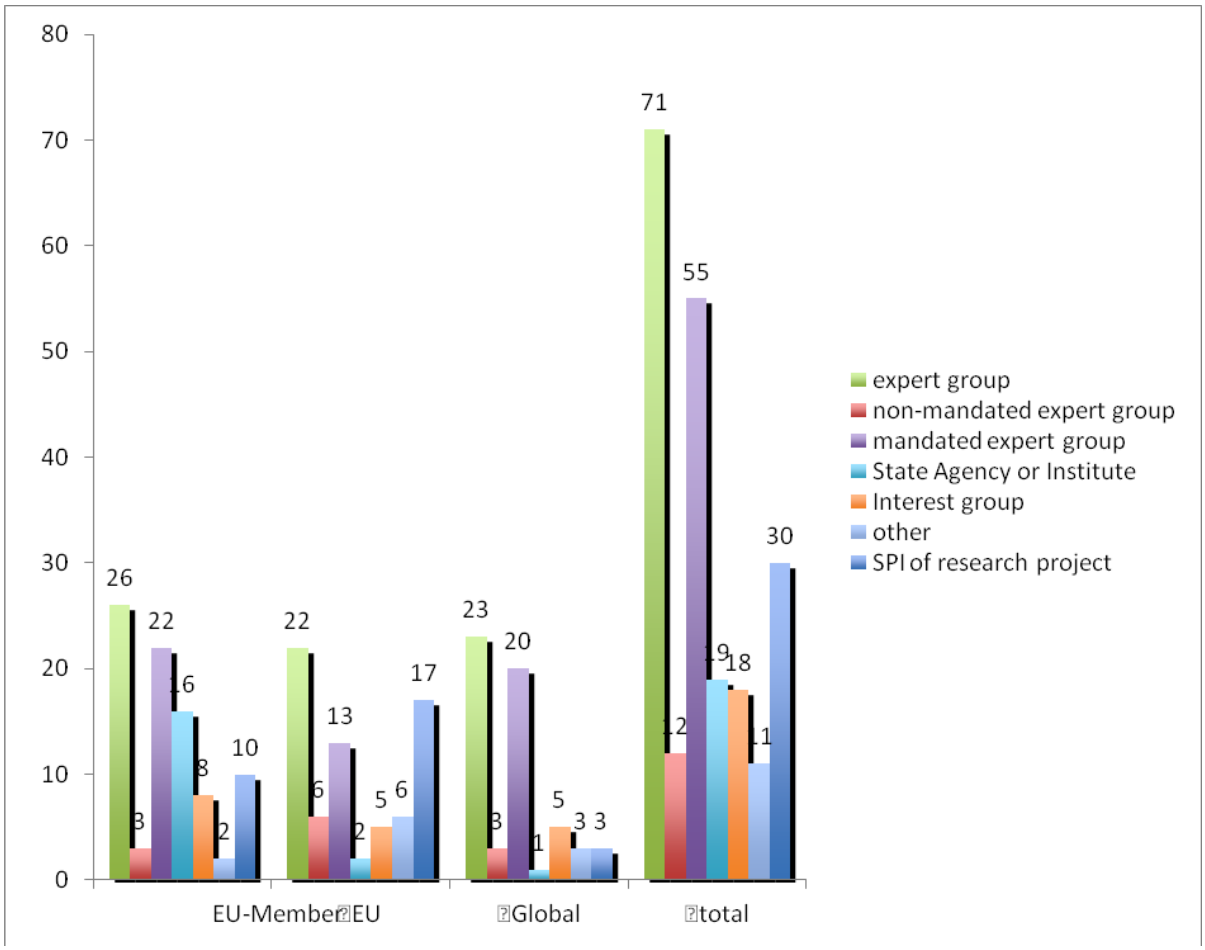

Figure 3 Quantitative overview of the mapping. Note that the sum of non-mandated and mandated expert groups is not equal to the number of expert groups. This is due to the fact that we were able to classify some SPIs as expert groups bud had no information whether they have a mandate or not.

7.2 Description of the SPI landscape by representatives of different SPI types

In this section we describe some of the interfaces in the SPI landscape by using our typology. We describe examples of SPIs for each type at the member states, EU and global level. Most of the information in this section is based on the database and is supplemented with additional information from websites and documents and partners' direct knowledge of some of the SPIs described.

1. **SPIs of research projects:**

a) **SPIs of science projects** (e.g. funded under EU Framework Programmes) link science and policy-making to in various ways (linking functions see chapter 4.2). Concerning participation, all EU FP7 projects are required to include stakeholders in their advisory boards. Only a few projects include stakeholders in a transdisciplinary manner, i.e. projects that integrate stakeholders into the problem framing and the actual research process (e.g. the EU project **HERMIONE**). Therefore, EU projects mainly concentrate on disciplinary or interdisciplinary studies. All EU FP projects are also required to have some outreach activities. As such, some projects have dedicated work packages for outreach and stakeholder participation:

The EU project **Policymix** investigates economic instruments for biodiversity conservation. The WP „Methodological synthesis and policy recommendations" includes a task to „synthesise policy design recommendations from the individual case studies in the form of policy design criteria and policy mix matrices"[11].

SCALES investigates how anthropogenic and natural processes interact across scales. The WP "Dissemination and Science-policy dialogue" has a task „science policy dialogue". The website describes how the link between science and policy-making is organized, for example by setting up ad hoc advisory groups for policy advice and by organizing workshops where stakeholders´ knowledge needs and knowledge emerging from the project are discussed.

EBONE is a project that aims to contribute to the development of international monitoring systems for biodiversity. WP10 „Stakeholder involvement, communication and dissemination" mentions a range of audiences they will engage with, e.g. EU institutions (DG Environment, Habitat Commission), national policy-makers and conservation managers (e.g. the German Federal Agency for Nature Conservation) and a range of standardization organisations such as the Group of Earth Observation Biodiversity Observation Network (GEO BON). Activities mentioned are inter alia participating in the European Science Week and the Green Week and publishing press releases through the Press Centre for Biodiversity Research.

MacMan investigated the ecology of and developed monitoring for the endangered butterfly genus *Maculinea*. WP 9 had the task of "putting the scientific and applied results from all WPs (especially WP 8) into the public domain and enabling their wide ranging exploitation"[12]. The WP description also mentioned that the legal copyright conditions would be managed in a way that potential users of the produced knowledge could use the project results for their practical conservation work. According to van den Hove (2004) MacMan established links to users of the project results (conservation agencies, land-users, planners, NGOs, Environmental Impact Assessment specialists) through (1) an advisory board that included the users, (2) sub projects carried out by users to test the project results (3) organised meetings between scientists and users, (4) involvement of users in project conferences and (5) publishing the project results in journals and handbooks accessible to the users.

Personal communication with the project coordinator also revealed that he was directly approached by landscape planners since *Maculinea* species are listed on annexes of EU directives which makes them relevant for planning policy.

b) **SPIs of supporting projects: BiodivERsA** is an example for supporting projects and was funded under FP6 as a coordination action (2005-2010). BiodivERsA aims to increase collaboration between funding agencies of EU member states to integrate funding of biodiversity research across the EU. It is thus an interface between actual research and research policy. Hitherto they developed two joint calls to fund research projects. Currently, BiodivERsA is in its second phase (2010-2014) and develops further joint calls for funding. The ultimate aim is to establish a "sustainable independent funding platform for biodiversity research"[13]. If this objective is accomplished then BiodivERsA might develop into the SPI-type platform for biodiversity research, including research funders and (probably) biodiversity policy organisations.

---

[11] http://policymix.nina.no/

[12] http://www.macman-project.de

[13] www.biodiversa.org

A cluster of three EU FP7 projects, called Science-Policy Interfacing in Water Management[14], aims to „ease access to and promote the use of FP environmental research results in the definition of national, EU and international policies". One of the projects is WaterDiss2.0 which aims to collect the results of approximately 60 water-related EU Framework Programme projects to make them available for the implementation of the Water Framework Directive (WFD). While the project does not explicitly address biodiversity its activities could be relevant for European freshwater biodiversity, which might profit from a better implementation of the WFD.

Alter-Net was funded within FP6 as a EU Network of Excellence (2004-2009). Alter-Net aimed at increasing collaboration between research institutes that carry out biodiversity research across Europe and developed a common research program for this purpose. Alter-net also contributed in establishing the European Long-Term Ecosystem Research sites (LTER) and the Long-Term Socio-Ecological Research platforms (LTSER). Further, Alter-Net had one WP for communication and dissemination to link to the wider public and policy-makers. The website claims that one activity was „communication and knowledge transfer at interfaces such as scientist-to-scientist, scientist-to-policymaker and with the general public"[15]. It developed several instruments in that direction (e.g. an expert database of potential contacts for policy questions and an open access journal for policy relevant research findings).

The partners kept Alter-net running after funding stopped so, strictly speaking, at present no longer falls into the category of supporting projects but may be considered an interest group involved in science.

An example for networking within science with the purpose of enhancing the link to policy-making is the **KNEU** project (FP7, 2010-2014) that attempts to build a European network of biodiversity and ecosystem services knowledge holders as part of a possible European SPI for biodiversity. The network of knowledge holders might support the provision of knowledge into policy processes. It should be noted that most SPIs that conduct large-scale assessments (e.g. intergovernmental panels in the SPI type expert group) require this type of networking. In the case of the IPCC, national focal points execute the task of linking the SPI (IPCC) with the relevant knowledge holders in a country (IPCC 2010).

A further example is the German project **Network Forum for biodiversity research Germany** (NeFo) that aims to both network within science to increase coherence for biodiversity research (network part of NeFo) and increase the interaction between science and policy-making (forum part of NeFo). For this, NeFo provides inter alia expertise of scientific knowledge holders as input for policy processes, e.g. for the CBD-SBSTTA meetings. NeFo is steered by a Scientifc Advisory Board, but lacks formal links to policy making bodies.

Another supporting project found through the mapping exercise was the FP6 project BioStrat (2006-2010). **BioStrat** (and the FP5 project BioPlatform prior to it) supported the production of new relevant scientific knowledge by contributing to the work of the European Platform for Biodiversity Research Strategy (EPBRS). This work was focused on identifying research needs for biodiversity topics, and thus facilitating future focused research.

2. Expert groups

[14] /www.spi-water.eu

[15] http://www.alter-net.info/about-alter-net, accessed 10th August 2011

a) **Mandated expert groups:**

The **German Advisory Council on the Environment (SRU)** was established by a charter of the German Federal Ministry of the Interior in 1971 and therefore is one of the oldest scientific policy advice organisations for environmental policy in Germany.

Members of the SRU are seven professors appointed by the Federal Government for four years and therefore the SRU is an example for an expert group composed mainly of scientists. Furthermore, the SRU employs 16 scientists and a secretariat in Berlin. The SRU defines independently the themes for its reports and assessments. It publishes a periodical report every four years and additionally thematic reports on important issues and also comments on on-going legislation processes. The reports cover a wide range of biodiversity related topics. For example, the SRU reviewed the German and European sustainability and biodiversity strategies in 2008 (SRU 2008) and assessed the possibilities of implementing the German National Biodiversity Strategy. Recently the SRU commented on the development of a German "Forest Strategy 2020" (SRU 2011).

The German Advisory Council on Global Change (**WBGU**) was set up by the Federal Government in 1992. The Council has nine members, which are appointed by the government for four years and all are senior scientists. The Council is supported by a secretariat in Berlin.

The Council publishes flagship reports every two years for which it independently defines the topic. For example the title of the most recent report was „World in Transition – A Social Contract for Sustainability". Additionally the federal government can commission the WBGU to prepare special reports on specific themes, for example the special report in 2006 on „The Future Oceans – Warming Up, Rising High, Turning Acid".

In its reports the WBGU assesses the current state of science and gives policy recommendations and options and also identifies research gaps. Hitherto, the Council has addressed mostly drivers of biodiversity change.

The German parliament has the ability to establish so called **enquête-commissions** for any topic. The enquête-commissions comprise members of the parliament and scientific experts in equal proportions. Therefore, enquêtes are examples of balanced expert groups that aim to link science and policy-making by inclusive participation**.** Examples of enquête commissions include "Protection of Humans and the Environment" ("Schutz des Menschen und der Umwelt") in 1994-1998 and "Growth, Wealth and Quality of Life" ("Wachstum, Wohlstand, Lebensqualität") dealing with sustainable economy and thereby touching on biodiversity. So far, no enquête commission has dealt exclusively with biodiversity.

The European Commission maintains a register of Commission expert groups and other similar entities[16]. These expert groups have the task either of helping the EC to prepare legislative proposals or support the implementation of existing EU legislation (e.g. by coordinating member countries). For this purpose they supplement the internal expertise of the Commission with scientific and practical knowledge. They provide opinions, recommendations and reports but none of them are binding for the Commission. The register contains only expert groups that meet more than once. There are specific rules concerning the creation and operation of EU expert groups that can be found on the registers website.

[16] http://ec.europa.eu/transparency/regexpert

There are two types of EU expert groups: those set up by a Commission decision, i.e., „formal expert groups", and those set up by an individual Commission department, i.e. „informal expert groups".

Many of the EU expert groups seem to support the coordination of the political administrative system in the EU and do not connect science and policy-making, since many descriptions of the expert groups in the EU database do not refer to science or scientific knowledge.

A good example of an informal expert group is the **Coordination Group for Biodiversity and Nature Conservation** which was set up by DG Environment in 2008 and replaces the Biodiversity Expert Group (BEG), Habitats Scientific Working Group and the ORNIS scientific working group. Members are representatives from DG Environment, member states and NGOs. The aim of the expert group is „to coordinate all issues related to the implementation of the Nature Directives (Birds Directive and Habitats Directive) and to the pre- and post-2010 Biodiversity policy and the Biodiversity Action Plan"[17].

A further example is the **Expert Group on Agriculture and Climate Change** that was set up by DG Agriculture and Rural Development in 2005 to exchange "information, experiences and good practices in the area of agriculture and climate change".

The **Nature Expert Group** was set up by DG Environment in 2006 to "facilitate the communication and experience sharing among the experts from the fields of Nature and the experts from the field of Forestry" and to "acquire a complete picture of different attitudes and the role of environmental inspection in protected areas (within Natura 2000 sites as well as in the national categories of protected areas) in the EU member states".

The **Environment Policy Review Group** was set up by DG Environment in 1990. In this group the directors general of all EU member's ministries for the environment, the directors general of European Economic Area countries and the Executive Director of the European Environment Agency participate. They meet to "gather views on EU environment policy issues that are in the pipeline" and are "collecting information on actual experiences in the MSs relating to the implementation of EU environmental policies".

An example for a formal expert group set up by a Commission decision related to biodiversity is the **Scientific Review Group On CITES** (SRG). It was established by Article 17 of Council Regulation 338/97 on the protection of species of wild fauna and flora by trade regulation. The expert group examines scientific questions relating to the application of the Council Regulation and gives advice to amend its Annexes B to D.

The **Bureau of European Policy Advisers** (BEPA) (including Chief Scientific Adviser) has been in place since 2004. The historical roots of BEPA lie in the Commission's Forward Studies Unit, which was established in 1989. BEPAoperates directly under the authority of the president of the EU Commission.

The function of the Bureau is to forge "links between the European Commission and think tanks, academia, civil society, churches and communities of conviction."[18].

---

[17] All quotations concerning expert groups from the Register of Commission expert groups and other similar entities are taken from the EU database

[18] http://ec.europa.eu/bepa/index_en.htm

BEPA consists of an analysis team and an outreach team. The analysis team conducts policy analysis and advice while the outreach team promotes links between policy-makers and society. BEPA organises regular meetings between the President, his Cabinet and relevant experts and academics.

So far we could not find any activities of BEPA that were closely related to the topic of biodiversity. However, BEPA does not seem to be restricted to particular topics and therefore might address biodiversity in the future.

The EEA initiated the **European Ecosystem Assessment (EURECA)** [19], a subglobal MA follow-up.[20] Discussions on EURECA started in 2009 and currently, concepts are revised and the way to involve stakeholders is under development. According to a project summary it will provide a platform for stakeholders to exchange knowledge (EEA 2008). As an additional element for policy advice and exchange, the EEA jointly with other partners launched in 2010 the information system BISE (Biodiversity Information System for Europe)[21], which aims to " strengthen the knowledge base and support decision-making on biodiversity".

On the global level there are a range of expert groups that are mandated by global conventions such as the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the CBD (Koetz et al. 2008), Ad Hoc technical Expert Groups of the CBD, the Animals Committee and Plants Committee mandated by CITES or the Global Biodiversity Outlook (GBO) mandated by the CBD. These SPIs are thematically focused to biodiversity themes.

The distinction between mandated and non-mandated is not always very clear-cut. For example, the initiative for the MA came from the science side. As it had no mandate, it did not have to be formally accounted for in CBD negotiations. But later it was supported by political bodies and international conventions, including the CBD.

A contrast to expert groups linked to global conventions are **intergovernmental panels** such as IPBES and the IPCC that are not mandated within the framework of international convention and therefore are independent of these. IPBES for example is mandated by the UN general assembly.

Intergovernmental SPIs such as the IPCC, and IPBES (if implemented as expected) have, in contrast to simpler expert groups, a strong internal differentiation in a governance unit and an assessment unit. The governance unit, e.g., the plenary of the IPCC or the future IPBES, consists of government representatives, scientists and interest groups but only the government representatives have a vote in the plenary. Thus, intergovernmental panels are not politically independent as they are governed by representatives of national states. The plenary decides on the topics of the assessments and may also be involved in the review process and the formulation of certain parts of the assessment reports, e.g., the summary for policy-makers as in the case of the IPCC. The assessment unit (e.g. working groups of the IPCC and the large amount of contributing authors) is mainly composed of scientists who carry out the actual scientific assessment (of climate change).

---

[19] http://eureca.ew.eea.europa.eu/

[20] As in EURECA existing knowledge is synthesized into an ecosystem assessment the task of common expert groups is by far exceeded. This shows that the SPI types given here are actually very broad and that the delimitation between different SPI types is sometimes quite fuzzy.

[21] http://biodiversity.europa.eu/

b) Non-mandated expert groups

A prominent example for a non-mandated expert group is the group of scientists that conducted the Global Biodiversity Assessment (GBA). Further examples are the German Council for Land Stewardship (Deutscher Rat für Landespflege – DRL), the European Platform for Biodiversity Research Policy (EPBRS), which only has a loose mandate via nomitated experts by research programme committee members of each country, or the Policy Committee of the Society for Conservation Biology.

3. State Agencies or institutes

An example with a long history is the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz - BfN), which exists in its present form since 1993. The BfN is under the jurisdiction of the Ministry for the Environment (BMU).

The BfN covers most aspects of biodiversity in its activities. It has administrative responsibilities, i.e. it implements conservation law (e.g., CITES), assesses scientific knowledge and gives advice and recommendations for policies. For example, ideas and methods for conservation prioritisation collected during a symposium organised by the BfN (Gruttke 2004) found their way into the recent German Federal State Law on Nature Conservation that came into force in 2010. Furthermore, the BfN is involved in the development of technical standards such as the standards for red list assessments or assessments for conservation responsibility. However, aside from development of methods the BfN does not conduct its own research but funds research (research programme UFOPLAN). The preceding organisation, the German Federal Research Institute for Nature Conservation and Landscape Ecology (Bundesforschungsanstalt für Naturschutz und Landschaftspflege - BFANL, 1976-1993), was mainly focused on research and had no administrative responsibilities.

Biodiversity-related research with a political mandate under the jurisdiction of certain ministries in Germany is partially done in separate ministerial research institutes. For example, in the German Heinrich von Thünen Institute for Rural Areas, Forest and Fishery (vTI) or the Federal Research Centre for Cultivated Plants (Julius-Kühn-Institute). The vTI has an Institute of Biodiversity. Both institutes focus on agricultural sciences and therefore thematically cover mostly aspects of biodiversity related to agricultural ecosystems. Consequently, both are under the jurisdiction of the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV). Most of the biodiversity research in Germany is carried out by universities and non-university research institutes.

Another organisation under the jurisdiction of the BMU is the German Federal Agency for the Environment (UBA) combines administrative issues with research and policy advice. However, its activities are rather peripheral to biodiversity. The UBA mainly covers environmental protection topics (air, water, soil). Nonetheless, the UBA increasingly connects its activities to the biodiversity topic by framing environmental threats as drivers of biodiversity change (UBA 2010) and has developed a concept for research together with the BfN that should provide the basis for implementation of the German National Biodiversity Strategy (BfN and UBA 2011).

In the Netherlands there are mainly two state agencies or institutes at the intersection between science and policy that are thematically related to biodiversity, the **National Institute for Health and the Environment** (**RIVM)** and **Netherlands Environmental Assessment Agency (PBL).**

RIVM is under the jurisdiction of three ministries one of which is the ministry of Spatial Planning and the Environment. RIVM was established in 1984 and in 1997 assigned the role of the Netherlands Environmental Assessment Agency (MNP). In 2006 the MNP became independent.

RIVM provides advice for policy and conducts environmental monitoring (quality of air, water and soil) and a range of applied research such as risk analysis, scenario building and development of methodologies and models. Thematically it touches only peripherally on biodiversity (mainly drivers).

By merging the Netherlands Environmental Assessment Agency with the Netherlands Institute for Spatial Research, the Netherlands Environmental Assessment Agency (PBL) was founded in 2008. The PBL is under the jurisdiction of the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM).

PBL has a more direct focus on biodiversity. It conducts applied research in the field of biodiversity to support decision-making. For example, PBL participated in a study that built global biodiversity scenarios (Pereira et al. 2010), and a whole dossier of the PBL website deals with biodiversity.

PBL seems to explicitly address issues arising at the SPI, e.g. it adopted specific procedures for Knowledge Quality Assessment (KQA) approaches and developed together with the university of Utrecht guidelines for assessing and communicating uncertainty (detailed references in van der Sluijs et al. (2008)).

The **European Environment Agency (EEA)** is based on a regulation that was adopted in 1990 and came into force in 1993.

The EEA has administrative responsibilities and collects and harmonizes environmental data from member states to assess the state of the European environment as required by EU legislation and to evaluate EU environmental policy (e.g. EUs commission's 6th Environment Action Programme, European Birds and Habitats directive).

The EEA maintains four environmental data centres (climate change, water, air, biodiversity, and land use) and coordinates the European environment Information and Observation NETwork (EIONET). Furthermore, the EEA publishes five-yearly assessments on the state of the European environment and thematic Environmental assessments, e.g. EURECA 2012. The EEA provides scientific advice to the EU community and its member states.

The **Joint Research Centre** (JRC) was founded in 1957 under the Euratom treaty and it is an integral part of the European Commission. JRC manages environmental data centres for forests and soils. Within JRC the Institute for Environment and Sustainability (IES) conducts a range of applied research related to biodiversity.

The **Natural Environment Research Council** (NERC) was founded in 1965 and is accountable to the British Parliament (currently through the Department for Business, Innovation and Skills). NERC funds research and conducts own research, e.g. in the Centre for Ecology and Hydrology (CEH) which has a biodiversity science programme. NERC organizes several SPI activities with the government and the parliament.Governmenal activities include yearly meetings with the Health Departments; Scottish Executive; Foreign and Commonwealth office (FCO); and the Department for Transport. They meet approximately 3 or 4 times a year with DEFRA and the Environment Agency. NERC and the Office for Science and Technology meet regularly to provide updates on relevant issues. NERC has Concordat agreements with the Scottish Executive, the Environment Agency and the Health Departments, and a MoU with the Welsh Assembly Government. All NERC research centres have advisory committees, which are composed of government department or agency

representatives. In addition, NERC scientists are members of numerous UK advisory NDPBs, e.g. the UK Biodiversity Research Advisory Board (UK BRAG). Some scientists have official roles as government advisors in certain specialist areas. NERC also communicates with parliaments: it has one individual membership of the Earth Sciences and one on the Environment All Parties Parliamentary Group (APPG).

In Romania, the **National Environmental Protection Agency** under the jurisdiction of the Ministry of Environment and Forests, through its regional and local agencies, has legal responsibility for environmental monitoring and nature conservation. Romania has a strong scientific research tradition in the natural sciences and, as in Germany, most of the research is aimed at addressing various aspects of biodiversity and nature conservation is carried out by university and non-university research institutes.

4. Interest groups

a) NGOs

IUCN conducts a range of important tasks that are important for the interaction between science and policy, e.g. developing red list classification scheme and conducting red list assessments. The red list assessments are the basis for a biodiversity indicator for policy, the so-called red list indicator. The IUCN covers all taxa at a species level for which sufficient data exist to be assessed for global threat assessments.

The IUCN is a hybrid of an NGO and a public institution. Its members are 80 nation states, 116 national agency, 752 national non-governmental organizations and 92 international non-governmental organizations (UNEP 2010).

IUCN brings together many biodiversity experts (mainly expertise about taxonomy and species level ecology) for example in the Species Survival Commission (SSC). According to the IUCN, SSC members "provide scientific advice to conservation organisations, government agencies and other IUCN members, and support the implementation of multilateral environmental agreements"[22]. The SSC is basically a large organized network of biodiversity experts. The experts are grouped thematically or topically in SSC specialist groups, such as the Crocodile Specialist Group or the Sustainable Use Specialist Group. Therefore, IUCN is capable of organising the enormous data input which is required inter alia for their global red list assessments.

Birdlife International is a global NGO with many national partners such as NABU in Germany. Birdlife conducts all red lists assessment for IUCN for birds and provides a large database on distribution and population sizes. Furthermore, it identifies Important Bird aAeas (IBAs) across the globe, which are the basis for the selection of conservation areas. The European Court of Justice has found the IBA inventory to be the best available scientific evidence concerning the habitats of birds and used the IBA inventory in several cases to assess whether EU member states had fulfilled their obligations to report sites for the Natura 2000 network[23] (EuropeanCommission 2006).

The German Umbrella Organisation of Avifaunists (DDA) coordinates German wide monitoring schemes for breeding birds. These data are the basis for red list assessments, national

[22] www.iucn.org/about/work/programmes/species/about_ssc

[23] www.birdlife.org/eu/EU_policy/Birds_Habitats_Directives/Birds_Directive_SPA.html

biodiversity indicators that are included in the German NBS and they can also be used to model the impact of climate change on protected areas.

b) Learned societies

The Society for Conservation Biology (SCB) carries out some activities that are typical for a scientific association such as publishing a journal (Conservation Biology), organising conferences and summer schools. However, the SCB also directly engages in the science- policy interface with its policy committee (PC). The European Section of the SCB also has its own PC, which states that "outreach to the public and policy makers is needed to advocate for biological diversity and to implement scientific findings resulting from conservation biology research.[24]

Since the political changes in 1989 environmental NGOs have been active in nature conservation and environmental protection issues in Romania. Together with other components of the structures of civil society (such as scientific organisations, local, regional, and international governments, agencies and institutions) NGOs have organised or participated in cooperative projects in the interest of biodiversity conservation. Thus, **the Romanian Ecological Society** has a key role as an interface between specialists and groups of specialists involved in the development of scientific knowledge, on one side, and the wide range of users (e.g., policy and decision makers, managers of protected areas, Natura 2000 sites, or natural resources, and teachers, NGO's, etc.) involved in conservation, restoration and sustainable use of biodiversity and ecosystems, on the other side.

[24] http://www.conbio.org/sections/europe/Policy/

8 Discussion

In this section we discuss insights gained, methodological shortcomings and prospects on how to further increase the usefulness of the SPI database and the SPI typology and derive conclusions and questions that will inform the forthcoming case studies in WP 1.2 and the other work packages of SPIRAL.

8.1 SPI typology and SPI landscape

Typological description of the SPI landscape: achievements, challenges and prospects

With the four generic SPI types (state agencies or institutes, expert groups, interest groups involved in science and science projects) we cover a wide range of SPIs across multiple political levels. Therefore, this mapping goes far beyond existing approaches to systematize the SPI landscape.

The differences between those generic types of SPIs are very large and there is also a large variation within each type as outlined in Chapter 7.2. The wide range of different types is due to the fact that SPIs are very broadly defined. The variety would even be greater if we considered SPIs which are not institutionalized (e.g. face-to-face communication between scientists and policy-makers) in the typology. Furthermore, biodiversity is a broad topic and consequently many SPIs deal with different aspects of biodiversity, e.g. certain taxonomic groups, marine or terrestrial ecosystems, drivers of biodiversity change.

An explanation for the great diversity of institutionalized SPIs is that biodiversity knowledge is produced in very different ways and insitutions and used in very different institutional contexts. This is in line with the observation of Gibbons et al. (1994) that knowledge has become socially distributed beyond the academic domain. This may require SPIs that are adapted to specific situations of knowledge production or knowledge use. However, this may also result in the challenge to coordinate SPIs across different social contexts.

Overall, we think that the different forms of institutionalization and functions of SPIs are well covered by the mapping so that a good qualitative overview of the broad SPI landscape across multiple political levels was achieved.

We often had problems to clearly assign an SPI to an SPI type. However, this is due to the very nature of the complex SPI landscape and the inherent limitations of models as our SPI typology. The current typology might need some refinement in the future when we extend the empirical basis, i.e. the SPI database, and our theoretical understanding increases. Nonetheless, the typology already fulfils the purpose of providing a structured overview of the SPI landscape, also making it possible to identify intermediate forms and analyse them accordingly.

A possibility might be to supplement the current cross-level typology with typologies specifically fitting the scientific and political system of individual EU member states, and thereby reflecting the SPI landscape of different countries in a qualitative manner. This would allow a qualitative comparison of different national SPI landscapes and also a comparison of national SPI landscapes with the EU landscape. This would require the sample to be broadened for selected countries in order to make a robust specific typology for each.

Quantitative comparison and detection of gaps

In order to detect biases towards SPI types in our mapping of science-policy interfaces, the mapping results need to be either representative for the overall SPI landscape or complete.

The mapping is based mainly on the input of the nine SPIRAL project partner institutions, which represent seven EU member states (Belgium, Finland, France, Germany, the Netherlands, Romania, and UK with two partners). SPIs of Germany and the UK are well represented while there are only few SPIs by the other countries addressed. Thus, there is a bias on the representation of the national SPIs of these Member States. As there is only one Eastern European partner (Romania), East European member states are certainly underrepresented. In terms of future work, it seems feasible to take Germany and the United Kingdom as case examples to gain a close to complete overview of the SPI landscape.

As we covered science projects only as examples, it is not feasible to compare the number of these projects to other SPIs. As the SPIRAL project partners are quite experienced in EU and global environmental policy we think that there is no bias in the selection of SPIs at this geographical level.

We regard the mapping task as an on-going process of compiling entries into our database. Thus, project partners and people associated with the project (e.g. the Dynamic Network of Advisers), together with projects complementary to SPIRAL such as KNEU, are invited to further contribute to the mapping comprehensiveness of the database for the lifetime of the SPIRAL project, and follow up research.

According to our quantitative results expert groups on each geographical level by far exceed state agencies or interest groups. This is most likely due to the fact that expert groups are often set up for a specific task that requires only a limited life-time, such as AHTEGs, and if a new task comes up a new expert group is set up.

From these expert groups, we found mandated expert groups much more frequently than non-mandated expert groups. These findings indicate that in contrast to state agencies, there is a focus on policy-independent scientific consultation. Further, the great number of politically mandated expert groups compared to a small number of non-mandated expert groups may indicate that participation in SPIs is more often a top-down than a bottom-up process. Moreover, it may be difficult for a non-mandated group to have influence, so it is more rewarding to engage in mandated SPIs. However, because of the inherent deficiencies of our data, we should be cautious in their interpretation.

8.2 Consequences from the mapping on WP 1 case studies

As a consequence of the mapping it is now possible to appraise the case studies against the background of a wider SPI landscape. This allows for an analysis of interactions of case study SPIs within the broader SPI landscape. For example, the case studies could analyse whether and how there is an interaction between SPIs of research projects and state agencies at the EU level, i.e. with JRC or the EEA or with national state agencies like the BfN in Germany or the PBL in the Netherlands.

So far, the case studies of WP1, task 1.2, have concentrated on European Framework Programme projects on biodiversity and national biodiversity strategies and national biodiversity action plans. In our case studies, we have not included certain types of SPIs, e.g. politically mandated long-term SPIs. However, we aim to reflect the overall landscape of SPIs in the general case studies in order to achieve a deeper insight of the knowledge gained by the mapping task. Therefore, it would be

advantageous if, for example, interviewed persons involved in a national biodiversity strategy were recruited from different SPI types.

The mapping provides a good overview of existing SPIs. However, as is common for such an overview, retrieved data are necessarily selective and our information is mainly based on homepages of SPI organizations. Based on the literature and the mapping exercise, this section explores the complementary information needed for the case studies of task 1.2 (WP1).

In the mapping we determined attributes crucial for the characterization of SPIs. For the case studies it is important to investigate the way in which these attributes are connected (e.g. functional and institutional attributes). In addition, it will be useful to analyse the way in which these attributes are connected to overarching criteria such as legitimacy and credibility. For example it would be interesting to specify for the case studies the way in which the political mandate is related to legitimacy and relevance or how the personnel composition of SPIs is related to their credibility.

Our mapping focused mainly on institutionalization and functions of SPIs. Although we obtained a large amount of information on these two aspects, the case studies should deliver more detailed findings. For example, as regards institutionalization we gained some knowledge on the personnel composition of organizations but this did not explain the roles of different actors within the SPI. Further, we could not determine whether actors were paid for the work in the SPI or wether they did the SPI work voluntarily and were employed by their home organizations. We only attained information on institutionalization and functions themselves, but in order to assess the functioning of SPIs properly, information on interplay between institutionalization and functions is needed. Therefore, the case study design should also emphasize the links between institutionalization, functions and processes.

An additional point is that the functions in the SPI mapping are derived from statements on objectives by the SPI. However, we do not have any information on implicit functions, for example the function of legitimation of a certain policy. Further, we do not know how much effort the SPIs actually expend on achieving their stated objectives. And lastly, the question is open as to what extent their objectives are finally met. In this respect we need to highlight factors effectively supporting the achievement of these and determine what the hindering factors are.

Stated objectives could be used as a reference for an assessment of goal achievement in SPIs treated in the case studies. However, the stated objectives gathered for the mapping exercise often lacked the necessary detail for evaluation purposes. In addition, issues could arise with regards to validity of the stated objectives since some SPIs may not have invested many resources in presenting their objectives on their websites adequately. For the purpose of the case studies, efforts should be made to identify valid and detailed stated objectives (e.g. documents describing the political mandate).

Finally, the case studies have to face dimensions beyond institutionalization and (procedural or outcome-oriented) functions. The case studies will need to address processes, outputs, impacts and the broader context in which an SPI operates.

To summarise, the following issues will need to be addressed in the case studies: detailed information on institutionalization and functions; possible causal relationships between institutionalization and functions; achievement of explicit and implicit functions; other SPI-related dimensions. The main challenges for the case studies resulting from the mapping are outlined in Table 1.

The mapping has provided significant progress in the analysis of biodiversity SPIs. It is evident that the mapping of the SPI landscape which first and foremost give a more or less comprehensive overview of SPIs cannot give as detailed information as required from case studies. Based on our results, we

argue that the mapping task does however offer a good basis for the subsequent analysis of case studies.

Table1: Open issues in the mapping of Science Policy Interfaces and strategies for their solution

Issue	Strategy for problem solution
Missing links between different SPIs of the landscape	• analysis of interactions of case study SPIs with other SPIs • information from KNEU
Failure to consider important SPI types in case studies	• Revision of case study design: balancing minimum amount of interviewees for a singular case study, coverage of different SPI types and comparison of different SPIs of one type
Superficial information on institutionalization and functions of SPI	• Gaining in-depth information on institutionalization and functions of SPI, e.g. on roles of actors, rewarding structure for people involved in SPIs • Analysis of the connection between institutionalization and functions • Examination of the way in which institutionalization and functions contribute to relevance, legitimacy and credibility of scientific knowledge provided in the SPI • Gaining knowledge on implicit functions of SPIs
Impossibility of evaluating SPIs according to the given information	• Evaluation of the success of SPIs by interviewees Assessment of goal achievement • Collating background information on the circumstances of success or failure
Failure to address aspects beyond institutionalization and functions	• Consideration of processes, outputs, impacts and the broader context in which an SPI operates

9 Literature

Anderson, J. E. (1975). Public Policy-Making: Decisions and Their Implementation, New York: Praeger.

BfN and UBA (2011). "Themenschwerpunkte für den Bereich Wissenschaft und Forschung zur Unterlegung der Nationalen Strategie zur biologischen Vielfalt (NBS) und des Bundesprogramms Biologische Vielfalt."

Cash, D. W., W. C. Clark, F. Alcock, N. M. Dickson, N. Eckley, D. H. Guston, J. Jäger and R. B. Mitchell (2003). "Knowledge systems for sustainable development." Proceedings of the National Academy of Sciences of the United States of America **100**(14): 8086-8091.

EEA (2008). "Eureca -Summary."

Engels, A. (2005). "The Science-Policy Interface." Integrated Assessment Journal **5**(1): 7-26.

EuropeanCommission (2006). Nature and Biodiversity Cases. Ruling of the European Court of Justice.

Funtowicz, S. and R. Strand (2007). Models of science and policy. Biosafety first: Holistic Approach to Risk and Uncertainty in genetic Engineering and genetically modified Organisms. T. Traavik and L. C. Lim, Tapir Academic Press.

Funtowicz, S. O. and J. R. Ravetz (1993). "Science for the post-normal age." Futures **25**(7): 739-755.

Gibbons, M., H. Nowotny and C. Limoges (1994). The new production of knowledge: the dynamics of science and research in contemporary societies. Thousand Oaks, Sage Publications Ltd.

Giddens, A. (1984). The constitution of society: Outline of the theory of structuration, University of California Press.

Gruttke, H. (2004). Ermittlung der Verantwortlichkeit für die Erhaltung mitteleuropäischer Arten. Bonn, Bundesamt für Naturschutz.

Howlett, M. and M. Ramesh (2003). Studying public policy: Policy cycles and policy subsystems, Oxford University Press.

IPCC, S. (2010). Guidance document for IPCC Government Focal Points on the nomination of potential Lead Authors, Coordinating Lead Authors and Review Editors. I.-. Secretariat.

Jann, W. and K. Wegrich (2003). Phasenmodelle und Politikprozesse: der policy cycle. Lehrbuch der Politikfeldanalyse. München, Olgenbourg Verlag**:** 71-103.

Koetz, T., P. Bridgewater, S. van den Hove and B. Siebenh¸ner (2008). "The role of the Subsidiary Body on Scientific, Technical and Technological Advice to the Convention on Biological Diversity as science-policy interface." Environmental Science & Policy **11**(6): 505-516.

Kropp, C. and J. Wagner (2010). "Knowledge on Stage: Scientific Policy Advice." Science, Technology & Human Values **35**(6): 812.

Pereira, H. M., P. W. Leadley, V. ProenÁa, R. Alkemade, J. P. W. Scharlemann, J. F. Fernandez-ManjarrÈs, M. B. Ara˙jo, P. Balvanera, R. Biggs and W. W. L. Cheung (2010). "Scenarios for global biodiversity in the 21st century." Science **330**(6010): 1496.

Pielke, R. A. (2007). The honest broker, Cambridge University Press.

Pretty, J. N. (1995). "Participatory learning for sustainable agriculture." World development **23**(8): 1247-1263.

Rudd, M. A. (2011). "How Research-Prioritization Exercises Affect Conservation Policy." Conservation Biology **25**(5): 860-866.

Sarewitz, D. and R. A. Pielke (2007). "The neglected heart of science policy: reconciling supply of and demand for science." environmental science & policy **10**(1): 5-16.

SPIRAL (2010). "Concept Note on Common Framework for Case Study Analysis."

SRU (2008). "Environmental Report."

SRU (2011). "Letter to Minister of Agriculture."

Svarstad, H., A. Sletten, R. Paloniemi, D. Barton and M. Grieg-gran (2011). "Three types of environmental justice: from concepts to empirical studies of social impacts of policy instruments for conservation of biodiversity." Policymix Report.

UBA (2010). "Durch Umweltschutz die biologische Vielfalt erhalten."

UNEP (2009). "United Nations Environment Programme. Gap analysis for the purpose of facilitating the discussions on how to improve and strengthen the science-policy interface on biodiversity and ecosystem services." Second ad hoc intergovernmental and multi-

stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services, Nairobi, 5–9 October 2009.

UNEP (2010). Analysis of the assessment landscape for biodiversity and ecosystem services. Third ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services.

Vadineanu, A. (2001). Sustainable development: Theory and Practice Regarding the Transition of Socio-Economic Systems towards Sustainability. Bucharest.

Van den Hove, S. (2004). Review of FP5 Biodiversity Research Projects to Assess Current and Potential Policy Impact. Report to the European Commission Research Directorate General, Unit DI-4 'Biodiversity and Ecosystems'.

Van den Hove, S. (2007). "A rationale for science-policy interfaces." Futures **39**(7): 807-826.

van den Hove, S. and L. Chabason (2009). "The Debate on an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES): Exploring gaps and needs." IDDRI Discussion Papers 1/2009.

van der Sluijs, J. P., A. C. Petersen, P. H. M. Janssen, J. S. Risbey and J. R. Ravetz (2008). "Exploring the quality of evidence for complex and contested policy decisions." Environmental Research Letters **3**: 024008.

Vatn, A. (2005). Institutions and the Environment. Cheltenham, Edward Elgar Publishing.

WCMC (2010). "Potential relationships between IPBES and existing instituions." Report prepared for the third ad hoc meeting on IPBES.

Weingart, P. and J. Lentsch (2008). Wissen Beraten Entscheiden. Form und Funktion wissenschaftlicher Politikberatung in Deutschland. Weilerswist, Velbrück Wissenschaft.

Yin, R. K. (2009). Case Study Research: Design and Methods. Los Angeles, Sage Publications.