Institutional dynamics *of* science-policy interfaces *in* international biodiversity governance

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A thesis submitted for the degree of Doctor of Environmental Sciences

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May 2011
ICTA, Autonomous University of Barcelona

Doctoral Program in Environmental Sciences

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Abstract

Over the past decades the international community has engaged in considerable efforts in science and politics to counter the degradation and loss of biological diversity and ecosystem services. Yet, despite these efforts, biological diversity and ecosystem services continue to be degraded and lost at alarming rates. This thesis focuses on the need for improved interrelations between science and policy as a crucial element of institutional reform necessary to address the current impasse of biodiversity and ecosystem services governance. Science-policy interfaces are critical forces in shaping the development of environmental governance. But interactions between science and policy are increasingly challenged by the complexity of today's problems in unprecedented ways. Growing awareness of the importance of science-policy interfaces as key elements of environmental governance has triggered a range of reflections and debate regarding the design of more effective science-policy interfaces including in biodiversity and ecosystem services governance. However, significant divergence remains in understanding what science-policy interfaces are and how they work, where and why they currently fail, and what would be needed to improve them. This divergence is impeding the opportunities to substantively engage with the necessary institutional reforms.

In this context, the objectives of this thesis have been (i) to further develop a coherent theoretical framework for science-policy interfaces that is useful for their design and management; (ii) to analyse shortcomings of a range of existing science-policy interfaces in biodiversity and ecosystem services governance; and (iii) to explore needs for and suitable options to improve them allowing for a more effective governance of biodiversity and ecosystem services.

To reach these objectives, the thesis builds on three case studies that cover critical assessment of (i) the use of participation as an important concept in science-policy interfaces in European biodiversity governance, in particular as regards the Birds and Habitats Directive; (ii) the role the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) as science-policy interface to the Convention on Biological Diversity; and (iii) the debate related to the now-to-be established Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES). The principle research methods applied are participant observation at a broad range of relevant events and activities, and critical discourse analysis of a wealth of related texts, discussions and interviews.

The thesis describes science-policy interfaces in institutional terms, as a combination of cognitive models, normative structures and rights, rules and procedures that define and enable social practices interrelating science and policy, assign roles to scientists, policy-makers and other relevant stake- and knowledge-holders, and guide their interactions according to given principles and purposes. A set of critical mismatches, gaps and other shortcomings has been identified together with three major rhetorical shifts that have emerged in response calling for (i) a shift from universal globalocentric towards a more flexible polycentric understanding of policy making; (ii) a shift from a puzzle-solving linear model towards a more integrated non-linear approach of science for policy; and (iii) a shift from a conservationist and outcome-oriented towards a more anthropocentric and driver/pressure-oriented approach to biodiversity governance. While this rhetoric is beginning to result in changing practices of how science and policy are being interfaced, remnants of the established institutional design continue to prevail. Based on the needs explored, what has emerged as recommendation from the here presented research is a discursive, dynamic and polycentric network of science-policy interfaces reaching across regions, sectors and scales – an option of which most elements are either currently being discussed, are firmly rooted in decisions taken by the international community or could build on processes and programmes that are already in place.

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Resumen

En las últimas décadas, la comunidad internacional ha realizado un esfuerzo considerable en el campo de las ciencias y la política para contrarrestar la degradación y la pérdida de la diversidad biológica y de los servicios de los ecosistemas. Sin embargo, a pesar de estos esfuerzos, la diversidad biológica y los servicios ecosistémicos siguen degradándose y perdiéndose a un ritmo alarmante. Esta tesis se centra en la necesidad de mejorar las interrelaciones entre la ciencia y la política como un elemento crucial de la reforma institucional necesaria para hacer frente al estancamiento actual en que se encuentra la gobernanza sobre la biodiversidad y los servicios del ecosistema. La interacción ciencia-políticas es fundamental en el desarrollo de la administración medioambiental. Sin embargo, esta interacción se enfrenta a un reto creciente debido a la complejidad sin precedentes de los problemas actuales. La creciente conciencia de la importancia de las interrelaciones entre ciencia y políticas como elementos clave de la gobernanza medioambiental ha desencadenado una serie de reflexiones y debates relativos al diseño de unas relaciones entre ciencia y políticas más eficaces en los campos ya mencionados de la biodiversidad y de los servicios del ecosistema. Sin embargo, prevalecen diferencias significativas en la comprensión de lo que son y cómo funcionan estas relaciones, dónde y por qué fallan en la actualidad, y qué sería necesario hacer para mejorarlas. Esta divergencia obstaculiza las oportunidades de llevar a cabo las necesarias reformas institucionales de forma sustancial.

En este contexto, los objetivos de esta tesis han sido (i) elaborar un marco teórico coherente de las relaciones ciencia-políticas que sea útil para el diseño y gestión de las mismas, (ii) analizar las deficiencias de las relaciones ciencia-políticas actuales en cuanto a la gobernanza de la biodiversidad y de los servicios del ecosistema, y (iii) explorar las necesidades y opciones que serían idóneas para mejorarlas per-

mitiendo una gestión más eficaz de la biodiversidad y servicios ecosistémicos. Para alcanzar estos objetivos, la tesis se basa en el examen intensivo de tres casos prácticos que cubren la evaluación crítica de (i) el uso de la participación como un concepto importante en las relaciones ciencia-políticas en la gobernanza de la biodiversidad europea, en particular en lo que respecta a la Directiva sobre hábitats y aves (Birds and Habitats Directive), (ii) el papel del Órgano subsidiario de asesoramiento científico, técnico y tecnológico (OSACTT) como interfaz entre ciencia y política en la Convención sobre diversidad biológica, y (iii) el debate en torno a la plataforma intergubernamental ciencia-políticas que se establecerá ahora sobre biodiversidad y servicios de los ecosistemas (IPBES, por sus siglas en inglés). Los principales métodos de investigación aplicados son la observación mediante la participación en una amplia gama de acontecimientos y actividades pertinentes, y el análisis crítico del discurso de una gran cantidad de textos, debates y entrevistas relacionados con el objeto de la tesis.

En ésta se describen las relaciones entre políticas y ciencia en términos institucionales, como una combinación de modelos cognitivos, estructuras normativas y derechos, normas y procedimientos que definen y promueven las prácticas sociales que relacionan ciencia y políticas, que asignan funciones a científicos, legisladores y otras partes interesadas y con conocimiento de estos temas, y que guían sus interacciones de acuerdo con determinados principios y objetivos. Se ha identificado una serie de desajustes críticos, lagunas y otras deficiencias junto con tres cambios retóricos importantes que han surgido en respuesta a dichas deficiencias. Lo que se requiere es la necesidad de (i) un cambio de una perspectiva global, de carácter universal, a una organización más flexible y policéntrica del establecimiento de políticas, (ii) un cambio de un modelo lineal dedicado a la resolución de problemas concretos a un enfoque más integrado, no lineal, de la ciencia para el desarrollo de políticas, y (iii) el cambio de un enfoque conservacionista y orientado a los resultados hacia uno más antropocéntrico y centrado en los factores causales en la gobernanza de la biodiversidad. En base a estas necesidades, lo que aquí se sugiere es el establecimiento de una red discursiva, dinámica y policéntrica de relaciones entre ciencia y políticas que abarque distintas regiones, sectores y escalas. Esta es una opción sobre la que actualmente se discuten la mayoría de sus elementos, está firmemente arraigada en las decisiones tomadas por la comunidad internacional o que podría basarse en procesos y programas que ya existen.

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Acknowledgments

Above all, I want to thank Dr. Sybille van den Hove and Prof. Joan Martinez Alier for their supervision of this thesis. I sincerely appreciate all their advise, constructive critique and effort in guiding me through this work on which I have grown so much.

Deeply thankful I am also to Katharine Farrell, Peter Bridgewater, Nikolas Kosoy and Marc LeMenestrel, Gerhard Söhngen, Anna Serra Llobet, Jochen Schmoll and Mara Sylvester for all their important support of different sort over the last years.

My deepest thanks go to my family that has in many different ways given me the essential fundament without which this thesis would not have been possible.

I am grateful also to the many friends and colleagues, which have made possible and/or accompanied my research during different phases of this PhD thesis, in particular Martin Sharman and Stefan Leiner from the European Commission, the Secretary General Ahmed Djoghlaf and Kalemani Mulongoy from the Secretariat of the Convention on Biological Diversity, Ivar Baste from UNEP, Horst Korn from the German Federal Agency for Nature Conservation, Jerry Harrison and Peter Herkenrath from the World Conservation Monitoring Centre, Maxime Thibon and Didier Babin from the IMoSEB Secretariat, Felix Rauschmayer from the Umweltforschungszentrum Leipzig, Bernd Siebenhüner from the University Osnabrück, Clark Miller and Chad Monfreda from Arizona State University, Richard Norgaard from the University of California at Berkeley and Roger Pielke from the University of Colorado.

Finally, I would like to express my gratitude to L'Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR) for the research grant that allowed me to conduct this research.

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List of Acronyms

ABS	Access and Benefit Sharing
AHTEG	Ad Hoc Technical Expert Group
ASEAN	Association of Southeast Asian Nations
BSP	Bali Strategic Plan for Technology Support and Capacity-Building
CBD	Convention on Biological Diversity
CoP	Conference of the Parties
DGIS	The Dutch Ministry of Foreign Affairs
EC	European Commission
EEA	European Environment Agency
EU	European Union
EPBRS	European Platform for Biodiversity Research Strategy
EWS	Environment Watch Strategy
ENB	Environmental News Bulletin
FAO	United Nation Food and Agriculture Organisation
FP7	Seventh Research Framework Programme of the EU
GBA	Global Biodiversity Assessment
GEF	Global Environment Facility
IEG	International Environmental Governance
ICSU	International Council for Science
IGO	Intergovernmental Organisations
IISD	International Institute for Sustainable Development
IMoSEB	International Mechanism of Scientific Expertise on Biodiversity
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
ISDR	International Strategy for Disaster Reduction

IUCN	World Conservation Union
MA	Millennium Ecosystem Assessments
MTS	UNEP's Medium Term Strategy for 2010-2013
NBSAP	National Biodiversity Strategies and Action Plan
NCSA	National Capacity Self-Assessment
NGO	Non-Governmental Organisation
NFP	National Focal Point
RSPB	Royal Society for the Protection of Birds
SBSTA	Subsidiary Body on Scientific and Technical Advice (UNFCCC)
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice (CBD)
SCBD	Secretariat of the CBD
Sida	Swedish International Development Cooperation Agency
SRU	Sachverstaendigenrat fuer Umweltfragen
SwedBio	Swedish International Biodiversity Programme
UAB	Autonomous University of Barcelona
UfZ	Helmholtz-Zentrum für Umweltforschung GmbH
UN	United Nations
UNDAF	United Nations Development Assistance Frameworks
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WCMC	World Conservation Monitoring Centre (UNEP)
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention to Combat Climate Change
UNU/IAS	United Nations University – Institute of Advanced Studies
WRI	World Resources Institute
WWF	World Wildlife Fund

1
Introduction

1.1.
Setting the scene

Over the past decades the international community has engaged in considerable efforts in science and politics to confront the degradation and loss of biological diversity and ecosystem services. These efforts have led to the development of a complex and continuously evolving system of multilevel biodiversity governance. Yet, despite an unprecedented accumulation of knowledge and a wide range of policy efforts, biological diversity and ecosystem services continue to be degraded and lost at alarming rates (SCBD 2010). According to the Millennium Ecosystem Assessments (MA 2005, p. vi), “changes in biodiversity due to human activities were more rapid in the past 50 years than at any time in human history, and the drivers of change that cause biodiversity loss and lead to changes in ecosystem services are either steady, show no evidence of declining over time, or are increasing in intensity.” Even in the richest, environmentally more conscious and technologically most advanced countries, the strategies of ecological modernisation and environmental management have been unable to significantly reduce[1], let alone to halt[2] the loss of biodiversity. Biodiversity, van den Hove and Chabason (2009, p. 20) argue, “turns out to be the Achilles’ heel of international environmental governance.”

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1 In April 2002, the Parties to the Convention on Biological Diversity (CBD) agreed to achieve by 2010 “a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth.” This so-called 2010 Target was subsequently endorsed by the 2002 World Summit on Sustainable Development and the United Nations General Assembly and was incorporated as a new target under the Millennium Development Goals.

2 In 2001, the EU committed to ‘halt the decline of biodiversity by 2010’ (Presidency Conclusions, Goteborg Council, 15 and 16 June 2001. SN/200/1/01 REV1, page 8).

There are many reasons for the impasse in biodiversity governance, including the outstanding complexity of the issue, the fragmentation of the governance system and the lack of awareness and of political will. Increasingly, however, insufficient, inappropriate or even dysfunctional interrelations between science and policy have been claimed to be among the key factors of the current situation (UNEP 2009a; van den Hove and Chabason 2009, Loreau and Oteng Yeboah 2006). Increasing awareness of the importance of science-policy interfaces as key elements of environmental governance (van den Hove 2007) and growing recognition that science-policy interfaces need to be improved at all levels of biodiversity and ecosystem services governance (e.g. at the International Conference on *Biodiversity: Science and Governance*, Jan. 24–28, 2005, Paris, France), have triggered a whole range of reflections, experimentations and debate regarding the design of more effective institutional arrangements interfacing the realms of science and policy in biodiversity governance. These include:

- the commitment of the European Commission to substantially strengthen the science-policy interface for conservation and sustainable use of biodiversity in the EU and globally (EC, 2006);
- the efforts of the Convention on Biological Diversity (CBD) to improve the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) as its official science-policy interface (Decision VIII/10, Annex III of the CBD); and
- the process convened by UNEP considering ways and means of improving the science-policy interface on biodiversity and ecosystem services for human well-being that has lead to the establishment of an Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES).

However, while there is a general recognition of the need to improve science-policy interfaces of biodiversity and ecosystem services governance, significant divergences are impeding the opportunities to get to substantive agreements on how to actually do so (IMoSEB 2008; UNEP 2009a). These divergences, in turn, reflect critical differences in understanding what science-policy interfaces are and how they work, where and why they currently fail, and what would need to be done to improve the situation.

1.2.
Aim, objectives and structure

The current set of political processes explicitly established to engage with institutional reforms aimed at improving science-policy interfaces for international biodiversity governance provides great opportunities. Critical of merely symbolic politics (Blühdorn 2007), which so far have at best tackled symptoms but rarely addressed the root causes of biodiversity loss and ecosystem degradation, there seems to be a consensus among scientists, decision-makers and the larger public that it is time to stop talking about things and take decisive actions.

However, to be able to actually go beyond rhetoric and get down to the issue of substantially improving the institutional arrangements interfacing science and policy for biodiversity governance, it is crucial to overcome the obstructions that are caused by the prevailing differences in understanding. But, *What are science-policy interfaces? How do they work? Where and why do current science-policy interfaces in biodiversity and ecosystem services governance fall short or even fail? And what would need to be done to improve this situation?*

With the aim to contribute to the current debate on how to improve science-policy interfaces of biodiversity and ecosystem services governance, these questions have been at the centre of my research and are reflected in the objectives of this thesis:

1 The further development of a coherent theoretical framework of science-policy interfaces that is able to coherently explain their nature and dynamics and that is useful for their design and management.

2 The analysis of mismatches, gaps and other shortcomings of existing science-policy interfaces in biodiversity governance in order to identify critical features where and why they currently falter or fail.

3 The exploration of needs and options that would be suitable to address the most prominent of these mismatches, gaps and other shortcomings and to improve science-policy interfaces in biodiversity governance.

To reach these objectives, this thesis rests on the intensive examination of three case studies, the development of a theoretical framework that co-evolved studying the different cases, and an extensive literature review. The principal research methods applied were participant observation and critical discourse analysis, constituting this study as qualitative social research (Bryman 2008).

The theoretical framework (which draws to large extents on already existing theory established in social science), the historical context (explaining the above-mentioned ongoing political processes relevant to the issue at hand), and the methodological approach of this thesis are described in detail in the rest of this introduction.

After the description of the scope and circumstances of my research, I present three cases studies that cover (i) the use of participation as an important concept in science-policy interfaces in European biodiversity governance, in particular as regards the Birds and Habitats Directive; (ii) the role the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) as science-policy interface to the Convention on Biological Diversity (CBD); and (iii) the debate on how an Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) could improve international biodiversity governance.

The research on these case studies has resulted in a set of co-authored scientific papers that have been published in peer-reviewed journals. These papers constitute the respective case study chapters of this thesis [3]. As a consequence of this structure, the thesis has to live with some unfortunate but inevitable repetitions, as each of the papers has also to be able to stand alone. To a certain extent this structure also unveils the evolution of my knowledge and experience, and linked to this the development of certain concepts and ideas reflected in the three articles that have been written at different phases of my research.

Finally, the thesis concludes with a synthesis of achievements in respect to the objectives set in the outset of the work. These include a description of science-policy interfaces in institutional terms, as a combination of cognitive models, normative structures and rights, rules and procedures that define and enable social practices interrelating science and policy, assign roles to scientists, policy-makers and other relevant stake- and knowledge-holders, and guide their interactions according to given principles and purposes.

The achievements further include the identification of a set of critical mismatches, gaps and other shortcomings, and three major rhetorical shifts that have emerged in response, calling for a shift (i) from universal globalocentric towards a more flexible polycentric understanding of policy making; (ii) from a puzzle-solving linear model towards a more integrated non-linear approach of science for policy; and (iii) from a conservationist and outcome-oriented approach towards a more anthropocentric and driver/pressure-oriented approach to biodiversity governance.

Based on the above, an argument has been developed suggesting a discursive, dynamic and polycentric network of science-policy interfaces reaching across regions, sectors and scales.

This proposal is then compared with the conclusions and recommendations on an Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) on which the international community agreed upon at the third ad hoc international and multi-stakeholder meeting convened by UNEP in Busan, South Korea, 5–9 June 2010.

The conclusion closes with an evaluation of the work achieved in terms of contribution to science and politics, it considers as well its shortcomings and limitations, and it explores the potential practical implications and interesting lines of future research. Following this conclusion are the consolidated bibliography and a supportive appendix.

[3] These materials are not part of any other doctoral thesis and the statements of the co-authors' consent can be found in Appendix A.

2

Theoretical framework

Before I dive into the theoretical framework of this thesis, elaborating in more detail on the 'idea of biodiversity', on the politics of environmental discourse, on making sense of science for environmental politics, and on the institutional dynamics of science-policy interfaces, I would like to briefly highlight the links between all of this (and what is to follow) and the study of ecological economics to which I have subscribed myself.

In his introductory statement to the first issue of Ecological Economics, Costanza (1989, p. 1) states "*Ecological Economics* addresses the relationships between ecosystems and economics in the broadest sense." Turning to the Old Greek roots of its name, ecological economics translates into the study of an *oikos nomos* with respect to the *oikos logos* – that is, the study of the 'law'/'rules' (nomos) of the 'household'/'world' that are put in place by a legislative authority, with respect to the 'structure'/'order' (logos) of the 'household'/'world', which, contrary to the order in the nomos, is impossible to be 'made' but has always been existent (Faber and Manstetten 2003, p. 39).

According to Costanza (1989, p. 1), ecological economics "is intended to be a new approach to *both* ecology and economics that recognizes the need to make economics more cognizant of ecological impacts and dependencies; the need to make ecology more sensitive to economic forces, incentives, and constraints; and the need to treat integrated economic-ecologic systems with a common (but diverse) set of conceptual and analytical tools." By providing a bridge between economics and ecology, Sneddon et al. (2006, p. 261) contend that "ecological economics may be understood as an attempt to refine and implement the broad vision of sustainable development advanced by Brundtland." However, they also argue that additional bridges need further development: “Recent discussions within ecological economics have highlighted the need for the field to expand its methodological and epistemological purview (Gale 1998; Peterson 2000; Nelson 2001; Muradian and Martinez-Alier 2001; Martinez-Alier 2002) and to engage more directly with a wide variety of non-academic political actors (Meppem 2000; Shi 2004; Norgaard 2004).” (Sneddon et al. 2006, p. 261)

What Sneddon et al. (2006, p. 261–264) suggest is a pluralistic and transdisciplinary approach that combines:

(i) ecological economics (as an explicitly transdisciplinary enterprise concerned with the incorporation of ecological concerns into economic methodologies and theory), with
(ii) political ecology (which seeks to link a rigorous characterisation of ecological transformation to the cultural, political and economic processes that are driving these changes with a particular focus on power relations within ecological conflicts),
(iii) Armatya Sen’s account of development as freedom (making the normative claim that development is ultimately about freedom (e.g., political rights and responsibilities, economic and social opportunities, transparency guarantees in social interactions), in contrast to a narrowly defined yet widely adopted identification of development with aggregate economic growth), and
(iv) deliberative democracy (as processes through which social and political changes occur, and through which to counter our fragmented understanding of reality and lead to richer collective knowledges).

Together, Sneddon et al. (2006) argue, these approaches offer a wide range of methodologies, normative positions, and ways of understanding human-environment relations from which to approach the dynamism and complexity of the current era of global environmental governance.

It is in these terms (of a broader understanding of ecological economics including political ecology, freedom-oriented development, and deliberative democracy) that I have developed the theoretical framework within which I then discuss the institutional dynamics of science-policy interfaces in international biodiversity governance.

2.1
The idea of biodiversity

"No feature of Earth is more complex, dynamic, and varied than the layer of living organisms that occupy its surfaces and its seas, and no feature is experiencing more dramatic change at the hands of humans than this extraordinary, singularly unique feature of Earth." (Millennium Ecosystem Assessment (MA) 2005, p. 18)

Biologists were the first to directly experience and note the dimension and scale of these changes of biological diversity. As a professional reaction in front of this "biological crisis" (Soulé 1985), a number of prominent North American biologists founded the North-American Society of Conservation Biology in 1985. In the foundational manifesto "What is Conservation Biology" Soulé (1985, p. 727) proclaims conservation biology as a new "crisis discipline" whose goal was to provide principles and tools to conserve biological diversity. "Conservation biology is to biology what surgery is to physiology or war to political science. It must respond to emergency situations with incomplete information, and its goal is a predetermined, desirable outcome, not simply an accumulation of scientific information or an enlightened discussion about interesting problems." (Van Dyke 2008, p. 3)

But, not only did the Society trigger the emergence of a new academic discipline, it also created what Haas (2004) calls an 'epistemic community', a type of knowledge elite of like-minded scientists and stakeholders, that was influential in bringing the issue of biological diversity to the attention of international governance. An important cornerstone for how biological diversity is currently known was a conference organised by the US National Academy of Science in 1986. This conference is not only referred to as the date of birth of the term of 'biodiversity', but also as the beginning of biological diversity as a political issue of global concern (Takacs 1996). This National Forum on BioDiversity brought together North America's most renowned biological scientists – among them Walter G. Rosen, Paul R. Ehrlich, Daniel Janzen, Thomas E. Lovejoy, Harold A. Mooney, Peter H. Raven, Michael E. Soulé and Edward O. Wilson. The Forum received extensive press coverage, and was followed by the publication of the book BioDiversity, a collection of the Forum papers and keynote speeches (Wilson 1988). Both, the Forum and the book are seen as significant in bringing public and political attention to the loss of biological diversity caused by human activity (Takacs 1996).

Part of the considerable impact of this conference on global environmental science and governance is related to the creation of the neologism 'biodiversity'. Initially just intended as nothing more than a shorthand for 'biological diversity' for use in internal paperwork during the preparation of that forum (Sarkar 2002), it became quickly accepted as to represent the vast array of topics and perspectives covered during the Washington forum (Wilson 1988) – and eventually created a new broad and unifying concept of nature/life on Earth. But, however coincidental the creation of the term itself might have been, the influence of the conference as such was by no means unintended: "The Washington Conference was an explicit political event, explicitly designed to make [US] Congress aware of this complexity of species that we're losing. And the word was coined – well different people get credit for coining the word – but the point was the word was punched into that system at that point deliberately." (Daniel Janzen; cited in Takacs 1996).

In biological terms, 'biodiversity', most commonly defined as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic systems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystem" (Article 2 of the CBD), does not create a new object of study that is outside of the existing definitions in biology and ecology (Escobar, 1998). It merely introduces a new model aimed at unifying the bits and pieces of biological sciences to understand the subject matter of biology in a more holistic fashion, presuming biological diversity to be densely packed, ordered and structured in some way. But, at a second glance, Takacs (1996, p. 1) argues that the notion of 'biodiversity' goes well beyond the scientific domain: "Conservation biologists have generated and disseminated the term biodiversity specifically to change the terrain of your mental map, reasoning that if you were to conceive of nature differently, you would view and value it differently." The "idea of biodiversity" (Takacs 1996), the original purpose of this new concept, its underlying explicit task, "is the generation of purposes that can provide a guideline for policy in order to shape, to structuralise pieces of nature." (Gutmann and Weingarten 2004, p. 49) Concluding the analysis of a range of interviews with a whole range of conservation biologists involved in the creation of the concept of biodiversity, Takacs (1996, p. 99) notes:

> *"The term biodiversity makes concrete – and promotes action on behalf of – a way of being, a way of thinking, a way of feeling, and a way of perceiving*

the world. It encompasses the multiplicity of scientists' factual, political, and emotional arguments in defence of nature, while simultaneously appearing as a purely scientific, objective entity. In the term biodiversity, subjective preference are packaged with hard facts; eco-feelings are joined to economic commodities; deep ecology is sold as dollars and sense to more pragmatic, or more myopic, policy makers and members of the public. Biodiversity shines with the gloss of scientific respectability, while underneath it is kaleidoscopic and all-encompassing: we can find in it what we want, and can justify many courses of action in its name. It reflects the interrelatedness of all living beings, of humans with the rest of the world, of our ideas of nature with nature itself. By promoting and using the concept of biodiversity, biologists hope to preserve as much of the biotic world, including the dynamic processes that shape the world, while simultaneously appropriating for themselves the authority to speak for it, to define and defend it."

However, subsequently, particularly with the work of the CBD which sets out to "profoundly reshape the relationships between humans and nature, as well as the distribution of social, cultural, political and economic rights, responsibilities and benefits among and within States" (Le Prestre 2002, p. 93), the issue of biodiversity has expanded far beyond its original biological conceptualisation and has become (re)claimed as belonging to many different competing legitimate knowledge domains within and outside of science. Escobar (1998, pp. 56-62) makes out at least four perspectives on the issue of biodiversity:

A globalocentric perspective focusing on resource management: Produced by dominant institutions, particularly the World Bank and the main northern environmental NGOs (e.g., World Conservation Union, World Resources Institute, and World Wildlife Fund), and supported by G-8 countries, the underlying mantra of this perspective is resource management under the paradigm of the market principle and of economic growth. The CBD and the activities by which it is surrounded are playing a central role for the dissemination of this perspective. Based on a particular representation of the 'threats to biodiversity', this perspective emphasises the loss and fragmentation of habitats, species introduction in alien habitats rather than underlying causes. In this sense, this view offers a set of prescriptions for the conservation and sustainable use of resources, and suggests appropriate mechanisms for biodiversity management. Accordingly, the discourse of biodiversity as resource management is linked to three other discourses: conservation science, sustainable development, and benefits sharing or, more recently, payment for environmental services. This predominant discourse, originating in dominant views of science, capital, and management, is actively being promoted from a variety of sites and through manifold academic, institutional, managerial, and political practices. The TEEB initiative is one recent example of this point of view focusing on the "best practices" of economic valuation of environmental services.

A 'third world' state perspective focusing on sovereignty: Fighting for sovereignty countries from the 'South' seek to negotiate the terms of biodiversity treaties and strategies for their own purposes. Nevertheless, this perspective does not question the globalocentric discourse in any fundamental way. According to Escobar, issues such as in-situ conservation and access to ex-situ collections, sovereignty of access to genetic resources, ecological debt, and the transfer of financial and technical resources to the Third World are important agenda items within this perspective. In general, Escobar states that national governments have a key position in international fora such as the CBD, since under CBD mandate, national governments have to pursue biodiversity planning according to blueprints that have already been established. Because these blueprints and plans have been conceived in very conventional terms of development planning Escobar argues that they might be perceived "ethnographically as instances of the organization of knowledge and power. The resulting policies of conservation and sustainable development will depend on the struggle and negotiation over models of nature and social practice among the groups involved" (Escobar 1998, 59).

A progressive NGO perspective raising issues of 'biodemocracy': Very clearly distinguished from the dominant globalocentric perspective, an increasing number of mainly southern NGOs claim the origins of diversity loss to be found in northern behaviour and patterns referring to counterproductive development strategies, the promoted monocultures of mind and agriculture, and the consumption habits of the North fostered by economic models. In their view, the globalocentric perspective amounts to a form of bio-imperialism. At the same time, they suggest a radical redefinition of production and productivity away from the logic of uniformity and toward the logic of diversity seeing this as the historical heritage of Third World communities. According to Escobar, this strategic use of the holism of ecology is convincingly presented as more enlightened science. The most important issues of the proposal for biodemocracy include: local control of natural resources, suspension of mega-development projects and of subsidies to diversity-destroying capital activities such as agrofuel development and tree-plantation projects, support for forest and agro-ecological practices based on the logic of diversity, redefinition of productivity and efficiency to reflect this logic, and recognition of the cultural basis of biological diversity. In addition, advocates of biodemocracy are opposed to both biotechnology as a tool that eliminates diversity more than it increases it, and they also oppose the adoption of intellectual property rights as the mechanism for the protection of local knowledge and resources. Instead, they advocate forms of collective rights that recognize the intrinsic value and the shared character of knowledge and resources. As such, this view thus constitutes an important critique of globalocentric perspectives.

A social movement perspective fighting for cultural autonomy: Especially in the southern hemisphere social movements have emerged that explicitly appeal to the biodiversity discourse as part of their strategy for cultural survival in general. In many cases, the concern with biodiversity has followed from broader struggles for territorial control defending not only resources or biodiversity, but an entire livelihood and cultural projects. In this context, Escobar is referring to social movements "that explicitly construct a political strategy for the defence of territory, culture, and identity linked to particular places and territories [...] that is mediated by ecological considerations" (Escobar 1998, 60). While having many points in common with the NGO perspective, they are distinct conceptually and politically. Their protagonists are often indigenous communities and their federations, rather than NGOs. With the conception of biodiversity as a hegemonic construct, activists of these movements acknowledge that this discourse opens up a space for the construction of culturally based forms of development that could counteract tendencies towards resource extraction in the peripheries.

Hence, depending on context and actor, 'biodiversity' is used to mean genes, or species, or populations, or ecosystems, or all of them together. It is used as a synonym for nature, for ecosystem health, natural resources or ecosystem services, or understood as a synonym for sustainability, or as something necessarily linked to cultural diversity. It is used in terms of conservation strategies, seen as common heritage of human kind, as a sovereign commodity linked with rights of access to, and benefit sharing of, the use of genetic resources, as a new form of bio-imperialism or biopiracy, as the origin of a new biodemocracy, or in terms of cultural identity. It is used either as object of scientific studies, as ethical or spiritual issue, as source of power, or as a mix of these and possibly a lot more. Hence, one could quote Yliskylä-Peuralahti (2003, p. 217) that: “Biodiversity as a concept has a [...] kind of dual nature: it can be treated as concrete biological phenomena (with a strong spatial dimension) to be observed as a landscape or measured for example in the form of species richness. At the same time, it is also a human construction—a powerful representation of nature that has an impact on how the environment is comprehended, perceived and valued.”

2.2 The politics of environmental discourse

The above-described multiplicity of legitimate perspectives is inherent to complex issues. Gallopin et al. (2001, p. 8) describe *multiplicity of legitimate perspectives* to be among the most important attributes exhibited by complex issues, next to *non-linearity* (e.g. unproportional cause-effect relations, chaotic behaviour, and runaway processes), *emergence* (with ‘the whole being more than the sum of its parts’), *self-organisation*, *multiplicity of scales*, and *irreducible uncertainty* of various kind and origin. Often conceived as to be the most complex issue in current international environmental politics, it should be of no surprise that biodiversity is continuously contested in a struggle about its meaning, interpretation and implementation, as any choice is bound to infringe on someone’s interests or values.

Making choices between conflicting alternatives belongs to the realm of ‘the political’. While some theorists envisage the political as a space of freedom and public deliberation, Mouffe (2005, p. 9) and colleagues see ‘the political’ as a space of power, conflict and antagonism, which she takes to be constitutive of human societies. Understanding ‘difference’ as a precondition for the existence of any (political) identity (ibid.), the political is essentially about dealing with eventually conflicting interests and values. Mouffe then defines ‘politics’ as “the set of practices and institutions through which an order is created, organizing human coexistence in the context of conflictuality provided by the political” (Mouffe 2005, p. 9).

Hajer (1995, p. 15) well describes that conflict over environmental problems has essentially become *discursive*: It no longer focuses on the question of whether there is an environmental crisis, but "has increasingly become a conflict of interpretation in which a complex set of actors can be seen to participate in a debate in which the terms of environmental discourse are set." Generally speaking, there are two traditions of political theory that are relevant to environmental 'discourse'. The first builds on Foucault's theory of discourse analysis, and is concerned with describing discursive practices and the interaction and coalescence of discourses in terms of expressions of coercive power. The second attempts to formulate a normative approach to discourse in democracy based on moral insight and normative validity, and has been strongly influenced by Habermas' theory of discourse ethics.

Following Foucaultian traditions of discourse analysis, Hajer (1995, p. 44) defines discourse "as a specific ensemble of ideas, concepts, and categorisations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to social and physical phenomena." As for biodiversity, Escobar (1998, p. 55), for example, suggests understanding the phenomenon of biodiversity as produced by 'technoscientific' networks based on "models (e.g., of ecosystems, conservation strategies); theories (e.g., of development, restoration); objects (from plants and genes to various technologies); actors (prospectors, taxonomists, planners, experts); strategies (resource management, intellectual property rights); etc."

By creating new meanings and new identities (i.e. by altering cognitive patterns and creating new cognitions), Hajer (1995, p. 59) argues that discourse is constitutive of the realities of environmental politics, and thus conceives of environmental politics "as a struggle for discursive hegemony in which actors try to secure support for their definition of reality." "Discourses shape what can and cannot be thought, delimit the range of policy options and thereby serve as precursors to policy outcomes." (Hajer and Versteeg 2005, p. 178) Key to Hajer's approach is the concept of 'story-lines', which "fulfil an essential role in the clustering of knowledge, the positioning of actors, and, ultimately, in the creation of coalitions amongst the actors of a given domain." (Hajer 1995, p. 63) Providing a generative sort of narrative, story-lines allow actors to draw upon the bewildering variety of separate discursive perspectives of a problem while suggesting a common understanding.

According to Hajer (1995, p. 63) "the power of storylines is essentially based on the idea that it sounds right." He further stresses (1995, p. 63) that "this should not be misunderstood as a purely cognitive process. Whether something sounds right is not only influenced by the plausibility of the argument itself, but also by the trust that people have in the author that utters the argument and the practice in which it is produced and is also influenced by the acceptability of a storyline for their own discursive identity." Credibility, acceptability, and trust are for Hajer the principal three factors that determine what he calls the 'argumentative game': "Credibility is required to make actors believe in the subject positioning that a given discourse implies for them and to live by the structure positionings it implies; acceptability requires that position to appear attractive or necessary; trust refers to the fact that doubt might be suppressed and inherent uncertainties might be taken for granted if actors manage to secure confidence either in the author (whether that is an institution or a person), e.g. by referring to its impeccable record, or in the practice through which a given definition of reality was achieved, e.g. by showing what sort of deliberation were the basis of a given claim." (Hajer 1995, p. 59)

With the nature and the outcome of the environmental conflict being dependent on discursive dynamics, Hajer (1995, p. 22) distinguishes three main tasks of regulation: "The regulation of a problem first and foremost requires forms of discourse closure: the problem needs a definition that gives policy-making a proper target. Secondly, regulation asks for social accommodation: policy-making implies finding ways to contain the social conflict that might erupt over environmental problems. Thirdly, regulation is supposed to allow for problem closure: it should remedy a situation that was perceived as problematic." Answers to how this might be achieved can be found in the more normative accounts of a discursive or deliberative democracy.

Mouffe (2005, p. 20) has stressed that "conflict, in order to be accepted as legitimate, needs to take a form that does not destroy the political association. This means that some kind of common bond must exist between the parties in conflict." For democracy this common bond is the adherence to its core values of freedom and equality for all. Responsive to the increasingly discursive nature of (not only environmental) politics, democratic legitimacy came more and more to be seen in terms of the ability or opportunity to participate in effective deliberation [6]– to the extent that "the essence of democracy itself is now widely taken to be deliberation, as opposed to voting, interest aggregation, and constitutional rights." (Dryzek 2000, p. 1) Broadly defined, 'deliberation' refers to communicative processes that are inclusive, open, accountable, and reciprocal and integer, and that allow its participants to reflect upon their judgements, preferences and views in non-coercive fashion (Dryzek 2000; Hajer and Versteeg 2005).

Following a normative account of discourse in the Habermasian sense, in which 'the unforced force of the better argument prevails', but with a critical orientation to established power structures, Dryzek (2000, p. 3) argues for a discursive democracy that "should be pluralistic in embracing the necessity to communicate across differences without erasing differences, reflexive in its questioning orientation to established traditions (including the traditions of deliberative democracy itself), transnational in its capacity to extend across state boundaries into settings where there is no constitutional framework, ecological in terms of openness to communication with non-human nature, and dynamic in its openness to ever-changing constraints upon and opportunities for democratisation."

Key to deliberative/discursive democracy are participatory approaches. Van den Hove (2006, p. 10) describes participatory approaches as "institutional settings where stakeholders of different types are brought together to participate more or less directly, and more or less formally, in some stage of the decision-making process … [and] refers to the implication in the decision-making process of persons external to the formal politico-administrative circle." Without such an open arena for reconciliation, so the argument (Jones 2002, p. 250), "competing discourses are more likely to be negotiated in the arena of protest, resistance and new social movements."

Knight and Johnson (1997, p. 292) emphasise that deliberative democracy makes strong demands in particular on the criterion of political equality: "Participants in the deliberative discourse process must be actively engaged in a discourse of argumentation and persuasion. The task for any participant in such a process is to develop and communicate reasons for action that will influence others to endorse her preferred collective outcomes." They stress that for deliberative democracy political equality (legitimacy) necessarily entails equal opportunity of political influence. Drawing on Rawls (1993) and Sen (1992), Knight and Johnson (1997, p. 296-297) elaborate that to achieve 'equal opportunity of political influence' deliberative democracy requires equal access to aggregated resources, including best available knowledge, and perhaps even more fundamentally, equal command of the capabilities needed to convert these resources into the means to achieve particular goals. The three capabilities they explicitly emphasise (Ibid., p. 298-299) are (i) the capacity 'to formulate authentic preferences'; (ii) the ability 'to make effective use of cultural resources'; and most important (iii) the endowment with 'basic cognitive abilities and skills'.

When basic thresholds of these capabilities are not reached, participants will be unable to affect the collective decision-making process. According to Bohman (1997, p. 333) the consequences of such 'political poverty' are two-sided: "On the one hand, politically impoverished groups cannot avoid public exclusion; they cannot successfully initiate the joint activity of public deliberation. On the other hand, such groups cannot avoid political inclusion either, since they are the legal addressees of the deliberative agreements over which they have no real control of influence. Because they cannot initiate deliberation, their silence is turned into consent by the more powerful deliberators who are able to ignore them." Although for many theorists of deliberative politics, exclusions are not only to be avoided but indeed avoidable, the reality of extreme social and political asymmetries leads rather to situations (at regional, national and international scales) of "participatory exclusions" (Agarwal 2001) where whole classes of people are unable to put forward (in their own terms and languages) their values, interests and knowledge regarding biodiversity conservation.

2.3 Making sense of science for environmental politics

Knowledge is a crucial element in the politics of environmental discourse as it is a fundamental source to make reasoned arguments. It is also fundamentally intertwined with power, as in "creating a joint understanding of the world, developing knowledge following particular conceptual guidelines is power." (Hajer and Verteeg 2005, p. 181)

Based on traditions of philosophy reaching back as far as Plato, who thought of 'knowledge' as 'justified true belief', Faber and Manstetten (2003) distinguish three different forms of knowledge: (i) ontological/essential knowledge, (ii) practical/lived knowledge, and (iii) scientific knowledge. According to Faber and Manstetten (2003), knowledge of the nature or essence of things emanates from the unconditional. Ontological knowledge therefore pertains to a holistic notion of things and lies beyond measurement. As such, this type of knowledge is the subject of the field of ethics. The human rights or the intrinsic value of nature, are examples where knowledge of this kind has found explicit expression in national and international law and claims unconfined validity.

Practical or 'lived' knowledge is described by Faber and Manstetten (2003) as that kind of knowledge, which rests in experiences and customs, combined with a sense for present circumstances featuring appropriateness and proportionality. Different to the other two forms of knowledge, this knowledge form exists only in pluralities, as knowledge of different groups, societies, cultures etc. It is particularly with this type of knowledge that traditional people are said to possess "an asset of incalculable value: a map to the biological diversity of the earth on which all life depends. Encoded in indigenous languages, customs and practices may be as much understanding of nature as is stored in the libraries of modern science." (Durning 1992, p. 7)

Scientific knowledge, in turn, stands for a way of obtaining knowledge systematically, the production of knowledge based on method. The essence of scientific knowledge lies within its core principles that scientific findings need to be verifiable, repeatable and of universal applicability. Thus, to be termed scientific knowledge, a method of inquiry must be based on gathering observable, empirical and measurable evidence subject to specific principles of reasoning. Scientific method, again, consists of the collection of data through observation and experimentation, and the formulation and testing of hypotheses. According to Nagel (1984, p. 4, cited in van den Hove 2007), the distinctive goal of science "is the desire for explanations which are at once systematic and controllable by factual evidence … and the organisation and classification of knowledge on the basis of explanatory principles."

In modern society, Nowotny et al. (2001, p. 1) argue, science has become by far the most dominant form of knowledge: "Not only has [science] determined technical processes, economic systems and social structures, it has also shaped our everyday experience of the world, our conscious thoughts and even our unconscious feelings." Crucial to this development has been a widespread perception of the role of science in society according to which scientific knowledge flows "from basic research to applied research to development and ultimately societal benefits" (Pielke 2007, p. 12), and "that specific knowledge or facts compel certain policy responses" (Pielke 2007, p. 13) suggesting that consensus on science will lead to consensus in politics and so to coordinated action.

This perception, also known as the 'linear model', builds on assumptions presupposed by theories in political science and the philosophy of science of the earlier twentieth century – in particular on the belief in a clear distinction between 'objective knowledge' and 'subjective values' (Weingart 1999). According to these accounts, science is perceived as providing 'hard' and objective facts, and policy as the product of a rational, technical and instrumental decision process moving through the distinct stages of agenda setting, decision-making and implementation (Hill 1997). It presumes that politically neutral scientists 'speak truth to power' providing objective representations of reality, upon which rational decisions are taken by elected representatives and faithfully implemented by public administrators, invoking a direct, unproblematic image of an instrumental relationship between science and policy.

However, the linear model is suitable only in the most simple of decision contexts (Pielke 2007), i.e. where the issue in question "can be adequately captured using a single perspective or description and by a standard model providing a satisfactory description or general solution through routine operations." (Gallopín et al. 2001, p. 7) For complex issues, however, the linear model has been characterised by a range of scholars as "descriptively inaccurate and normatively undesirable." (Pielke 2007, p. 13)

Instead, a number of alternatives to the linear model have emerged from fields such as sociology of science, science studies, comparative policy analysis and deliberative democratic theory (e.g. Funtowicz and Ravetz 1993; Nowotny et al. 2001; Pielke 2007; van den Hove 2007; Farrell 2005). Common to all these perspectives is the concept of some form of discursive model, promoting complex interrelations between science and policy with deliberation, exchange, and comparative evaluation and critique across epistemic frameworks, and with the aim of what Jasanoff (1998) called 'reasoning together'. Although science and politics are characterised by different processes, rationalities, discourses and norms – e.g., what constitutes reliable evidence, a convincing argument, procedural fairness, or an appropriate characterization of uncertainty (Jasanoff and Wynne 1998; Miller 2001; Pohl 2007) – when it comes to complex environmental issues they are far from being sharply differentiated, homogeneous, and autonomous 'pure types' of social activities (van den Hove 2007). Instead, scientific and political practices have been shown to interact over a whole range of domains, through the constant intermingling of processes, products and actors, to the extent that scientific knowledge and political order can be understood to co-evolve (van den Hove 2007; Nowotny et al. 2001; Wynne 1992).

Nevertheless, though subject to a robust critique and raising awareness of the inappropriateness of the linear model in environmental politics, "its underlying assumptions are implicit in much policy discourse, not least in the mantras of 'evidence-based policy' and 'sound science'." (Owens 2005, p. 288) Also in the case of international biodiversity governance we find assumptions consistent with the presence of an underlying linear model, where science was established as the central and by far the most important source of valid information about nature and human-nature interrelation. It is in this context that Hajer (1995, p. 10) makes out "two features of present environmental politics that could indeed be cause for concern: first, the changing basis of legitimate decision-making; and second, the hidden link between science and politics."

First, along the lines of Ravetz, who pointed out that in the context of global environmental change environmental experts call for extremely 'hard' decisions but have only 'soft' evidence to support their claims, Hajer (1995, p. 11) notes that "decision-making on global problems requires an almost unprecedented degree of trust in experts and in our political elites at the same time as this trust is continually undermined by scientific controversies and political indecision." Second, in that power is examined in creating the very terms with which politics is conducted, Hajer (1995, p. 11) argues that apocalyptical overtones in the presentation of global environmental problems (such as those of conservation biologists presented above), seriously confine the political debate on what needs to be done, by whom, and under what conditions: "Implicitly global environmental problems are presented as being a priori of a different order, and thus marginalise many other environmental concerns that might affect many people or ecosystems much more directly." With the linear model and the presumption that more knowledge will reduce uncertainties and increase capacity for control still prevailing, Gallopin et al. (2001, p. 11) see "an instrumental notion of science and, at a deeper level, an ideology of domination at work." It is in this sense that these authors note "a growing feeling from many quarters that science is not responding adequately to the challenges of our time, and particularly those posed by the quest for sustainable development." (Gallopin et al. 2001, p. 1).

In an attempt to outline measures that should be taken to address limits of current science, Gallopin et al. (2001, p. 9) point out at least three levels at which complexity impinges upon scientific enquiry: "(i) physical reality, where the properties of self-organisation, irreducible uncertainty, emergence, and others, come into play; (ii) the need to consider different "epistemologies" (a plurality of perceptions or viewpoints must be acknowledged and respected, even if not accepted as equally valid); and (iii) the need to consider different "intentionalities" (differing goals)." As Haraway (1991, p. 187) has aptly put it, in this situation the key question for how to make sense of science in environmental politics is: "How to have simultaneously an account of radical historical contingency for all knowledge claims and knowing subjects, a critical practice for recognising our own 'semiotic technologies' for making meanings, and a no-nonsense commitment to faithful accounts of a 'real' world."

Part of the answer is claimed to lie in what Funtowicz and Ravetz (1991) have called 'post-normal science'. Post-normal science, which emerged from the analysis of technological risks (nuclear accidents, for instance), found a niche in the intellectual and personal setting of Ecological Economics. Its origins lie in positivist, logical empiricist approaches to the philosophy of science and not in Habermasian deliberative politics, but there has been a confluence between both currents of thought. Post normal science focuses on those aspects of problem-solving that tend to be neglected in traditional accounts of scientific practice, such as uncertainty, value-loading and plurality of legitimate perspectives (Funtowicz and Ravetz 1994). By bringing 'facts' and 'values' into a unified conception of problem solving, and by replacing 'truth' by 'quality' as its core evaluative concept, Funtowicz and Ravetz (1994) argue that post-normal science provides a response to the challenges that have emerged at the interface between science and policy. Central to post-normal science is the concept of the 'extension of the peer community' (an open dialogue between all those affected), which, according to Funtowicz and Ravetz (1994), is essential for maintaining the quality of the process of resolution of complex issues. Similar to a Habermasian approach to deliberative democracy, also in post-normal science "quality, explicitly comprising ethics and morality, becomes the organising principle" (Funtowicz and Ravetz 1994, p. 204).

Many academics, in particular deep ecologists and conservation biologists, denounce such social constructivist approaches as a valid foundation for researching environmental problems (Jones 2002, referring among others to Soule and Lease, 1995). In an approach to defend and clarify some of the confusion around the definition, application and value of social constructivism with respect to the environment, Jones (2002, p. 248) highlights those traditions of constructivism that "accept epistemological relativism (i.e. that we can never know reality exactly as it is), while rejecting ontological relativism (i.e. that our accounts of the world are not constrained by nature)" – also referred to as 'moderate' constructivism. Maintaining the belief in the physicality of the natural world, "this view enables rational grounds to be developed for preferring one belief to another. … All beliefs are accepted as socially produced (epistemically relative) but not necessarily equally valid." (Jones 2002, p. 249)

Presenting a solution for how to acknowledge and respect a plurality of perceptions while not accepting them to be all equally valid, including different intentionalities, Jones (2002) draws on arguments advanced by anthropologists and sociologists such as Little (1991). According to Jones (2002, p. 249), Little believes that while different cultures may have a distinctive set of general beliefs about the world that are quite foreign to each other, they share a "core set of concepts and beliefs defining the ordinary world that establishes the possibility of interpretation across cultural boundaries." Little (1991, p. 207, cited in Jones 2002) explains that "[W]hat makes communication across conceptual schemes in science feasible, in this approach, is the possibility of a shared reference to real physical objects and properties." Jones (2002, p. 249) contends that "[t]hus, deep but mutually intelligible disagreements about the way the world works are recognised (Little 1991). In that it is possible for meaningful communication to occur across paradigm boundaries, it may be possible to institute certain processes to negotiate across paradigms."

In any case, even when it is possible to prioritise one perspective over others, Pielke (2007, p. 140) argues that it makes sense for science for politics to present a whole range of different policy alternatives, as "policy-makers frequently need new options, and not more science." Contrary to the linear model, which perceives the appropriate work of the science-policy interface (the measure of its credibility) being to assist decision makers in 'closing down' policy debates, scholars such as Funtowicz and Ravetz (1990), Pielke (2007) and Stirling (2006) suggest an urgent need for institutions that seek to 'open up' difficult policy processes by providing decision makers with "plural and conditional advice: systematically revealing how alternative reasonable courses of action would appear preferable under different detailed 'framing assumptions' and showing how these dependencies relate to the real world." (Stirling, 2006, p. 101) In clarifying and, at times, seeking to expand the scope of choices available to decision-makers, Pielke (2007, p. 9) argues that such "honest brokering of policy alternatives matters because a powerful role for science in society is to facilitate the creation of new and innovative policy alternatives."

2.4 Institutional dynamics of science-policy interfaces

Finally, if environmental politics is constituted through discourse, and environmental discourses are influenced by scientific knowledge, then institutional issues arise: What institutional practices interfacing science and policy can be envisaged to conduct debates in such a way that environmental politics can take place in an effective but also more democratic way? This institutional question becomes all the more pressing as "environmental debates often take place in a situation of institutional ambiguity, in which there are no generally accepted rules and norms according to which politics is to be conducted and policy measures are to be agreed upon." (Hajer and Versteeg 2005, p. 182) It is in this sense that here I approach science-policy interfaces in terms of institutions.

Vatn (2005) suggests understanding institutions as the cognitive models, normative structures and behavioural constraints that shape human interactions. Cognitive models, creating common frames of references and classifying relevant behaviour, "constitute the basis for creating necessary meaning and order so that cooperation becomes possible." (Ibid, p. 206) Normative structures create "the pressure placed on individuals to fulfil certain obligations and expectations" (Ibid, p. 207) that result from common values and the identification of normatively appropriate behaviour. And behavioural constraints resemble more general pre-given 'rules of the game' that are exogenous to a given context (Ibid, p. 205). Together, "institutions give rise to social practices, assign roles to the participants in these practices, and guide the interactions among the occupants of the various roles." (Young et al. 2008, p. xiii)

Like science, as the systematic pursuit of producing ideally objective knowledge (Pielke 2007), and politics, as the systematic quest of organising human coexistence in the context of power, conflict and antagonism (Mouffe 2005), also interrelations of science and policy can be understood in institutional terms. Nowhere are these interactions more intensely and inextricably interwoven as in the identification, formulation, implementation and analysis of policies (Jasanoff 1990; Nowotny et al. 2001). Accordingly science-policy interfaces are here defined as the institutional arrangements that are established to interface science and policy – providing the cognitive models, normative structures, rights, rules and procedures that define and enable social practices interrelating science and policy, assign roles to scientists, policy-makers and other relevant stake- and knowledge-holders, and guide their interactions according to given principles and purposes.

As social constructions, Young (2004, p. 215) notes that "the establishment or refinement of institutions … involves acts of creation rather than processes of discovery" and that one should expect to find institutions "bearing the stamp of theories, discourses, ideologies, or, more generally, patterns of thought that were influential at the time of their formation." Once established, Young (2009, p. 2) further argues, institutions develop, just like complex dynamic systems, "in the sense that they move toward realising their potential or make adjustments needed to maintain their compatibility with changing biophysical and socioeconomic circumstances." Most of these developments are incremental adjustments to existing regulatory provisions, allowing a system to adapt to disturbances without changing its principle assumptions, normative structures or rules. Over time, however, Young (2009) notes that institutions become increasingly entrenched, fall prey to rigidification, develop institutional mismatches and become more and more vulnerable to various types of stresses. Stresses, in turn, tend to proliferate and to become interactive and cumulative over time to the extent that they fundamentally impede the effectiveness of the institution itself. When stresses begin to overwhelm an institution's resilience (i.e. its capacity to deal with stress without major changes to its basic structures), Young (2009) continues, established institutional arrangements can suddenly be fundamentally questioned or even collapse, leading to 'institutional crises' that present opportunities to introduce more constitutive changes and processes of necessary institutional (re)formation that are unimaginable during normal periods.

But needed institutional changes are not always guaranteed. Young et al. (2008) put forward three causes to explain why established institutions can be highly resistant to change and institutional mismatches difficult to eliminate, even if they become severe and widely understood: (i) limited systemic knowledge gives rise to ‘false analogies’, (ii) systemic path dependency constrains institutional change, and (iii) political resistance towards institutional change emerges.

On the one hand, Young (2009) points to the consequences of limited knowledge regarding the institutional system and/or the nature of the problem that prevents the chances to take advantage of these moments of institutional crisis. When institutions finally collapse, so Young (2009), they often do so abruptly and unanticipatedly and the resulting windows of opportunity for institutional change are usually of short duration. “Whether or not individual stakeholders are prepared to introduce carefully crafted alternatives when a window opens, some new institutional arrangements will emerge in fairly short order to fill the vacuum caused by the disruption of an existing order.” (Young 2009, p. 7) Often insufficiently prepared when confronted with such a window of opportunity, stakeholders frequently lack the necessary critical knowledge about the nature of the institutional mismatches and of viable alternatives, and usually stick to conventional, preconceived and typically simplistic remedies or blueprints. However, conventional approaches often fall too short of transformative change and panaceas often fail assuming that institutional arrangements that are successful in one context will work well also in other settings (Ostrom et al. 2007). “One size does not fit all when it comes to designing institutions to solve environmental problems. It therefore calls for an effort to identify critical features of specific problems followed by an effort to specify institutional arrangements that are best suited to deal with the most prominent of these features in the case(s) at hand.” (Young 2002, p. 19) Young (2009, p. 7) therefore makes a strong case “for thinking systematically about institutional alternatives in advance, so that well-crafted options are available when crises open up windows of opportunity for the introduction of substantial institutional change.”

On the other hand, Young (2008) alludes to systemic path dependency and political behaviour as important parameters constraining or even obstructing institutional change. As regards systemic institutional inertia, he notes that far-reaching revisions in the operating rules governing the activities of key stakeholders are often constrained because “stakeholders become attached to the way things are done, existing social practices become routines, and the status quo turns into the default option.” (Young 2006, p. 13) If new information conflicts with existing behaviour and belief, actors often try to avoid this so called ‘cognitive dissonance’ “by rejecting or avoiding information that challenges believe systems or by interpreting dissonant information in a biased way" (Bradshaw and Borchers 2000, p. 3). If this social inertia is born not out of paucity of information but of a complex, deep-seated resistance to change, Bradshaw and Borchers (2000, p. 4) speak of a 'volition' phase of the dissonance between existing beliefs and behaviour and new conflicting information. "Some actors or interest groups may well benefit, at least in the short run, from maintaining or even nurturing the growth of misfits" (Young 2008, p. 29). As a result, institutional mismatches are often not resolved, but artificially suppressed, leading to what Funtowicz and Ravetz (1994, p. 571) call the ancien régime syndrome "characterised by underperformance in key attributes, by prohibition of diversity, and by prevention of novelty." From his studies Young (2008) concludes that efforts to address institutional mismatches involve political processes and require explicit acts of institutional reform aimed at altering the features of the institutional structures that give rise to the identified problems.

Historical Context and Methodological Approach

Within the theoretical framework presented above, addressing fundamental shortcomings of science-policy interfaces requires explicit acts of institutional reform. The earlier mentioned political processes established to improve science-policy interfaces in international biodiversity governance provide great opportunities to address the prevailing institutional gaps, mismatches and shortcomings. In the following, I outline the four political processes that have been the focus of my studies and I present my methodological approach.

3.1 Historical context

3.1.1 Towards an EU mechanism for independent, authoritative research-based advice

Triggered by an assessment of the European Union's (EU) Biodiversity Strategy [4] concluded in 2006, and the subsequent commitment of the European Commission (EC) to substantially strengthen the science-policy interface for conservation and sustainable use of biodiversity in the EU and globally, efforts are underway to establish "an EU mechanism for independent, authoritative research-based advice" (EC 2006, p.13).

[6] Communication from the Commission to the Council and the European Parliament on a European Community biodiversity strategy, COM (1998)42.

Adopted in 1998, the European Union's Biodiversity Strategy was developed to meet the community's obligations as a Party to the CBD[5] and to give the existing policy instruments a coherent framework. The strategy builds around four themes, covering (i) conservation and sustainable use of biological diversity; (ii) sharing of benefits arising out of the utilisation of genetic resources; (iii) research, identification, monitoring and exchange of information; (iv) education, training and awareness. Four Biodiversity Action Plans (for the Conservation of Natural Resources, for Agriculture, for Fisheries, and for Economic and Development Co-operation) lay out in detail what actions should be taken to implement the Strategy in specific areas of Community activity.

In May 2004, the European Commission convened a Stakeholders' Conference on *Biodiversity and the EU - Sustaining Life, Sustaining Livelihoods* in Malahide, Ireland, to finalise a year long consultative process designed to assess the implementation, effectiveness and appropriateness of the EU Biodiversity Strategy and its four Biodiversity Action Plans and to identify priorities towards meeting the 2010 commitments to halt this decline in the EU and significantly reduce the current rate of loss globally by 2010. The Conference brought together experts from the key sectors affecting biodiversity, from the European Commission, Member States and civil society. It was also supported by contributions from the research community, which provided a declaration and recommendations on biodiversity research, preparing at a meeting of the European Platform for Biodiversity Research Strategy (EPBRS) held in Killarney, Ireland, just prior to the Malahide Conference. The 'Message from Malahide', the official result of this conference, detailed priority objectives, targets, indicators of success and implementation arrangements for the EU's biodiversity politics up to 2010.

In May 2006, the European Commission adopted a communication on "*Halting Biodiversity Loss by 2010 – and Beyond: Sustaining ecosystem services for human well-being*". Drawing on the Message from Malahide and other wide–ranging expert and public consultation, this Communication (i) outlines the extent of the problem and reviews the adequacy of the EU response so far; (ii) identifies key policy areas for action, and related objectives and supporting measures to deliver the 2010 targets and put biodiversity on course to recovery; which are (iii) translated into specific targets and actions in the annexed "EU Action Plan to 2010 and Beyond." The EU Biodiversity Action Plan addresses the challenge of integrating biodiversity concerns into other policy sectors in a unified way, specifying a comprehensive plan of priority actions and outlines the responsibility of community institutions and Member States in relation to each.

Under the key policy area "The Knowledge Base" the EC commits "to substantially strengthen the knowledge base for conservation and sustainable use of biodiversity, in the EU and globally" (Objective 10). According to this objective, *"understanding biodiversity presents one of the greatest scientific challenges facing mankind. There is a critical need to strengthen our understanding of biodiversity and ecosystem services, if we are to refine our policy response in the future. This requires strengthening (under FP7 and national research programmes) the European Research Area, its international dimension, research infrastructures, the science–policy interface and data interoperability for biodiversity." (EC 2006, p. 13). The communication further states that, "subject to funding being found from existing financial resources, the Commission will establish an EU mechanism for independent, authoritative research-based advice to inform implementation and further policy development. Internationally, the EU should identify and support ways and means to strengthen independent scientific advice to global policy making, inter alia by actively contributing to CBD consideration of the 2007 evaluation of the MA, and the ongoing consultations on the need for improved International Mechanisms on Scientific Expertise on Biodiversity."* (EC 2006, p.13)

Progress towards such a EU mechanism has been fairly little so far. In May 2009, the EPBRS organised a *Workshop on a Network of Knowledge on Biodiversity* bringing together (mainly) key European networks in biodiversity science and politics to discuss both a European mechanism and an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) of which the former could be the European 'branch'.[6]

Further, under the 7th Framework Programme (FP7) the EC is financing two projects that are intended to further prepare the grounds for the establishment of a EU science-policy interface on biodiversity: (i) A research project focused on *Science-Policy Interfaces for biodiversity: Research, Action, and Learning* (SPIRAL)[7] aiming to deliver a series of practical products for the benefit of users involved in inter-

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5 Article 6 of the CBD specifically requests each party to "develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned"; and to "integrate as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies" (CBD 1992).

6 http://www.epbrs.org/event/show/24

7 http://www.spiral-project.eu/

faces, including workshops, networking opportunities, handbooks, policy briefs, targeted synthetic reports, an internet pilot platform, and a dedicated website; (ii) a coordinating action *Developing a Knowledge Network for European Expertise on biodiversity and ecosystem services to inform policy making and economic sectors* (KNEU)[8]. As the discussions on an IPBES became more concrete (see below), it was expected that the efforts towards a EU mechanism would be stepped up again.

Table 01

Relevant events regarding a future EU mechanism for independent, authoritative research-based advice

1998	Adoption of the EC Biodiversity Strategy, including the thematic areas of research, identification, monitoring and exchange of information, and education, training and awareness
2003-2004	Consultative process designed by the European Commission to assess the implementation, effectiveness and appropriateness of the EC Biodiversity Strategy and to identify priorities towards meeting the 2010 commitments
21–24 May 2004	EPBRS meeting on 'Sustaining Livelihoods and Biodiversity – Attaining the 2010 targets in the European Biodiversity Strategy' held in Killarney, Ireland
25-27 May 2004	Stakeholders' Conference on Biodiversity and the EU - Sustaining Life, Sustaining Livelihoods in Malahide, Ireland, preparing a 'Message from Malahide' detailing priority objectives, targets, indicators of success and implementation arrangements
May 2006,	The European Commission adopted a communication on "Halting Biodiversity Loss by 2010 – and Beyond: Sustaining ecosystem services for human well-being", identifying key policy areas for action, and related objectives and supporting measures to deliver the 2010 targets and put biodiversity on course to recovery, and including, inter alia, an objective "to substantially strengthen the knowledge base for conservation and sustainable use of biodiversity, in the EU and globally" (Objective 10), including the establishment of an EU mechanism for independent, authoritative research-based advice
6th May 2009,	Workshop on a Network of Knowledge on Biodiversity bringing together key European networks in biodiversity science and science-policy interfaces, organised by the EPBRS in , Brussels, Belgium
May 2010 – July 2013	Under the 7th Framework Programme the European Commission supports a research project focused on Science-Policy Interfaces for biodiversity: Research, Action, and Learning (SPIRAL)
November 2010 - April 2013	Under the 7th Framework Programme the European Commission supports the coordinated action KNEU for Developing a Knowledge Network for European Expertise on biodiversity and ecosystem services to inform policy making and economic sectors

3.1.2
Ways and means to improve the effectiveness of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA)

Another important process of relevant institutional reform concerns the efforts of the Convention on Biological Diversity (CBD) to improve the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), the Convention's first and most important, subsidiary body and its official science-policy interface. This is analysed in Chapter 5.

Article 25 of the CBD establishes SBSTTA as an open-ended intergovernmental multidisciplinary scientific advisory body for the Conference of the Parties (COP) of the CBD. As outlined in Article 25, the functions of SBSTTA include (i) the provision of advice to the COP and its other subsidiary bodies, (ii) the preparation of scientific and technical assessments, (iii) the identification and development of technologies, methodologies and know-how relating to conservation, sustainable use and benefit sharing of biological diversity; and (iv) the provision of advice on scientific programmes and international cooperation in research and development related to conservation and sustainable use of biological diversity.

However, since its inception in 1995, SBSTTA has been subject to discussions on its role in improving the scientific underpinnings of the CBD. Although originally envisaged as an advisory mechanism with strong scientific character, SBSTTA has developed into what many refer to as a 'Mini-COP' — a body with strong political features negotiating draft decisions in preparation of the subsequent meeting of the COP (CBD, 2005; Le Prestre, 2002). In line with its operating principles "to constantly improve the quality of its advice by improving scientific, technical and technological input into, debate at, and work of, meetings of the Subsidiary Body," SBSTTA has undergone several changes addressing issues identified as impeding the quality of its advice (CBD, 2005).

The last significant change of SBSTTA's modus operandi, updating operational principles, rules and procedures of the body, took place at the eighth COP in Curitiba, Brazil, in March 2006 (Decision VIII/10, Annex III). Among the relevant novelties of this consolidated modus operandi is a general set of strategic ways and means of improving the advice of the Subsidiary Body to improve 'the scientific, technical and technological inputs into SBSTTA meetings' and 'the scientific, technical and technological debate during SBSTTA meetings' (emphasis added). To further "strengthen the scientific underpinnings of the Convention and to make

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[8] http://www.ufz.de/index.php?en=20873

concrete proposals on how to operationalise the requests of the Conference of the Parties contained in decision VIII/10" a brainstorming meeting of the past, present and future Chairs of SBSTTA was convened in Paris, France, 24-25 July 2006 distilling past experience of SBSTTA. Questions that the past, present and future Chairs of SBSTTA addressed at this meeting included the following (CBD 2006b):

- Does SBSTTA fulfill its mandate (Article 25)? If not, what should be done?
- What should be done to enhance the scientific and technical nature and depth of SBSTTA (i.e. profile of participants, inter-sessional and in-session work, SBSTTA output, etc...)?
- Is SBSTTA's mandate restricted to biological and natural sciences or does it allow for discussions of political and socio-economic nature? If it does, to what extent should the latter be addressed in the context of SBSTTA meetings?
- Does SBSTTA's mandate need to be adjusted to changing contexts now that emphasis is on implementation of the Convention provisions and the Programmes of Work, and achieving the 2010 targets?
- How can scientific discussions be facilitated or promoted during SBSTTA meetings (statements; discussions; keynote and other presentations; side events; poster sessions; contact groups; etc)? and
- How should SBSTTA present its advice to COP (as draft decisions or differently)?

Some of the strategic ways and means of improving the advice of SBSTTA recommended by the COP under Decision VIII/10, Annex III were applied in preparation for and during the twelfth and thirteenth meeting of SBSTTA. These include, the establishment of an official peer-review processes of the drafts of documents prepared by the Secretariat as a measure to enhance the quality of inputs to SBSTTA meetings (practiced since SBSTTA 13), and the guideline that "where different views are being put forward, the meeting will not attempt to negotiate an agreed compromise but instead present these divergent views in the form of options for consideration by the Conference of the Parties" to facilitate scientific, technical and technological discussions of items for in-depth review during SBSTTA meetings.

Also at the fourteenth meeting in May 2010, Parties of the CBD discussed ways and means to improve the effectiveness of SBSTTA (Recommendation XIV/17). While it is too early to assess the effectiveness of the measures just taken at SBSTTA 12 and SBSTTA 13, this meeting addressed other urgent issues and measures that are crucial to the functioning of SBSTTA. These include, among other things, issues related to the preparation of and documentation for SBSTTA meetings and SBSTTA's modus operandi, in particular as regards it relations to an IPBES to ensure complementarity and avoid duplication.

Table 02

Relevant events regarding SBSTTA's efforts to improve its effectiveness as science-policy interface to the CBD

September 1995	Paris, France – The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), established under Article 25 of the CBD, begins his work as scientific advisory body for the Convention.
March 2006	Curitiba, Brazil – Eighth meeting of the Conference of the Parties to the Convention on Biological Diversity – Adoption of a consolidated modus operandi for SBSTTA introducing a set of strategic ways and means of improving the advice of SBSTTA.
24-25 July 2006	Paris, France – Brainstorming meeting of the past, present and future Chairs of SBSTTA to strengthen the scientific underpinnings of the Convention and to make concrete proposals on how to operationalise the requests of the COP contained in decision VIII/10
2 - 6 July 2007	Paris, France – Twelfth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 12)
18 - 22 February 2008	Rome, Italy – Thirteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 13)
10 - 21 May 2010	Nairobi, Kenya – Fourteenth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 14)
18 - 29 October 2010	Nagoya, Japan – Tenth meeting of the Conference of the Parties to the Convention on Biological Diversity

3.1.3
The history of the process leading to an establishment of an Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)

The central focus of my research (in Chapter 6 of this thesis) has been the processes considering ways and means of improving the international science-policy interface on biodiversity and ecosystem services for human well-being that have lead to the establishment of an Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES). Intentions to establish a central science-policy interface for international biodiversity governance are as old as the Convention on Biological Diversity (CBD) itself (Le Prestre 2002)[9]. But it is only now, almost 20 years after the agreement of the CBD, that the international community is taking substantive steps to establish such a science-policy interface for international biodiversity governance.

Particularly two processes have been relevant to the lead up to the current discussions towards an IPBES. The first is the Millennium Ecosystem Assessment (MA) and its follow-up process that was developed following completion of the MA in 2005. In a one-off initiative the MA assessed the consequences of ecosystem change for human well-being, involving the work of more than 1360 experts and drawing on 32 sub-global assessments worldwide (MA 2005). Following its completion, a global strategy for following-up on the MA was developed in 2007 by a group of interested partner organizations.[10] Taking account of the experience of the MA[11], the recommendations of two independent evaluations of the MA conducted in 2006 and 2007,[12] and CBD discussions on how to substantially increase the impact of the MA,[13] this process aims to strategically address the following four issues (ICSU 2008): (i) continuing to build a knowledge base through sub-global assessments; (ii) promoting the consideration of ecosystem services in decision making processes; (iii) making assessment tools and methodologies widely available; and (iv) exploring needs, options and modalities for further global assessments. Further, one could see the TEEB initiative ("The economics of ecosystems and biodiversity") under UNEP between 2008 and 2011 as a development of point ii), on the premise that the economic valuation of ecosystem services increases their social and political visibility.

The second process relevant to the emergence of the IPBES discussions is the consultative process towards and International Mechanism of Scientific Expertise on Biodiversity (IMoSEB),[14] a French initiative that was launched in February 2006, following discussions at the International Conference "Biodiversity: Science and Governance", held in Paris, 24–28 January 2005. Between February 2006 and November 2007, the IMoSEB process prompted a series of studies, consultations, international and regional meetings and statements exploring the needs, scope and options of an International Mechanism of Scientific Expertise on Biodiversity (Loreau and Oteng-Yeboah 2006; Görg et al. 2007; IMoSEB 2008). Drawing on the consultations, the final meeting of the International Steering Committee identified a number of key needs and criteria to improve science-policy interfaces in biodiversity governance, and invited the Executive Director of UNEP to convene an intergovernmental meeting with all key stakeholders, both

governmental and non-governmental, to consider establishing an efficient international science-policy interface addressing the findings of the consultation.
In February 2008, UNEP's Governing Council agreed to a first Ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services "to consider ways and means of improving the science-policy interface on biodiversity and ecosystem services for human well-being, including possible establishment of an intergovernmental science-policy platform on biodiversity and ecosystem services (IPBES)." [15] A concept note, building to large parts on the MA follow-up strategy (ICSU 2008) and the final statement adopted by the IMoSEB Steering Committee, was developed to constitute the basis for the documentation of the first IPBES Meeting, which was convened in Putrajaya, Malaysia, from 10-12 November 2008. After discussions, which only in parts drew on the presented background papers, this first meeting recognised that mechanisms to improve the science-policy interface for biodiversity and ecosystem services for human well-being and sustainable development should

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9 Also the Global Biodiversity Assessment (GBA) (Heywood and Watson, 1995) was an attempt to establish a mechanism similar to that of the Intergovernmental Panel on Climate Change (IPCC). Heywood, V.H., Watson, R.T. (Ed.), 1995. Global Biodiversity Assessment. Published for the United Nations Environment Programme, Cambridge University Press, Cambridge, UK.

10 Partner institutions involved in MA follow-up process include: UNDP, EEA, FAO, GEF, Sida, Stockholm Resilience Centre, SwedBio, The Cropper Foundation, The Dutch Ministry of Foreign Affairs (DGIS), IUCN, UNESCO, UNEP-WCMC, ISDR, UNU/IAS, and WRI. Since the start of the MA follow-up process a number of other organisations have joined the efforts.

11 See: Millennium Ecosystem Assessment. 2003. People and Ecosystems: A Framework for Assessment and Action. World Resources Institute; Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Synthesis. Island Press; Reid, W.V. et al. 2006. Bridging Scales and Knowledge Systems: Concepts and Applications in Ecosystem Assessment. Island Press, the Global Environmental Assessment Project lead by Harvard University (www.hks.harvard.edu/gea).

12 The GEF review was completed in 2006 (www.unep.org/eou/Pdfs/Millennium Eco Assessment Report unedited.pdf). The review conducted by the United Kingdom's Environmental Audit Committee of the House of Commons was published in 2007 (www.publications.parliament.uk/pa/cm200607/cmselect/cmenvaud/77/77.pdf)

13 The Conference of the Parties (COP) of the Convention on Biological Diversity (CBD) considered the implications of the MA for the work of the Convention (decisions VIII/9 and IX/15), and, inter alia, requested the Executive Secretary, and invited Parties and other Governments, to contribute actively to the implementation of the global strategy for follow-up to the MA aimed at addressing knowledge gaps, promoting sub-global assessments, promoting application of the MA framework, methodologies and findings, and outreach.

14 Information on the process, all reports and submissions, can be found at www.imoseb.net

15 UNEP, 2009, Decision GC/25/10

16 UNEP/IPBES/1/6

continue to be explored, and called for a gap analysis to be undertaken by UNEP with the aim of supporting future discussions.[16]

The gap analysis for the purpose of facilitating the discussions on how to improve and strengthen the science-policy interface on biodiversity and ecosystem services[17] was presented at the second IPBES Meeting, held 5-9 October 2009, in Nairobi, Kenya. At this meeting, participants exchanged views on the major findings of the gap analysis, options to strengthen the science-policy interface, functions of an IPBES and possible governance structures. In general there was strong support for a new intergovernmental mechanism to strengthen the science-policy interface on biodiversity and ecosystem services, as long as it would be credible, legitimate and relevant, strengthen the generation of knowledge at the national, regional and global levels, and catalyse capacity-building for scientists, policymakers and members of civil society, including local communities, to enable them to participate more effectively in the science-policy interface and to increase the participation of scientists from developing countries (UNEP 2010).

A third and final ad hoc intergovernmental and multi-stakeholder meeting was convened on 7-11 June 2010 in Busan, Republic of Korea, to consider whether to establish an intergovernmental science-policy platform on biodiversity and ecosystem services. Participants of this meeting concluded that "an intergovernmental science policy platform for biodiversity and ecosystem services should be established to strengthen the science policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long term human well being and sustainable development" (UNEP 2010b, p. 2). They further laid out the principle structure and nature of this new mechanism in the so-called 'Busan Outcomes' (UNEP 2010b).

The UNGA, at its 65th session in November 2010, then, requested UNEP "to convene a plenary meeting providing for the full and effective participation of all Member States, in particular representatives from developing countries, to consider modalities and arrangements to fully operationalise the platform at the earliest opportunity."[18]

In response to the Busan Outcome, UNGA resolution 65/162 and a decision of the Governing Council of UNEP,[19] UNEP is now working closely with UNESCO, FAO, UNDP and other relevant organizations to convene a plenary meeting to fully operationalise the IPBES. This plenary meeting, to be held in the form of an open-ended intergovernmental meeting, is provisionally scheduled for two sessions – the first one being scheduled from 3-7 October 2011 in Nairobi, Kenya, and a second session being planed in the February-April 2012 timeframe.

Table 03

Relevant events of the process towards an Intergovernmental Platform on Biodiversity and Ecosystem Services

Jan. 24–28, 2005	International Conference on Biodiversity: Science and Governance, Paris, France
2001	Presentation of final results of the Millennium Ecosystem Assessment on Mar. 30, 2005 (launched June 5, 2001)
Feb. 21–22, 2006	First International Steering Committee of the IMoSEB consultations, Paris, France
Oct. 2-4, 2006	Workshop on International Science-Policy Interfaces for Biodiversity Governance - Needs, Challenges, Experience, Leipzig, Germany; organised by UfZ, UAB, and European Commission
Jan. to Oct. 2007	Regional consultations on IMoSEB in North America, Africa, Europe, Latin America, and Pacific
Oct. 22–23, 2007	Workshop on the Millennium Ecosystem Assessment Follow-up, Stockholm, Sweden; organised by the Swedish Ministry of the Environment
Nov. 15–17, 2007	Final International Steering Committee of the IMoSEB consultations, Montpellier, France
Jan. 2008	Launching of the Millennium Ecosystem Assessment Follow-up – A Global Strategy for Turning Knowledge into Action
Nov. 10–12, 2008	First Ad-hoc Intergovernmental and Multi-stakeholder Meeting on an Intergovernmental Science-Policy Interface on Biodiversity and Ecosystem Services, Putrajaya, Malaysia
Oct. 5–9, 2009	Second Ad-hoc Intergovernmental and Multi-stakeholder Meeting on an Intergovernmental Science-Policy Interface on Biodiversity and Ecosystem Services, Nairobi, Kenya
7-11 June 2010	Third Ad-hoc Intergovernmental and Multi-stakeholder Meeting on an Intergovernmental Science-Policy Interface on Biodiversity and Ecosystem Services, in Busan, Republic of Korea
12 November 2010	The 65th session of the UN General Assembly, takes decision 65/162 requesting UNEP to provide for an intergovernmental meeting to fully operationalise an IPBES
3-7 October 2011	First session of the open-ended intergovernmental meeting operationalising scheduled in Nairobi, Kenya

17 UNEP/IPBES/2/INF/1
18 http://ipbes.net/downloads/doc_download/8-unga-resolution.html
19 http://ipbes.net/downloads/doc_download/3-gc-decision.html

3.1.4
The debate on and reform of International Environmental Governance

Finally, although not only related to the issue of biodiversity governance, the debate on and reform of International Environmental Governance (IEG) is yet another important process that is of relevance for efforts aimed at improving science-policy interfaces for biodiversity governance. The still ongoing debate and the resulting reforms suggest relevant changes in international environmental governance that provide the broader and longer-term institutional framework within which a science-policy interface for biodiversity governance could develop.

The IEG debate was triggered by the 2000 Malmö Ministerial Declaration[20] that called to "review the requirements for a greatly strengthened institutional structure for international environmental governance based on an assessment of future needs for an institutional architecture that has the capacity to effectively address wide-ranging environmental threats in a globalising world." Following the 2000 Malmö Ministerial Declaration, the international community adopted in 2002 the Cartagena Package [21] on international environmental governance. The Cartagena Package calls, among other things, for strengthening the science base of UNEP; supporting capacity building, technology transfer and country-level coordination; and improving coordination and coherence between multilateral environmental agreements and across the UN system. At the 2005 World Summit, setting the global policy agenda for a UN system-wide coherence and reform, the world leaders agreed to explore the possibility of a more coherent institutional framework for international environmental governance,[22] including measures towards strengthened scientific knowledge, assessment and cooperation; improved policy advice and guidance; enhanced coordination; better treaty compliance; and better integration of environmental activities in the broader sustainable development framework at the operational level.

These decisions triggered and/or influenced a whole range of interrelated processes and decisions, including the adoption of the Bali Strategic Plan for

Technology Support and Capacity-Building (BSP) [23] in 2005, and the Environment Watch Strategy (EWS) [24] for strengthening the scientific base of UNEP, which has been under discussion since 2002 and of which a revised version was presented at UNEP's 25th Governing Council in 2009. Both the BSP, which aims at more coherent, coordinated and effective delivery of environmental capacity-building and technical support at all levels (UNEP 2005), and the EWS, "designed to achieve enhanced institutional, scientific and technological infrastructures and capacity for cooperation in keeping the state of the environment under review and providing timely, accurate, credible, relevant and consistent environmental data and information" (UNEP 2009d, p. 5), represent significant shifts in paradigm for international environmental governance.

With the Bali Strategic Plan for Technology Support and Capacity-Building the international community agreed to provide for a framework and systematic measures for technological support and capacity building based on national or regional priorities and needs (UNEP 2005). Particularly the capacity of developing countries as well as countries with economies in transition is to be strengthened so they can, among other things, (i) participate fully in the development of coherent international environmental policy, particularly regarding negotiations concerning multilateral environmental agreements; (ii) comply with international agreements and implement their obligations at the national level; and (iii) achieve their environmental goals, targets and objectives, as well as environment-related internationally agreed development goals (UNEP 2005, p. 2). Further, the international community also commits to supporting a number of important capacity-building more specifically addressing science and research, including "the need to strengthen national capacities for data collection, research, analysis, monitoring and integrated environmental assessment; support for assessments of environmental issues of regional and sub-regional importance and for the assessment and early warning of emerging environmental

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20 UNEP 2000 Governing Council decision SS.VI/1, annex
21 UNEP 2002 Governing Council decision SS.VII/1
22 General Assembly resolution 60/1 of September 2005, paragraph 169
23 UNEP, 2005 GC23/6/Add.1
24 UNEP/GC.25/INF/20

issues; support for scientific exchanges and for the establishment of environmental and inter-disciplinary information networks; and promotion of coherent partnership approaches" (UNEP 2005, p. 7).

The Environment Watch Strategy presented by UNEP in 2009 reflects the state of play of UNEP's Science Initiative to strengthen its scientific base that, ongoing since 2002, has passed through several phases including three global multi-stakeholder consultations. [25] It is designed in accordance with and aims to contribute to the implementation of the relevant parts of the BSP, and sets out, among other things, to move toward a structured set of worldwide multi-scaled assessments, leading or supporting the preparation of a set of mutually supportive assessment processes, including periodic global assessments; a dynamic set of thematic environmental assessments; regional and sub-regional environmental assessments; and national and sub-national assessments (UNEP 2009d, p. 10). Also cooperation, coordination and partnerships, in particular through networks at and across national, regional and global levels, are to take a prominent role. It is a declared objective of the proposed EWS to connect national, international, scientific and technical capacities and efforts, to support scientific exchanges, establish environmental and interdisciplinary networks and promote coherent partnerships, linking "incrementally relevant thematic and geographically oriented networks at various levels, including regional, multidisciplinary, thematic and, as appropriate, national environmental information networks and partner institutions, working towards a highly connected system by 2020." [26]

And both, the BSP and the EWS are fundamental elements of UNEP's Medium Term Strategy for 2010-2013 (MTS), [27] which also clearly reflects the evolution of the role and mandate UNEP is undergoing as paradigms of international environmental governance shift, moving away from (while not abandoning) UNEP's traditional mandate (UNEP 2008b). The most important directional shifts are the enhanced efforts towards more coherence, cooperation and integration, the emphasis on implementation of agreed environmental priorities, the stronger focus on regional institutional arrangements and the commitment to better support governments according to their priorities in establishing, implementing and strengthening the necessary processes, institutions, laws, policies and programmes, to achieve sustainable development (UNEP 2008b).

Meanwhile, consultations on the IEG process in more general terms are continuing on a high-level. In 2009, a consultative group set up by UNEP presented a set of options for improving IEG, inter alia on “creating a strong, credible and coherent science base” (UNEP 2009c), which has been identified as one of the core challenge to the current IEG system. The suggestions of this report, which was presented at the 65th session of the UN General Assembly in September 2010, include, among other things, (i) the strengthening of science-policy interfaces in international environmental governance; (ii) supporting national, regional and sub-regional capacities for collecting, analysing and utilising data and information; and (iii) an increased focus on enhancing policy options, particularly at the national and local levels, going beyond only assessing the problems (UNEP 2010, p. 7).

Table 04

Relevant events of the debate on and reform of International Environmental Governance

2000	Malmö Ministerial Declaration calling to review the requirements for a greatly strengthened institutional structure for international environmental governance (UNEP 2000 Governing Council decision SS.VI/1, annex)
2002	Cartagena Package, UNEP GC/GMEF decision SS.VII/1 …
2005	World Summit Outcome, Paragraph 169 -UNGA Informal Consultative Process on the Institutional Framework for UN Environment Work
2002	UNEP’s science initiative to strengthen its scientific base, ongoing since 2002, including three global multi-stakeholder consultations and the latest proposal of an Environment Watch Strategy (UNEP/GC.25/INF/20) presented in 2009
2005	Adoption of the Bali Strategic Plan for Technology Support and Capacity-Building in 2005 (UNEP, 2005 GC23/6/Add.1)
2010	UNEP’s Medium Term Strategy for 2010-2013 (UNEP/GCSS.X/8)
2008	Joint Inspection Unit Report on the Management Review of Environmental Governance in the UN System
2009	Consultative Group set up under UNEP GC decision 25/4 to present a set of options for improving international environmental governance, first meeting in Belgrade, 27-28 June 2009, second meeting 28-29 October 2009, Rome

[25] For more information see www.unep.org/scienceinitiative.
[26] This includes the interlinking of nodes and focal points of existing regional environmental information networks and partner institutions, such as subsidiary scientific bodies of MEAs, as well as the establishment of national networks.
[27] UNEP/GCSS.X/8

3.2 Methodological approach

As stated in the introduction, the aim of this thesis is to contribute to the current debate on how to improve science-policy interfaces for biodiversity and ecosystem services governance by addressing the central questions of '*What are science-policy interfaces and how do they work?*', '*Where and why do current science-policy interfaces in biodiversity and ecosystem services governance fall short or even fail?*', and '*What would need to be done to improve this situation?*'. Interested also in the why and how of decision-making, not just the *what*, *where*, and *when*, I have approached these questions choosing (i) a qualitative research strategy, (ii) a research design that includes an intensive examination of three case studies and the development of a theoretical framework that co-evolved studying the different cases and extensive literature review, and have (iii) employed participant observation and critical discourse analysis as principal research methods.

The theoretical framework has been presented above. The conception of science-policy interfaces as complex, dynamic and socially constructed institutions (comprised of cognitive models, normative structures and behavioural constraints) offers a useful framework to analyse and explain the nature of science-policy interfaces for biodiversity governance in conceptual, normative, and political terms, as well as to explore their shortcomings and feasible measures by which they could be improved. The institutional arrangements currently established to interface science and policy for international biodiversity governance, can arguably be seen in a situation of severe institutional stress. Institutional mismatches have increasingly become visible, shortcomings of the system more and more recognised, and the question of how to (re)form science-policy interfaces has become central to institutional developments needed to improve international biodiversity governance.

The thesis does not argue that that mere fact of improving science-policy interfaces will be enough to stop biodiversity loss, in the presence of strong driving forces such as population growth (until 2050 or so), and a larger and larger human appropriation of net primary production coupled to land use changes. It argues that there is a possibility for institutional architectures at European and particularly at global levels that have the capacity to address wide-ranging threats to biodiversity better than it is the case today, provided that participatory decentralization in science-policy interfaces (in "polycentric networks"), and reliance on the knowledge of multiple stakeholders, become guiding principles.

What follows are three case studies related to three of the political processes established to engage with the necessary institutional reform. As stated above, these cover (i) the use of participation as an important concept in science-policy interfaces in European biodiversity governance; (ii) the role the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) as science-policy interface to the Convention on Biological Diversity (CBD); and (iii) the debate related to the possible establishment of an Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES).

The debate on how to improve the science-policy interface for international biodiversity governance, triggered by the political processes towards the establishment of an Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES), has been the central focus of my research interest, ever since I have attended the International Conference on *Biodiversity and Governance*, January 2005 in Paris, where this process took its course. At that time I was finishing my Master Thesis (on the 'Dimensions of Science-Policy Interfaces'), and this unfolding debate on the needs and options of what was then still called an International Mechanism of Scientific Expertise on Biodiversity (IMoSEB) promised to offer an excellent opportunity to study the 'real life' development of a central institutional arrangement interfacing science and policy for environmental governance.

The case study on the theory and practice of participation in European biodiversity governance, in turn, –triggered by joint research under the 6th Framework Programme funded project on Participatory Approaches in Science and Technology (PATH) and the participation at meetings of the European Platform for Biodiversity Research strategy (EPBRS)– provided good prospects to examine valuable experiences with participatory approaches as one of the key concepts for science-policy interfaces and deliberative democracy at large within arguably one of the environmentally most advanced and progressive polities. This would potentially contribute useful insights on general trends, best practices, gaps and shortcomings and lessons learned, e.g. to the

debate towards the establishment of a European science-policy mechanism, as well as to discussions related to participatory approached in science-policy interfaces for international governance in general.
The case study on the role the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) as science-policy interface to the Convention on Biological Diversity (CBD) was chosen for the following two reasons. On the one hand, SBSTTA's functioning has increasingly come under scrutiny triggering an ongoing discussion within the CBD of how to improve its scientific underpinnings (e.g. CBD 2005). On the other hand, SBSTTA is the official science-policy interface of the CBD, and as such arguably the most central science-policy interface of current international biodiversity governance. As such it would also play an important role in the development of an IPBES, no matter what form such a mechanism would take. Indeed, the relation to or eventual overlaps with SBSTTA have been a central concern of the IPBES debate on (e.g. IMoSEB 2008; CBD 2010). Including SBSTTA as a case study, allowed me to explore the nature of one of the key existing science-policy interfaces and potential links and synergies it could develop with an IPBES.

The main research methods I applied are what Bryman (2008) refers to as 'participant observation' and 'critical discourse analysis'. Discourse analysis, Hajer and Versteeg (2005) note, is the study of 'language-in-use' and can be placed in the interpretative and social constructionist tradition in the social sciences. In trying to make sense of the continuous struggle about meaning, interpretation and implementation, Hajer and Versteeg (2005, p. 176, employing a 'critical' notion of discourse analysis in the sense of Foucault) argue that "discourse analysis has three particular strengths; the capacity to reveal the role of language in politics, to reveal the embeddedness of language in practice, and to illuminate mechanisms and answer 'how questions'." Particularly because discourse analysis is treating institutions not as a dependent variable but tries to explain the mechanisms by which a policy does or does not come about, it provides the means to ask what institutions do and how they work. As such, Hajer and Versteeg (2005, p. 182) contend that discourse analysis "can help to expose how society is shaped by and through discursive interaction." Following Bryman (2008), analysis of particular discursive events is usually carried out according to a three-dimensional framework, including (i) an examination of the actual content, structure and meaning of the text under scrutiny; (ii) an examination of the form of discourse interaction used to communicate meanings and beliefs; and (iii) considerations of the social context in which the discursive event is taking place.

This takes me to the research method of 'participant observation', and as such to the 'fieldwork' of my studies. Bryman (2008, p. 402) refers to participant observation as the immersion of the researcher "in a group for an extended period of time, observing behaviour, listening to what is said in conversations both between others and with the fieldworker, and asking questions", together with the additional gathering of further data through interviews and the collection of documents. Of particular importance to this research method is the kind of role the researcher adopts in relation to the social setting and its members. Bryman (2008, p. 412, drawing on Gans 1968) presents a scheme classifying participant observer roles arrayed on a continuum of degrees of involvement with and detachment from the social settings: (i) A *total participant*, in which the ethnographer is completely involved in a certain situation and has to resume a researcher stance once the situation has unfolded; (ii) a *researcher-participant*, whereby the ethnographer participates in a situation but is only semi-involved, so that he can function fully as a researcher in the course of the situation; and (iii) a *total researcher*, which entails observation without involvement in the situation, as in attendance at a public meeting, when in this role, the researcher does not participate in the flow of events.

Over the course of my research I have employed each of these three roles in various different settings and for different purposes. Already the study on participatory approaches in EU biodiversity governance has considerably been influenced by important insights and experiences I gained from (i) participating actively in meetings of the European Platform for Biodiversity Research strategy (EPBRS), in particular the meeting on 'Attaining the 2010 targets in the European Biodiversity Strategy' held in Killarney, Ireland, in May 2004, (ii) attending the Stakeholders' Conference on Biodiversity and the EU held subsequently in Malahide, Ireland (see Table 1 for historical placement of these events), and (iii) throughout my internship at the Directorate General for Environment of the European Commission from March to August 2006. While the resulting paper, which I have co-authored with Felix Rauschmayer and Sybille van den Hove (presented in Chapter 4), draws to a larger extent on two national case studies presented in existing scientific literature, the conceptual framework of the paper –the three shifts in European biodiversity governance (from a top-down to bottom-up oriented understanding of policy-making; from a disciplinary to a more post-normal understanding of science; and from a conservationist to a more anthropocentric understanding of biodiversity)– is building in part on the participant observation and critical discourse analysis I was able to do at the respective events.

For the study of the role of SBSTTA as science-policy interfaces of the CBD, I was able to attend at and/or participate in a range of key meetings relevant to this debate (see Table 2 for historical placement of these events). It began with an invitation by the Executive Secretary of the CBD (Ahmed Djoghlaf) to attend (observe) the Brainstorming meeting of the past, present and future Chairs of SBSTTA, which was held to further discuss and concretise ways and means to strengthen the scientific underpinnings of the Convention. This was followed by an invitation by Mr. Djoghlaf to visit the Secretariat of the CBD in Montreal (which I did during the month of June 2007) and to participate (as linked to the Secretariat's staff) in the Twelfth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 12, 2-6 July 2007, Paris, France) in order to study the nature of SBSTTA. During my visit at the Secretariat in Montreal, I was able to interview a range of staff members (including Mr. Kalemani Mulongoy, Principal Officer of Scientific, Technical and Technological Matters, and several other members of his team) and to observe the last preparations for SBSTTA 12. At the SBSTTA 12 meeting I was engaged with secretariat-related tasks organising the meeting. Before my time with the CBD Secretariat (June to July 2007), I was also able to attend the European Expert Meeting held in preparation of SBSTTA-12, April 10-14, 2007 on the Isle of Vilm, Germany. At these meetings, members of European national delegations, the European Commission and scientific experts met to discuss the documents that would be addressed at the upcoming SBSTTA meeting. Based on all these opportunities, I was able to study a prominent part of the development of the central documents of the SBSTTA and of the process through which knowledge is officially interfaced with policy-making of the CBD. The insight and experiences gained observing and analysing this set of meetings provided the base of the paper presented in Chapter 5, co-authored with Peter Bridgewater, Sybille van den Hove and Bernd Siebenhüner.

Most of my fieldwork and analysis, however, was dedicated to the debate regarding the possible establishment of an Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES). As already mentioned above, it all began with the attendance of the International Conference on *Biodiversity: Science and Governance*, Jan. 24–28, 2005, Paris, France. Since then I have attended, participated in, and been involved with, a large range of relevant activities and events regarding the IPBES (former IMoSEB) debate (see Table 3 for historical placement of these events). These include: (i) several smaller European Commission-level meetings following the First International Steering Committee of the IMoSEB consultations (Feb. 21–22, 2006, Paris, France), which I was able to attend being an intern to the European Commission at that time; (ii) the Workshop on International Science-Policy Interfaces for Biodiversity Governance - Needs, Challenges, Experience (Oct. 2-4, 2006, Leipzig, Germany), which was organised by UfZ, UAB and European Commission as a contribution to the IMoSEB Consultative Process (first during my time as intern to the European Commission and then as research fellow at the UAB, I had an instrumental role in organising and facilitating this workshop). The main outcome, the 'Leipzig Workshop Recommendations for a Knowledge-Policy Interface for Biodiversity Governance' (also presented in the Appendix to this thesis), has been taken up by the IMoSEB Consultative Process (IMoSEB 2008); (iii) participation in the European Regional Consultation on IMoSEB, held April 26-28 2007 in Geneva, Switzerland; (iv) an invitation to attend (observe) the Final International Steering Committee of the IMoSEB consultations (November 15–17 2007 in Montpellier, France); and (v) the participation in and contribution to the facilitation of the Workshop on a 'Network of Knowledge on Biodiversity', organised by the EPBRS in April 2009, Brussels, Belgium.

Of particular influence was my time as consultant at UNEP's World Conservation Monitoring Centre (UNEP-WCMC), which contracted me to support the preparation of a study that was commission by UNEP as a response to the first IPBES meeting hosted by UNEP in November 2008 in Putrajaya, Malaysia. This so-called Gap Analysis (UNEP, 2009a), which was lead-authored by Jerry Harrison (UNEP-WCMC) and myself, was to analyse existing gaps in the science-policy interface of biodiversity governance for the purpose of facilitating the discussions at the following IPBES meetings. The Gap Analysis is based on a range of comments that were made on a preliminary gap analysis, on further review of scientific literature, policy reports, institutional research, and on consultations with stakeholders familiar with the different processes and mecha-

[28] A total of 739 comments on the preliminary gap analysis (UNEP/GC.25/INF/30) were received from 54 different submissions, 21 from Governments (including the EC), six from IGOs, 12 from universities and research institutes (often individuals) and 15 from civil society organizations. A number of the comments received related to the potential outcomes rather than the gap analysis itself, but otherwise the comments were addressed as far as possible.
A copy of the comments received can be found on www.ipbes.net.)

nisms under review. The Gap Analysis is included in the appendix to this thesis (although without its over 80 pages long Annex) as it contributed to its development and is also one of the key practical application of my research.

Additionally to this set of participant observations, I conducted a range of interviews, among others with Michel Loreau (then still Chair of Diversitas and Chair of the IMoSEB process), Thomas Rosswall (then still Director of the International Council of Scientific Unions ICSU), Ivar Baste (Director of UNEP's Environmental Management Group EMG and initiator of UNEP's 'Science Initiative'), Horst Korn (Federal Agency for Nature Conservation and Member of the IMoSEB Steering Committee), José Sarukhan (former Rector of the Universidad Nacional Autónoma de México and Member of the IMoSEB Steering Committee), and several members of the European Commission (including Martin Sharman, Stefan Leiner and Jörg Roos).

Further, additional to a very broad academic literature review, I collected and studied all relevant documents with regard to the IMoSEB process, the Millennium Ecosystem Assessment Follow-up initiative, and the IPBES meetings. Sources have been in particular the respective websites of these processes (www.imoseb.net and www.ipbes.net), and the reports issued by the Environmental News Bulletin (ENB) by the International Institute on Sustainable Development that provide news, information and analysis on international environment and sustainable development negotiations and policy making (www.iisd.ca).

Taking all together, this fieldwork and the collection of interviews and documents provided me with a considerable overview of the nature, contents and development of the debate on how to improve the science-policy interface for biodiversity governance. The third paper (Chapter 6), co-authored with Katharine Farrell and Peter Bridgewater, is based on this research.

Participation in EU biodiversity governance: How far beyond rhetoric?

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Environment and Planning C: Government and Policy 2009, volume 27, pages 42-58

4.1 Introduction

In this paper we look at how participation has been theorised and practised in the context of the European Union's multilevel governance of biodiversity. We define participatory approaches as institutional settings where the public and/or stakeholders of different types are brought together to participate more or less directly, and more or less formally, in some stage of the decision-making process. Stakeholders are deemed to be of different types if, for a given issue, they hold different worldviews, and act on the basis of different rationales. Hence, participation refers to the implication in the decision-making process of persons external to the formal politico-administrative circle (van den Hove 2006).

Governance is, in one of its most renowned definitions, "the sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse interests may be accommodated and co-operative action may be taken. It includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interest" (Commission on Global Governance 1995, p. 2).

In this paper we start from two normative stances: first, participatory processes have the potential to lead to more effective governance, and, second, participatory processes must allow for the articulation and integration of different types of knowledges.

Over the years participation has emerged as one of the key principles of governance. In the case of environmental governance the normative stance towards participation, and hence towards what Marks and Hooghe (2004) call type-2 governance, finds a justification in the characteristics of environmental issues and the ensuing problem- solving requirements (Engelen et al. 2008). Environmental issues are typically characterised by physical and social complexity, uncertainty, large temporal and spatial scales, and irreversibility. This calls for dynamic decision-making processes of capacity building, aiming at innovative, flexible, and adjustable answers allowing for progressive integration of information as it becomes available, and for the articulation and integration of different knowledges, value judgments, and logics while involving various actors from different backgrounds and levels. Additionally, these processes should allow going beyond traditional politics and coordination across different policy areas and levels, while providing for more democratic practices. We have shown elsewhere that participatory processes have the potential to answer these problem-solving requirements [see van den Hove (2000) for a more detailed analysis]. As for the roles of participation in governance processes, they are multiple and may (at least in principle) correspond to a wide range of objectives such as, for example, decisions that are more efficient, time-effective or cost-effective, informed, acceptable, legitimate, fair, competent, and/or democratic (e.g. Dryzek 1990; Renn et al. 1995; van de Hove 2003; Wittmer et al. 2006). In this paper we will not analyse whether this normative stance is justified, but will look at its translation into the practice of biodiversity governance in Europe.

The institutionalisation of governance does indeed encompass a general normative stance towards participation – for example, in Principle 10 of the Rio Declaration, the EC white paper on European governance, or the Aarhus Convention. Underlying this normative stance is the assumption that more participation necessarily leads to better governance. As the German case study will illustrate, if participation has the potential to improve governance, the way that participation is taking place will ultimately dictate whether this potential is realised. Participation in some cases can indeed be inefficient, counterproductive, undemocratic, or a mere camouflage for voicing narrow self-interests.

Our second normative stance stems from the recognition that, in an uncertain and indeterminate world, scientific knowledge is not the only type of knowledge that is relevant to policy. Other types of knowledge – local, indigenous, political, moral, and institutional – also need to be included (e.g. Ellis and Waterton 2005; Faber and Manstetten 2003; Goerg et al. 2007; van den Hove 2007; Wynne 1992), which are not evident (Grove-White et al. 2007). Participation offers an obvious means for the articulation and inclusion of such knowledge types and we posit that this is a necessary requirement for participatory processes addressing complex issues as it could improve the participatory nature of the process as well as lead to better and more legitimate choices (Rauschmayer and Wittmer 2006).

As stressed by Jessop (2002), "the expansion of governance practices in many different spheres represents a secular response to a dramatic intensification of societal complexity" (p. 2), but it can also be linked to an intensified complexity of policy issues. The field of biodiversity conservation and use is a case in hand of biophysical and societal complexity and, as such, it has also been subject to this expansion of governance.

Biodiversity is primarily described in terms of its biophysical dimension as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (CBD 1992, article 2). This variability can be understood as the dynamic outcome of evolutionary processes involving complex interactions between biological, physical, and chemical processes over time spans going from fractions of seconds to millions of years and taking place in a web of interrelations ranging from microscopic to planetary scales. However, the biophysical dimension is not the only relevant dimension by which biodiversity is characterised. Social and technological systems now influence many of the natural processes of the biogeochemical environment, hence creating socio-ecological systems (Young et al. 2006), which encompass a large cultural and biological diversity.

Biodiversity has a strong local dimension (Redford and Brosius 2006), not only through its immediate perception by human beings but also through the changes of ecosystem services related to its decline. So far, human-nature interactions at the local level are still seen as the major direct causes of biodiversity loss (MA 2003, p. 120-121). The focus on the local scale is not sufficient, though, as many of those local interactions are caused by trends and interactions at higher levels. Local and global processes are deeply intertwined: what happens at one scale is not only connected to other scales (e.g. the influence of global markets on local land-use change for agriculture), but is to some degree itself part of processes at other scales [e.g. national governments agree to global treaties, global agreements enforce or weaken the rights of local actors, local resource-use decisions result in global climate change, national law stimulates or resolves local conflicts (Goerg and Rauschmayer 2009)]. Additionally, global climate-change effects on biodiversity are quickly rising to the top position amongst anthropogenic drivers of biodiversity loss (Thomas et al. 2004).

On the response side, ever since the community of concerned scientists has framed the problem as a major threat to nature and ultimately also to society, and has managed to bring the issues on the political agendas at all levels [Takacs (1996); Ungar (2003), see Loreau et al. (2006) for a recent example], a complex multilayered network of actors, institutions, and interactions has developed to address the conservation and sustainable use of biodiversity (Escobar 1998). Hence, both drivers of biodiversity loss and response mechanisms are of an inherently global dimension and are at the same time deeply rooted in the local context. Such complexity places the issue in a multilevel governance framework, crossing local and global dimensions of both the issue at hand and the institutions addressing it. This multilevel framework appears as a necessity for at least two reasons. First, the fact that biodiversity has a strong local dimension does not imply that the local level of governance is the only important one. On the contrary, it may well be that the local level lacks the capacity (or will) to act in a strategic way to protect and sustainably use biodiversity. Second, and at the opposite end of the governance spectrum, the global level cannot devise and implement strategic orientation of biodiversity policy without the unique knowledges held at the local level.

EU biodiversity policy provides a good cause for studying participation in a context of multilevel governance for two main reasons. First, EU biodiversity policy development reaches back as far as the 1970s and has been – and remains – highly controversial. As such, it provides a broad range of positive as well as negative examples related to theory and practice of participatory approaches. Second, EU environmental policies, and in particular biodiversity policies, mirror the wider EU evolution towards a multilevel polity and the inherent contradictions accompanying this evolution: “These contradictions include the maintenance of unity in diversity, the competition between national priorities and supranational imperatives, and the distribution of power between actors at different spatial levels of government" (Jordan 2002, p. 321). Moreover, the European Union remains the most established example of a multilevel governance system that is institutionalised.

To explore the theory and practice of participation in this multilevel governance framework we focus mainly on the political scale [29] rather than on the many other scales that are also relevant to the question of participation (e.g. power, formality, space, time). We hope to contribute to the exploration of the linkages between sustainability governance, participatory approaches, and postnormal science.

Three main conclusions emerged from our analysis of case studies: the need to take historical developments into account; the context-specific nature of participatory approaches; and the slow translation into practice of the three major rhetorical shifts in biodiversity governance that we used as guiding threads in our exploration. These shifts are presented in the following section.

4.2 Three shifts in EU biodiversity governance

Participation has been present to some degree in European biodiversity policy since the 1970s. However, the ways in which`participation' has been theorised and put into practice have changed considerably over the years.

Among the many intertwined trends and processes taking place in multilevel biodiversity governance we identified three major shifts of particular relevance to our analysis as they all potentially lead to intensifying participatory processes. The first shift corresponds to the progressive change of policy-making processes in general – and environmental-policy processes in particular – from a top-down state-centred strictly administrative understanding of policy making towards more flexible, and to some degree bottom-up, approaches (Buller, 2004). This first shift has the potential to increase participation by opening up the policy process to other actors, moving towards more local-level participation and/or more public participation.

29 A scale is a spatial, temporal, quantitative, or analytical dimension used to describe a phenomenon (Gibson et al. 2000).

The second shift relates to the changing role and perception of science. In the early phases of environmental politics, under the dominance of the technocratic expert model, science has been regarded as the unchallenged provider of knowledge both on issues and on potential solutions. There is now an increased recognition of the need to move towards a more democratic,`postnormal', type of science which leads to an enlargement of the peer community for quality assurance as well as for an extension of facts, and which "encompasses the management of irreducible uncertainties in knowledge and in ethics and the recognition of different legitimate perspectives and ways of knowing" (Funtowicz and Ravetz 1993, p. 754). Postnormal science brings to the forefront the recognition that facts are debatable in an uncertain world. This shift implies a move towards more participation in both the provision of knowledge and the assessment of knowledge quality (including its relevance, legitimacy, and credibility – that is, participation in the very debate about facts. It also implies a move towards taking different types of knowledges, `ways of knowing', and knowledge holders into account.

The third shift is more specific to biodiversity and perhaps less obvious than the previous shifts. It corresponds to a shift from a conservation focus in biodiversity discourses and policies towards a more anthropocentric and utilitarian ecosystems goods-and-services approach framed in a general normative context of sustainability. It reflects a change in perception of the issue itself. While at first, policy measures were driven by a merely protectionist rationality, there has been a gradual change towards a combination of biodiversity conservation and its sustainable use. This shift is documented in the Convention on Biological Diversity (CBD), and is even more accentuated in the Malawi principles, guiding the implementation of the ecosystem approach (CBD 1998). An important and more recent example of this shift is the Millennium Ecosystem Assessment, an exercise to assess the status and trends of ecosystems, but more particularly of ecosystem services. More than 1300 actors on global and subglobal scales agreed on this utilitarian approach, focusing on the changes in ecosystem services used for human well-being (Millennium Ecosystem Assessment, 2005). This is in effect a shift from a monodimensional (conservation- based) to a multidimensional (conservation and sustainable use) framing of the issue. Hence, it may be regarded as a shift towards taking into account different value systems (relating for example to environmental, economic, social, and cultural dimensions of ecosystems). Participatory processes have the potential to allow for articulation of different value systems (van den Hove 2000); hence, this shift may induce more participatory approaches. For instance, the ecosystem approach as defined by the CBD includes provisions for broad participation of all stakeholders (CBD Conference of the Parties Decisions V/6). While this third shift is becoming obvious at least in the discourses on, and general argumentation in favour of, bio- diversity conservation (see, for example, Costanza 2006; Reid et al. 2000), it is still unclear to what extent such shift actually takes place in policy practices.

We stressed that each of these shifts could potentially lead to more participation. But it is important to note that the influence can go both ways, as more participation may actually act as a driver for such shifts, hence creating positive feedback loops. More participation may imply a shift towards more bottom-up decision processes – it can lead to more postnormal types of scientific activity as it may bring about the inclusion of a broader range of perspectives in the scientific production and quality assurance process (van den Hove 2007), and it can constitute an incentive for framing issues in more than one dimension.

In our study we use these three shifts as guiding threads to explore changes in the theory and practice of participatory approaches in biodiversity politics. We analyse EU biodiversity governance and its evolution to identify whether and how these shifts have taken or are taking place and what that implies for participatory decision processes. While doing this, we pay particular attention to the political levels (ie local, national, European) and the phases of the policy processes under consideration. The argument focuses on the Birds and Habitats directives and the corresponding Natura 2000 process and on the implementation of these directives at national or subnational levels in France and Germany, although other elements of EU biodiversity policy are also briefly addressed to put the Natura 2000 process into context.We look at subnational levels to gain evidence on the existence of the shifts, and not with the intention to address the question of the Europeanisation of national biodiversity policies (Jordan and Liefferink 2004). The main questions explored are: (i) Did these shifts happen in practice in EU biodiversity governance? (ii) Did participation emerge as a`necessary' process as a result of these shifts? (iii) To what extent did participation itself lead to these shifts? (iv) If participatory approaches were indeed implemented, what were the successes and failures and what were the reasons for them?

4.3
Participation in European biodiversity policy

4.3.1
Early 1970s to 1979 – framing of the Birds Directive

The policy development that led to what is now the Natura 2000 network took up momentum as the result of organised public concerns regarding the killing of migratory birds about thirty years ago. A campaign, directed in particular by Dutch and German citizens [more on that campaign in Gammell (1987)], influenced policy makers at the European level, eventually leading to the adoption of the first Environmental Action Programme in 1973, which contained broad reference to biodiversity issues (Fairbrass and Jordan 2001a). In the following years the European Parliament received petitions from various interest groups, and tabled questions, the Commission conducted studies, consulted national wildlife experts, and reminded the member states of their commitments under international conventions, while several member states quarrelled over an expansion of the EU's competencies into habitat and bird protection, questioning the political and legal basis of the Community action in this area (Baker 2003; Fairbrass and Jordan 2001b). The outcome of that period has been the adoption of the Birds Directive in April 1979 (European Community 1979).

This legislation addresses the conservation of all species of naturally occurring birds in the wild state in the European territory of the member states: "It covers the protection, management and control of these species and lays down rules for their exploitation" [European Community 1979, p. 4, Article 1, SPA (1)], and applies "to birds, their eggs, nests and habitats" [p. 4, Article 1(2)]. Primarily, however, conservation measures focus on the establishment of special protection areas and their management in accordance with the ecological needs of birds.

During the period leading up to the establishment of the Birds Directive in 1979, participation in the decision-making process took place only in the form of consultation of national scientific experts. Although the emergence of the issue on the agenda was to a certain extent bottom up, as it was the result of nongovernmental organisation (NGO) and public pressure, the subsequent policy process was very much a top-down, expertise-driven, species-based, conservation-oriented process.

4.3.2
Early 1980s to 1992 – framing of the Habitats Directive

As in the case of the Birds Directive, the processes leading up to the adoption of the Habitats Directive can be seen as mix of a variety of interactions of a broad range of policy actors. In this case, around ten years after the Birds Directive had been adopted, it was particularly the "active campaigning of conservation groups (for example, the RSPB [Royal Society for the Protection of Birds], the WWF [World Wildlife Fund] and the Mammal Society) and support from certain leading Members of the European Parliament" (Fairbrass and Jordan 2001a, p. 512; more details in Dixon 1998; Sharp 1998) that initiated and sustained policy action.

The formulation and negotiation of this legislation were partly dominated by issues of national autonomy versus the European competencies of the EC, which had been expanded considerably under the Birds Directive and had proven to interfere with national development plans (Fairbrass and Jordan 2001b).

After several years of negotiation, the Habitats Directive (European Community 1992) was adopted in June 1992. With the aim`to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States" [European Community 1992, Article 2(1)], the Habitats Directive calls for "a coherent European ecological network of special areas of conservation [to] be set up under the title Natura 2000. This network [shall be] composed of sites hosting the natural habitat types listed in Annex I and habitats of the species listed in Annex II ... [and] the special protection areas classified by the Member States pursuant to Directive 79/409/EEC [Birds Directive]" [European Community 1992, Article 3(1)].

In contrast to the Birds Directive, the Habitats Directive makes explicit reference to sustainable development and socioeconomic aspects. In particular the preamble states that: "the main aim of the Directive being to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements, this Directive makes a contribution to the general objective of sustainable development" (European Community 1992), and that "the maintenance of such biodiversity may in certain cases require the maintenance, or indeed the encouragement of human activities" (European Community 1992).

Back in 1992 (the year of the Rio Conference), referring to sustainable development in regulatory texts was still an exception. The CBD for instance makes only limited reference to sustainable development per se, but rather focuses intensively on sustainable uses, a powerful illustration of the shift from purely conservationist to sustainable-uses rhetoric. In contrast, and notwithstanding the explicit reference to sustainable development, sustainable use is not so straightforwardly at the centre of the Habitats Directive. Nevertheless, socioeconomic aspects are given a significant place, in particular in Article 2, which states that: "measures taken pursuant to this Directive shall take account of economic, social and cultural requirements and regional and local characteristics" [European Community 1992, Article 2(3)].

Article 6 states that "for imperative reasons of overriding public interest, including those of a social or economic nature" [Article 6(4)], development plans may be carried out, but "the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected" [Article 6(4)]. Hence, the Directive opens the door to a precedence of the economic`imperatives' over ecological ones. One may identify preliminary signs of a change of concept, away from pure conservation but not so obviously towards sustainable uses. [30]

As in the case of the Birds Directive, participation while drafting the Habitats Directive was limited to the phase of putting the issue on the agenda, in the form of NGO and public pressure. The public and stakeholders had a limited influence on the definition of fundamental principles of the legislation and on its design.

Overall, both the Habitats Directive and the Birds Directive are based on ecological criteria and reflect a general`top-down' administrative, expert-based, and protectionist approach. The directives represent a considerable broadening of the competencies of the European Union in the field of environmental policy, extending its influence onto regional and local conservation policy. As such, there is little evidence of a shift towards bottom-up postnormal, science, or an ecosystems approach at the time of the design of the Birds and the Habitats directives which still very much build on a rather monocriterial, conservation-oriented, framing of biodiversity governance.

4.3.3
National-level designation of Natura 2000 sites

EU directives are by definition binding as to the results to be achieved by member states, but leave to the national authorities the choice of form and methods [see Article 249 of the treaty establishing the European Community (European Community 2002)]. Apart from the clear conservation criteria that determine the selection of sites, neither the Birds Directive nor the Habitats Directive provides guidance for the procedure of site designation and their management. In principle, in accordance with the subsidiarity principle of the European Union, it is up to member states to decide whether public and/or stakeholder participation is appropriate in the designation and site-management processes. In practice, the aim of defining at least 10% of each national territory as sites within the Natura 2000 network, combined with the focus on ecologically motivated site-selection criteria and an initially tight time schedule, left little room for participation of stakeholders other than scientific experts during the designation phase. From that phase on, recurrent conflicts have emerged between landowners, users and their representatives, conservation administration, and environmental NGOs. These conflicts run through all levels of the politicoadministrative system and have considerably delayed the designation of sites (Sauer et al. 2005), hence delaying the initial schedule.

For the purposes of this paper we addressed the sub-European levels by looking at two case studies, France and Germany, to explore if and how the three governance shifts materialise at the national and subnational implementation level and look at the implications for participation.

4.3.4
France: more bottom up, more dimensions

In their study on the designation process, Pinton et al. (2005) (see also Alphandéry and Fortier 2001) differentiate between three phases in the creation

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30 Interestingly, although the Habitats Directive is in principle more powerfully legally binding than the Birds Directive, from a purely environmental perspective it is also weaker than the Birds Directive because of the commitment of the Habitats Directive to `economic, social, cultural, and regional requirements'.

of the Natura 2000 network in France: (a) the scientific construction and its social contestation; (b) the consensual validation of the inventory; and (c) the elaboration of a site-specific objectives document.

(a) In January 1993 the French environmental ministry started the inventory of habitats suitable for the Natura 2000 network and – in accordance with the spirit of the directive – gave this task to scientists. The transscale activity – deciding about local sites, grouped in biogeographical zones (France is home to four of these zones) according to a nationally decided procedure following a European directive – proved to create a high level of conflicts. These conflicts were aggravated by the fact that site selection was to be done according to biological criteria, whereas the economic, social, and legal consequences of the designation were unclear since their consideration was not supposed to enter the selection process. For Pinton (2008), this first phase "was based on the belief in a radical separation between science and action. Scientific knowledge was seen as stable and considered independently of action, in order to then be translated into public action" (p. 224).

In 1996 the final biological inventory listed 1316 sites corresponding to 13% of the French territory. In 1994 the national-level hunting and agriculture stakeholders had started from a rather positive attitude towards the launching of the inventory through accompanying statements in the first two Natura 2000 information letters edited by the French environmental ministry. Subsequently, the unclear consequences, the disputable scientific basis of the selection and site delimitation, and the nonparticipation of local and regional-level stakeholders in the selection process, led to a high level of protest, which started from actors at the local and subnational levels. The government reacted with an invalidation of the inventory and froze the site-selection process.

(b) In 1997 the ministry of environment sent a list of 534 sites (1.6% of the territory) to the European Commission sites which were believed to pose no problems. Nevertheless, the Conseil d'État, the highest French court, invalidated this list because of the lack of consultations with property owners, which were a necessary part of the original selection procedure. In 1999 the ministry asked the regional authorities (prefects of the ninety-six French departments on European territory) to classify the sites according to their social acceptability, and sent another list of 534 sites to the EC. [31] The prefects were asked to organise consultation processes including the mayors and deputies at the department level (conseil regional). As in the implementation of the Water Framework Directive, the regional tier to the management of natural resources was herewith strengthened (Buller 1996).

Pinton et al. (2005) show that the scientific legitimacy, which was the basis for the first extensive list, was far from being recognised by those stakeholders who are users of nature, especially at the subnational level. The subsequent deliberation process led to the selection of a relatively low number of sites with a high regional disparity within France, but these sites have been agreed on by the stakeholders. Contrary to the selection process in most other EU member states, the concertation process in France prepared the management plans to be elaborated in the next phase.

(c) In 1998 a new methodological guide for creating site-specific`objectives documents' (̔documents d'objectifs') was presented. The objectives document is in between a statutory document for the creation of the site and the management plan asked for by the directive in a later stage of the Natura 2000 process. The document describes the status of the site and defines the appropriate means for preserving or orienting it. The approach is based on concertation and pragmatic consideration of local situations, aiming at a contractual management of the site (Valentin-Smith 1998). This guide has been elaborated based on thirty-seven pilot sites, and constitutes a decentralised concept for applying the directive. The elaboration is under the responsibility of the department prefects, hence is at a subnational level. National, departmental, and local authorities, mayors, hunting, agriculture, forestry, sport or tourism associations, environmental NGOs, etc, cooperate in steering committees of variable size (from eight to more than one hundred members) (Pinton et al. 2005, p. 104-105). Environmental NGOs are weakly represented and participation of scientists at this stage of the process turned out to be very limited (Pinton 2008, p. 221; Pinton et al. 2005, p. 110 and 192). Slowly, the list of sites evolved and stabilised at around 1200 sites by the end of 2003, representing 7.6% of the territory, and as such far below the 10% asked for by the European legislation. Today, though, the percentage of French territory occupied by Natura 2000 sites is at 11.83%, and is very close to the EU mean.

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31 Nevertheless, France was convicted in the same year by the European High Court of Justice for not implementing Article 6 of the directive – that is, the article dealing with the establishment of conservation measures and management plans.

Pinton et al. (2005, p. 192) stress the shift in French nature policy achieved through consensual,[32] on-site, debates: stakeholder-specific knowledges have been asked for and used by other stakeholders, and the steering committees genuinely tried to strike a balance between the objectives of production or leisure and the objectives of nature conservation. According to Pinton (2008, p. 216), the phase involving the creation of objectives documents "mobilized different knowledge registers in order to associate them within the definition of management measures. This approach closely links cognitive and deliberative activities, which implies identifying how and on what basis exchanges are established and agreements reached, and beyond that, to question the nature and the scope of such agreements" (p. 216). A remaining open question is that of the continuation of the participatory process over time, or, in Pinton's terms, "does it generate new configurations that are seen as essential to a biodiversity conservation policy?" (p. 225).

Analysing this case study in terms of the three shifts we can see that the conflicts during the first phase emerged from the fact that the process was very much top down and expert centred. The preparation of the inventory was left in the hands of scientists alone under a top-down process led by the ministry of the environment, but this approach and the scientific basis of the selection were promptly contested by local actors and conflicts emerged. While this demand for territorialisation of a policy based on undifferentiated environmental criteria can be considered typical for French environmental policy (Buller 2004), the shift towards a more bottom-up participatory approach for both site selection and design of management plans is at odds with the strong political verticality of French administration.We interpret this as a case where participation itself is a driver behind a shift towards approaches that are less top down.

An interesting point here is that it seems that the increased participation of stake- holders at different levels resulted in a strong decline of scientific participation. Although the intention seems to have been different, scientists' participation in the process leading to the objectives documents was very limited. Hence, one cannot conclude that this led to a more postnormal-science approach but rather to an exclusion of science. There seems to have been a clash between two sources of legitimacy, science and public participation, and the resulting process did not manage to reconcile them. One possible explanation for this is that, whereas it was probably more the process legitimacy that was contestable [ie leaving everything in the hands of scientists in a nontransparent way, separating science and action, using data sources which were limited and disconnected from the field (Pinton 2008)], it crystallised as a contestation of the legitimacy of science itself, which made it more difficult to include scientists as one legitimate category of actors in the following developments. Another factor at play was that scientific expertise was brought into the process in a way that de facto excluded or weakened other types of knowledges to be considered and weakened the legitimacy of the whole process. A lesson can be learned here about the difficulty of designing participatory processes which genuinely allow for all different types of knowledges to be brought in, including scientific knowledge. As for the shift from a monodimensional conservation approach towards more pluridimensional framings in terms of conservation and sustainable uses, this case again indicates that it is the conflicts at the local level which forced more participatory methods and, through them, a better recognition of multiple dimensions of the biodiversity issue (cultural, social, economic, environmental).

The challenge posed by multilevel governance of biodiversity is well illustrated by the questions asked by Pinton (2008): "How can a European system of reference for nature conservation tie in with local cultures? And how can a spatial policy that defines objectives at the European level, be translated into a regional policy based on the local use of nature?" (p. 210). We see a tension between larger level spatial policies and lower level (local-level) culture and uses. In the French case this tension is addressed by increasing local-level participation. However, Pinton notes that the rules governing this participation remain in the hands of central authorities. In the light of our three shifts this means that the shift from bottom up to top down did not apply to rules of procedure.

Finally, the French case illustrates the importance of participation of stakeholders at different stages of the policy process. If the emergence of the issue on the agenda was to a certain extent participatory, the drafting and adoption of the directive was not. Then, during the implementation phases at national level, French stakeholders insisted on having "a say at every stage of the procedure and not just at the final stage (the implementation of management measures)" (Pinton 2008, p. 211-212).

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[32] Note that the use of the consensus model has serious flaws (van den Hove 2006), but seems to be an enduring theme with scholars discussing participation.

4.3.5
Germany: little formal, but effective informal, participation?

In Germany, nature conservation is primarily a field of competence of the federal states (the laender) – the national level has the right to set a frame, and is responsible for the implementation of European legal norms in Germany. The consultation and participation processes at the designation phase were organised very differently by the different laender and are therefore very difficult to summarise. The laender approaches ranged from uncoordinated participation of some groups, to standardised procedures to which all interested citizens had the possibility to contribute [for example, in Bavaria (Weber and Christophersen (2002)]. However, they all shared the tension between the relatively strict rules of the directives, leaving little room and time flexibility for implementing participation, and the intention to involve a range of actors, which is a typical feature of nature-conservation agencies in Germany.

The nature agencies at laender level were responsible for putting together their lists of designated sites, and did so without much consultation of lower level agencies (typically the district level). This top-down approach is inconsistent with the traditional proceeding within this administration. Traditionally, nature-conservation agencies at lower levels are in charge of the designation of nature-protection sites and are the main partner for dialogue with local actors. In the Natura 2000 designation process, though, lower level nature-conservation agencies were rarely involved and had to say. Similarly, land-use agencies (agriculture, forestry, etc) had little or no influence on the designation of sites. This procedure is in contradiction with the trend within the German planning-system tradition to use informational instruments such as communication, participation, and cooperation (Sauer et al. 2005, p. 13). The German scientific council for environmental issues (Sachverstaendigenrat fuer Umweltfragen SRU) also suggested the establishment of continuous participatory processes in procedures of spatial planning (SRU 1998), and reinforced this in its advice on nature protection (SRU 2002).

In contrast to what eventually happened in the French case, German laender governments, which are responsible for nature conservation, mostly provided neither means nor particular attention to involve local stakeholders in the selection process. Subsidies, which in general can be used for achieving the aims of the Habitats Directive, could not be used for enhancing participatory processes, and their use mostly was, and still is, restricted towards direct conservation measures on the ground (Suda et al. 2005). The implementation practice showed that, especially at the local level, no additional funding was mobilised to finance additional participatory activities (p. 29–30).

As an exception, Bavaria proposed for its last declaration of Natura 2000 sites in 2004, after a first online consultation of land owners, communes, and concerned citizens in 2003, a six-week period where citizens, organisations, and local authorities had the right to enounce objections to specific sites (Schreiber 2005). More than 16000 objections were raised and in another six-week period were analysed and evaluated by the nature-conservation agency. This led to a reduction of approximately 1% of the area to be declared to the European Commission (BUGV 2006). Local actors had neither official position nor task in the designation phase: their role was restricted to posing comments and the provision of their nature-specific knowledge. The process put in place in Bavaria, although a bit more open than in other laender, was a one-way consultation process rather than a genuine participatory process where a dialogue takes place between actors. During the management phase, however, the participation of local actors is supposed to be central.

According to Sauer et al. (2005), the time necessary for consultation in site-selection processes in Germany was often underestimated and was badly selected so that many actors could not participate (in times of summer vacations or during the harvest period). For these authors, representatives of nature-conservation agencies at all levels showed an ambivalent behaviour towards participatory approaches. Torn between the search for consensus and their perception to be the only competent representatives for the`needs' of the Natura 2000 sites, they often conceptualised participatory approaches in such a way that those had very limited potential to influence the results or the procedure (Sauer et al. 2005, p. 54). As a consequence, trust in the (powerless) local administration, the habitual communication partner in nature conservation site issues, was lost.

As Sauer et al. (2005) showed, participants were disappointed by the fact that they had no influence on the designation and named the process`fake participation'. Encouraged by official announcement using rhetoric such as`consensus',`mutual', and`in agreement with the affected', they had come to believe that they would be able to make a difference. But it turned out that the administration had invited them more to inform them or to use their local knowledge to update the administrations' knowledge regarding the sites. Hence, participation was used rather to gain information than to account for different values. Participants also showed`participation fatigue' as they had experienced little influence of their participation to several former participatory approaches in similar contexts (Sauer et al. 2005). Consequently, actors have asked for a more influential participation in the decision-making processes. In general, the German experience shows that participatory approaches conducted half-heartedly or in the wrong situation might cause conflict and refutation of the entire process. Sauer et al. (2005) have also noticed a reluctance of stakeholder to participate, for fear of losing their influence once participating. In this sense,`bad' participation processes, or mere one-way consultation processes presented as participation, might create even more conflicts. Whereas in the French case the lack of participation led to conflicts which induced more participation, in the German case`bad' participation led to conflicts associated with disillusions regarding participation, hence less direct impetus for opening up the decision-making process.

Nature conservation NGOs have not been involved officially in the process of site selection (Frischmuth and Mayr 2003, p. 12). They were supposed only to be involved in the participatory process planned for the design and implementation of the management plans, but they nevertheless`participated' in the earlier phase by creating`shadow lists' of suitable habitats to be included in the national lists sent to the EC (Mayr and Frischmuth 2003, p. 18; Weber and Christophersen 2002). Already in 1989 the Commission had asked nature-conservation NGOs for a list of`important bird areas'. A list updated by these NGOs served as background material for a complaint by the EC against Germany in 2001 due to the slow implementation of the directive. German NGOs also elaborated lists for the other sites of the Natura 2000 network, and discussed these with the EC administration, which accepted these shadow lists as background material for the verification of the officially listed sites (Mayr and Frischmuth 2003, p. 19). Hereby, the environmental NGOs circumvented the practically nonparticipatory laender and national policies and bypassed laender and federal levels to reach directly the European level (Weber and Christophersen 2002). Weber and Christophersen question as well whether this direct participation of environmental NGOs would not impact on the perceived legitimacy of the list of Natura 2000 sites by other stakeholders, such as forest owners and farmers.

This process is an indicator for the changing use of scientific knowledge. Nature-conservation NGOs in Germany very often have very close links to academic nature-conservation biologists, and often possess good scientific knowledge (at least at the laender or national level). They used this scientific knowledge to generate the shadow lists.

For both official and shadow lists, there exist considerable gaps in the knowledge about the sets of habitats and species of designated sites because of missing financial resources and the initially tight time schedule imposed by the EU process.[33] They are either incomplete or depend on old datasets or knowledge provided by third parties (private citizens, NGOs, etc), and, consequently, local actors often doubt their quality (Sauer et al. 2005, p. 31). Furthermore, inconsistencies with regard to the borders of sites (eg along administrative borders dividing fields and lakes) are perceived by affected local actors as`arbitrary' and unjust. This situation is similar to the French case where it is clear that old and inappropriate data without acknowledgement of local on-site knowledge also created doubts about the credibility and the scientific legitimacy of the designation procedure. The shift observed in France to more bottom- up participation and the linking of site selection to the elaboration of management plans has only been met in a few, very well-funded, cases in Germany (Suda et al. 2005). The coming years will show whether the German laender can compensate for this lack of participation when building up the management plans (also Wendler and Jessel 2004).

33 This time pressure must also be understood in the framework of a precautionary approach whereby if the EU had given member states unlimited time for implementing the directives it is likely that some member states would have delayed any action on the grounds that knowledge is incomplete. The often irreversible nature of biodiversity and habitat losses justifies a precautionary stance.

The German case, where nature policy is under state authority as opposed to federal authority, gives an unclear picture. The general trend during the designation phase seems to have been very top down, based on a technocratic understanding of scientific expertise and a monodimensional framing of the issue in terms of conservation, hence no obvious practical occurrence of the three shifts mentioned above can be highlighted. Some limited and more-or-less-informal forms of participation have at times been observed, but none seemed to emerge as a consequence of one of the shifts. At the local level, for instance, stakeholders could in certain cases have a say on site boundaries (eg exclusion of potential industrial sites). At the national level the informal creation of shadow lists by environmental NGOs, which have since been accepted by the Commission, is an interesting example of actors participating in the decision process through bypassing political levels. This model of shadow lists has been practised as well in many new EU member states (Mayr and Frischmuth 2003). We have no concluding indication either for Germany that participation itself led to less top-down policy, to a different role of science or to an extension of the monodimensional frame of nature conservation. Successes and failures of participation differed a lot and the interested reader can refer to Sauer et al. (2005) for deeper insight.

4.3.6
Recent developments in EU biodiversity policy

At the EU level, and looking at more recent developments in biodiversity policy, one can observe a significant shift in rhetoric, whereby participation is more and more present. This is likely to have an impact in practice in terms of our three shifts in the future. In 1998 the EU Biodiversity Strategy was adopted, under the fifth Environmental Action Programme. The text contains no mention of participation. For its review under the sixth Environmental Action Programme in 2004 a wide stakeholder process was organised – the 'Malahide Process' – and the resulting 2006 EC communication entitled`Halting the loss of biodiversity for 2010 and beyond' fully integrates a participation discourse (Commission of the European Communities 2006). Two of the four so-called`supporting measures' for the action plan in this communication relate to building partnerships on the one hand and building public education, awareness, and participation on the other hand. As far as management of Natura 2000 sites is concerned, the EC promotes intensive public participation for the establishment of management plans.

Participation in EU biodiversity policy stems from a double movement. On the one hand one witnesses the emergence of governance principles calling for more participation. These calls are based on normative, substantive, or instrumental reasons, as well as on the recognition of the physical and societal complexity of the issues at hand. As a result, participation appears in discourses but not necessarily in practice. On the other hand, movement leading to more participation in EU biodiversity policy was the discontent amongst actors who distrust and refuse the top-down, expertise-driven, monodimensional way of policy making. This led to significant conflicts at various policy levels, which constituted a powerful driver towards implementation of more participatory approaches, as illustrated by the French case. This double movement brings to light the existing gap between top-down rhetoric on participation and the bottom-up perceptions of that rhetoric.

4.4 Conclusions

This exploration of participatory approaches in multilevel governance of biodiversity in the European Union highlights the importance of accounting for historical developments when analysing participation, as both the normative discourse on participation and the real-life implementation of participatory approaches are evolving. Furthermore, the specificities of the political and cultural contexts make comparisons between different member states difficult. Nevertheless, looking at different national and sub-national levels in different countries does bring to light some of the intrinsic difficulties relating to how the directives themselves treat (or do not treat) participation.

Looking at the three rhetorical shifts in multilevel biodiversity governance in the European case indicates that those shifts are only beginning to take place in the practice of EU biodiversity governance. At all political levels, from EU to local, there seems to remain a big gap between the rhetoric on participation that is present in political discourses, and even in legal texts, and the real-life implementation of participatory processes.

As far as the first shift is concerned, no clear or significant shift from top-down to bottom-up approaches can be observed. When there is a shift towards more participation at the local level, conflict – and not normative choices embedded in governance rhetoric – appears to be the dominant driver. In those cases, the rules defining and governing participation are dictated by a higher level. It can be argued that this is to a certain extent unavoidable if the objective of the participatory approach is to contribute to decisions taken at that higher level. Regarding the shift towards postnormal practices of science we noted the difficulty of designing participatory processes, which genuinely allow for all types of knowledges to be brought in, including scientific knowledge. As for the third shift – towards ecosystem-related approaches and a pluridimensional framing of the issue – it is important to recall that the monodimensional conservation framing is a result of history; it is in this very way that biodiversity loss was constructed as a societal issue and was brought on the political agenda. Actors in biodiversity polity progressively recognised that the conservation discourse was not sufficient to maintain the issue on the agenda, let alone to ensure that governments and people would act upon it. The shift towards a multidimensional-approach discourse took place in parallel to – and sometimes in confusion with – a utilitarian ecosystems goods-and-service approach. This could have serious repercussions since it may lead to a framing of biodiversity in purely utilitarian terms. Such a reductionist approach ultimately comes down to another monodimensional framing of the issue hence replacing one monodimensional framing (purely ecological) with another (purely economic) (on this, see, for example, McCauley 2006).

As was stressed above, the shifts in multilevel biodiversity governance that we focused on have the potential to induce more participatory governance but the induction can also work the other way – that is, if for any reason more participatory processes are implemented, then these processes have the potential to induce the shifts. The impression left by the journey through EU biodiversity governance is that it is probably this latter mechanism that is dominant. Conflict is still often a major driver for the implementation of participatory processes, which then induce shifts towards more bottom-up governance, building on a more 'postnormal' type of science and allowing for multiple framing of issues.

5

The role of the Subsidiary Body on Scientific, Technical and Technological Advice to the Convention on Biological Diversity as science–policy interface

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Environmental Science & Policy 11 (2008) 505–516

5.1 Introduction

There is widespread agreement that the governance of biodiversity is not as effective as it could be – or as it should be. Despite a multiplication of policy processes addressing biodiversity and an increase of high-quality biodiversity research, in natural and social sciences, as well as through interdisciplinary endeavours (van den Hove and Sharman, 2006), it seems inevitable that the target endorsed by the 2002 World Summit on Sustainable Development in Johannesburg to achieve by 2010 a significant reduction of the current rate of biodiversity loss will not be met. According to the Millennium Ecosystem Assessment (MA), this trend of loss will even accelerate in the future (MA 2005).

Interrelations between science and policy for biodiversity governance have been gaining increasing attention, not least because weak scientific foundations of policy-making are claimed to be a key factor in the apparent impasse in biodiversity governance (MA 2005; Loreau and Oteng Yeboah 2006). In light of these arguments, there is a general view that the interface between science and policy must be strengthened, in particular at the international level, in support of more effective biodiversity governance (Loreau and Oteng Yeboah 2006; Barbault and Le Duc 2005; Watson 2005; Miller 2003; Pielke 2002).

In this context, as the 'official' interface between science and policy of the Convention on Biological Diversity (CBD), the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) has come under close scrutiny; and has become subject of discussions on its role in improving the scientific underpinnings of the CBD. The debate on the role of SBSTTA has been ongoing since its inception in 1995 (CBD 2005; Le Prestre 2002). Established under Article 25 of the Convention (CBD 2007) as an open-ended intergovernmental multidisciplinary scientific advisory body for the Conference of the Parties (CoP) of the CBD, the SBSTTA was envisaged as an advisory mechanism with strong scientific character. However, since it met for the first time in 1995 it has developed into what many refer to as a 'Mini-CoP' – a body with strong political features negotiating draft decisions in preparation of the subsequent meeting of the CoP.

One of SBSTTA's operating principles is to continuously "improve the quality of its advice by improving scientific, technical and technological input into, debate at, and work of, meetings of the Subsidiary Body" [34] As a consequence it has undergone several changes addressing issues identified as impeding the quality of its advice (CBD 2005). However, commenting on the 13th meeting of the SBSSTA, held in February 2008 in Rome, the independent reporting service of the International Institute for Sustainable Development (IISD) noted that: "The week's wrangling over whether to "welcome" "take note of" or "adopt" scientific reports such as the ecological criteria for marine areas in need of protection, led some to point out that despite recent efforts to reform SBSTTA's procedures in order to "work smarter," it still remains a prep-COP, where parties negotiate the policy ramifications of best available science." (IISD 2008, p. 17) The continuing struggle to bring about a more scientific role for SBSTTA, amid an ongoing discussion regarding its function, have fuelled a debate over whether the SBSTTA should be changed to provide "strictly scientific advice", or continue a political role "negotiating substantive decisions" of the CoP, and even whether it has "the capacity to develop sound scientific and technical advice." (CBD 2005, p. 10; see also IISD, 2008) Meanwhile SBSTTA remains trapped between trying to be a body of scientific nature as originally conceptualised, and depreciating the more political nature it has developed in reality, and which at least officially it is not permitted to have. SBSSTA 13, where an over-emphasis on procedural considerations has led to deadlocks and to much of the text of the recommendations transmitted to CoP9 being bracketed (i.e. not agreed on), is an example of the consequences of such situation, and left many concerned about the

Convention's functioning in general (IISD 2008). This article analyses the actual role and future perspectives of SBSTTA as the CBD's official science–policy interface. We aim to provide arguments to help solving SBSTTA's 'identity crisis', and to promote an alternative approach towards enhancing its ability to be the science–policy interface for the CBD.[35] We also address analytical questions regarding the role, nature and organisation of scientific advice mechanisms in international and highly political contexts of multilateral environmental agreements in general.[36]

Both the theoretical debate in general, and the analysis of SBSTTA's role and functions in particular, are also relevant for the ongoing consultative process towards an International Mechanism of Scientific Expertise on Biodiversity (IMoSEB, www.imoseb.net). Up to now, arguments concerning the establishment of an IMoSEB have ranged from IMoSEB being a duplication or even a threat to SBSTTA, undermining its competencies (personal communication with national delegates and members of the Convention's Secretariat)[37] to IMoSEB being the crucial missing link for more effective international biodiversity governance (Loreau and Oteng Yeboah 2006).

Data for this study have been drawn from desk studies, 8 detailed interviews and a number of informal communication with staff members of the CBD Secretariat, national delegates to SBSTTA and CoP, and other stakeholders, and from direct observations of, or participation to, relevant processes.

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34 Decision VIII/10, Annex III, paragraph 4.

35 In doing so, the article informally contributes to a call of the Working Group on Review of Implementation (WGRI) of the Convention on Biological Diversity encouraging an external review of the convention's processes to improve its functioning and "credibility of the Convention as an instrument for global consensus building on biodiversity" (CBD 2005, p. 23).

36 Continuing a debate which Miller (2001a,b) initiated by studying the role of the Subsidiary Body of Scientific and Technological Advice (SBSTA) of the UN Framework Convention on Climate Change (UNFCCC) and SBSTA's relationships with the intergovernmental Panel on Climate Change (IPCC).

37 At SBSTTA's twelfth meeting (SBSTTA 12), for example, a delegation stated that any scientific initiative to produce, collect and feed knowledge regarding biodiversity into the CBD should take place under the CBD-Regime, that SBSTTA is perfectly able to fulfil this role, hence that no IMoSEB would be needed.

5.2 Science, politics and science –policy interfaces—theoretical considerations

We define science–policy interfaces “as 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 with the aim of enriching decision-making.” (van den Hove 2007, p. 807) As such, science–policy interfaces aim at managing the interrelations between the two societal domains ‘science’ and ‘politics’, each of which functions according to different time scales, categories and priorities (Pohl 2008). Both science and politics are social practices characterised by specific knowledges, processes, discourses and norms—e.g. what constitutes reliable evidence, a convincing argument, procedural fairness (Jasanoff and Wynne 1998; Miller 2001a; Cash et al. 2003; Pohl 2008).

Science is a societal activity whose most important aim is the generation of scientific knowledge—objective knowledge mainly in the form of explanations of the world and predictions of its evolution (e.g. van den Hove 2007). Pursuing the ideal of objectivity, science depends on processes that allow for the ‘criticisability’ of its arguments (Popper 1989). ‘The scientific’ may therefore be described as the dimension of ‘organised scepticism’ based on the best available systematic/factual argument and free discussion trying to escape as much as possible from ideology, passions, and emotions. Making choices between conflicting alternatives belongs to the realm of ‘the political’. While some theorists envisage the political as a space of freedom and public deliberation, Mouffe and colleagues see ‘the political’ as a space of power, conflict and antagonism: “[B]y ‘the political’ I mean the dimension of antagonism which I take to be constitutive of human societies.” (Mouffe 2005, p. 9) Understanding ‘difference’ as a precondition for the existence of any (political) identity (ibid.), the political is essentially about dealing with eventually conflicting interests and values, and therefore about subjectivity. Mouffe then defines ‘politics’ as “the set of practices and institutions through which an order is created, organizing human coexistence in the context of conflictuality provided by the political” (Mouffe 2005, p. 9). Central to politics are ‘policies’, understood as the art, method or tactics, ‘techniques of power' or 'political technologies' (Foucault 1991, p. 95) of governments and regimes to establish order. Policy-making is therefore inherently a political process, inevitably involving conflict, the expression of interests and values, bargaining, negotiation and compromise.

In principle then, 'the political' and 'the scientific' seem to represent contrasting if not opposing rationalities: the scientific aiming at an ideal of objectivity trying to be as detached as possible from individual values and interests, and the political intrinsically focusing on the subjective, representing the realm of competing values and interest. However, the practice of the respective rationalities, the realities of science and politics are far from being sharply differentiated 'pure types' of social activities. They are not homogeneous, autonomous and opposing domains that intermittently exchange products (van den Hove 2007; Miller 2003). Instead, the scientific and political spheres deeply intersect with each other over a whole range of domains through the constant intermingling of processes, products and actors to the extent that scientific knowledge and political order mutually coevolve (Wynne 1992; Nowotny et al. 2001; van den Hove 2007). As stressed by Nowotny et al., this is part of a broader trend by which "[t]he great categorisations of the human enterprise produced by successive revolutions of modernity – scientific, political, cultural, industrial – and around which the contemporary world is organised now appear to be either in flux, eroded or socially contested." (Nowotny et al. 2001, p. 21) It is in fields where the production of scientific knowledge is aimed to support policy-making – so-called issue-driven science – where scientific and political realms intersect the most as there processes of selecting, framing and addressing a scientific problem as well as the design of potential solutions pertain to both the scientific and the political processes. However, while the politicisation of science and the scientification of politics are to some degree inherent and valuable aspects of the science–politics intersection, deep, fuzzy and often hidden or unconscious interrelations might also lead to "confusion or even dangerous instabilities" (Guston et al. 2001, p. 399) between science and politics. It is the raison d'etre of science–policy interfaces, as we understand them, to manage these interrelations at the intersection of science and politics. Based on historical analyses of environmental issues from initial scientific discoveries to their emergence on high-level policy agendas, it has been suggested that salience, legitimacy and credibility are among the most important attributes of effective science/knowledge–policy interfaces (Cash et al. 2003; Farrell and Jaeger 2006).[38]

Other key features of effective science–policy interfaces are (i) processes allowing for the participation of and open dialogue between relevant social actors representing politics, science and other knowledge claims; (ii) processes that provide the opportunity – and often also the incentives – for the co-production and use of 'boundary objects': joint products that are both adaptable to different viewpoints and robust enough to maintain identity across them; and (iii) processes that allow for transparent and direct lines of responsibility and accountability to each of two relatively distinct social worlds (Guston 1999; Cash et al. 2003; van den Hove 2007).

However, in a more complex representation of the relation between science and policy as described above, the design features of science–policy interfaces are not uniform but depend on the 'environment' in which they are established. This then allows for conceptualising a whole array of types of science–policy interfaces ranging over a spectrum from very scientific to predominately political. While the overall function of any science–policy interface remains the management of the problematic interrelations of science and politics, its position on that spectrum depends very much on the context in and the purpose for which it is established. There exists no 'one-type-fits-all' solution to the question which is the most effective science–policy interface. Instead it is often networks of science–policy interfaces of different institutional types and functions with complex, partly redundant, and layered institutional arrangements that constitute the most effective knowledge systems in managing complex issues (Cash et al. 2003; Dietz et al. 2003). Only through such collaboration, it is argued, is it possible to effectively bolster salience, credibility, legitimacy, and the tradeoffs among them (Cash et al. 2003). To better understand the character and role of a given science–policy interface it is necessary to understand these institutions as collections of rights, rules, and decision making procedures, and hence as social constructions. As for any institution, the establishment or refinement of any science–policy interface involves acts of creation rather than processes of discovery and "we should expect to find these governance systems bearing the stamp of theories, discourses, ideologies, or, more generally, patterns of thought that were influential at the time of their formation." (Young 2004, p. 215) The characteristics of the science–policy interface depend also on the purpose it is to serve—e.g. whether to assist in 'opening up' or 'closing down' a policy process. More scientific science–policy interfaces are better suited to 'open up' a policy process in the sense that "[t]he resulting output to decision makers is delivered as 'plural and conditional' advice: systematically revealing how alternative reasonable courses of action would appear preferable under different detailed 'framing assumptions' and showing how these dependencies relate to the real world of public constituencies, specialist professions and stakeholder interests." (Stirling 2006, p. 101) At the other end of the spectrum are science–policy interfaces whose "aim is to 'assist' decision-making by cutting through the messy, intractable and conflict-prone diversity of views and develop instead a clear authoritative prescriptive recommendation. … [with a] resulting output to decision-makers delivered as a 'unitary and prescriptive' advice." (Stirling 2006, p. 101) In aiming much more at the provision of a resolution, eventually involving value- and interest-laden decisions, such processes are better embedded in institutions of a more political nature. Both historical context and purpose predominantly frame the legal structures of a science–policy interface. The legal structures in turn determine issues of accountability, membership and procedures. Issues such as accountability, participation and e.g. voting procedures are thus inherently linked to the history and purpose of an institution. In the remainder of this article we describe and analyse SBSTTA in terms of its historical background, purpose and legal structure, with the aim to place it on the continuum between science and politics, and to then explore how it could eventually articulate more effectively with other science–policy interfaces to enhance biodiversity governance.

[38] In this context, salience, or relevance, of a science/knowledge–policy interface is intended to reflect its ability to address the particular concerns of its users. Legitimacy is a measure of the political acceptability or perceived fairness, reflecting the perception that the production of information and technology has been respectful of stakeholders' divergent values and beliefs, unbiased in its conduct, and fair in its treatment of opposing views and interests. And credibility involves the scientific and technical believability to a defined user, and can be gained from several bases, including (i) the conformance of new information to competing sources of information; (ii) the processes that lead to the creation of policy-relevant knowledge and advice; (iii) the credentials of the participants; and (iv) on the degree of consensus on an issue (Farrell and Jaeger 2006; Cash et al. 2003).

5.3 A description of SBSTTA as the CBD's science–policy interface

As outlined in Article 25 of the CBD the functions of SBSTTA include (i) the provision of advice to the CoP and its other subsidiary bodies, (ii) the preparation of scientific and technical assessments, (iii) the identification and development of technologies, methodologies and know-how relating to conservation, sustainable use and benefit sharing of biological diversity; and (iv) the provision of advice on scientific programmes and international cooperation in research and development related to conservation and sustainable use of biological diversity. SBSTTA's operational principles, rules and procedures are laid down in its modus operandi, which, after several changes, was consolidated by the eighth CoP in March 2006 (Decision VIII/10, Annex III). It states that SBSTTA, in carrying out its functions, shall support the implementation of the multi-year programme of work of the CoP and the Strategic Plan of the Convention.[39] It is to fulfil this task "under the authority of, and in accordance with, guidance laid down by the CoP, and upon its request."[40] The processes of the Subsidiary Body are overseen by a Bureau, composed of ten members elected for fixed 2-year terms by the Parties at SBSTTA meetings (two from each of the five UN regional groups) presided over by a Chairperson elected by Bureau members, who also chairs the SBSTTA itself. All other organisational matter is left to the Secretariat of the CBD (SCBD). The SBSTTA meets on a yearly basis, in two 1-week meetings before each ordinary meeting of the biannual CoP. As laid down in the mandate, SBSTTA is open to participation by all Parties to the Convention, who should send "government representatives competent in the relevant field of expertise" (Article 25, paragraph 1). In addition to national delegations the Convention encourages the presence of nongovernmental organisations (NGOs), intergovernmental organizations (IGOs) and other stakeholders. The meetings are attended by an average of 500 participants (CBD 2006a). The majority of delegates come from national ministries of environment (around 60%), another 10–20% from the ministries of fisheries, agriculture and forestry, and between 5 and 10% from foreign affairs departments (CBD 2006b). Only about 7% of delegates are directly from academic and research institutions (ibid.). In general, approximately 20% of participants are observers, i.e. non-party representatives. The agenda of the meetings results in general from requests from the CoP, further developed by the SCBD in consultation with the SBSTTA Bureau. Throughout the meeting, participants discuss, elaborate, and negotiate a set of consensual recommendations for each of the items of the agenda. However, SBSTTA as an institution is much more than just its meetings and the negotiation of its recommendations, even though most of the interaction between SBSTTA members is limited to the time of the meetings. Understood in terms of a science–policy interface as outlined above, SBSTTA comprises a whole set of processes and rules that reach far beyond the actual meetings. In fact, the work being done in the intersessional period is at least as crucial to the overall processes and functioning of SBSTTA as the meetings themselves. For each agenda item the SCBD develops the official documentation in accordance to guidelines provided by the modus operandi.[41] It consists of focused draft technical reports of a maximum length of 15 pages, containing background information on a given issue, and including proposed conclusions and recommendations in the form of draft decisions for consideration of SBSTTA. It is these documents – their development over the intersessional period and the negotiation of at least the proposed recommendations during the meetings – around which basically all official processes of SBSTTA are organised. To ensure a transparent process and contributions, comments and feedback at various stages, SCBD is to establish work plans, timetables, and resource requirements for the preparation of each of the official documents. There exists a whole range of possible processes that the SCBD can use to prepare these documents. The general elements and sequences of SBSTTA's intersessional work are outlined in Fig. 1. Although some of the official documents are developed based on literature only, the preparation of most official documents involves a varying mix of ways and means. Often they are prepared in collaboration with other institutions of expertise regarding a respective issue, or with help of contracted consultants. Other processes that contribute to the preparation of these documents include requests made to SBSTTA's national focal points, electronic fora organised by the SCBD, or workshops that might be convened on specific topics.

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39 Decision VIII/10, Annex III, paragraph 3.
40 Decision VIII/10, Annex III, paragraph 1.
41 Decision VIII/10, Annex III, paragraph 12–14.

As of today, the strongest mechanism on which the SCBD can draw when preparing the official documentation is a so-called Ad Hoc Technical Expert Group (AHTEG). Under the guidance of CoP, and in accordance with the rules laid down in the modus operandi,[42] the SCBD may establish a limited number of these AHTEGs to provide detailed scientific, technical and technological information on specific priority issues. The SCBD, in consultation with the SBSTTA Bureau, selects scientific and technical experts from nominations submitted by Parties for each AHTEG. These expert groups are to be composed of no more than fifteen experts nominated by Parties, competent in the relevant field of expertise, and of a limited number of experts from appropriate organisations, depending on the subject matter. It is also the AHTEGs through which SBSTTA develops its scientific and technical assessments. For the development of such assessments the modus operandi provides for detailed guidelines.[43] Any assessment must be mandated by the CoP, shall be regionally balanced, and carried out in an objective and authoritative manner, and according to the terms of reference that clearly establish the mandate, duration of operation and expected outcomes. Finally, to assist with the 'peer-review' of the documents, the SCBD may establish, in consultation with the SBSTTA Chair and Bureau, so-called Liaison Groups comprising a balanced range of experts qualified in fields relating to the objectives of the Convention. In general, most of the documents informing the official documentation are either referenced or provided alongside with the official documents. All of this information is made available at least 3 months before the SBSTTA meeting on the website of the Convention (www.cbd.int).

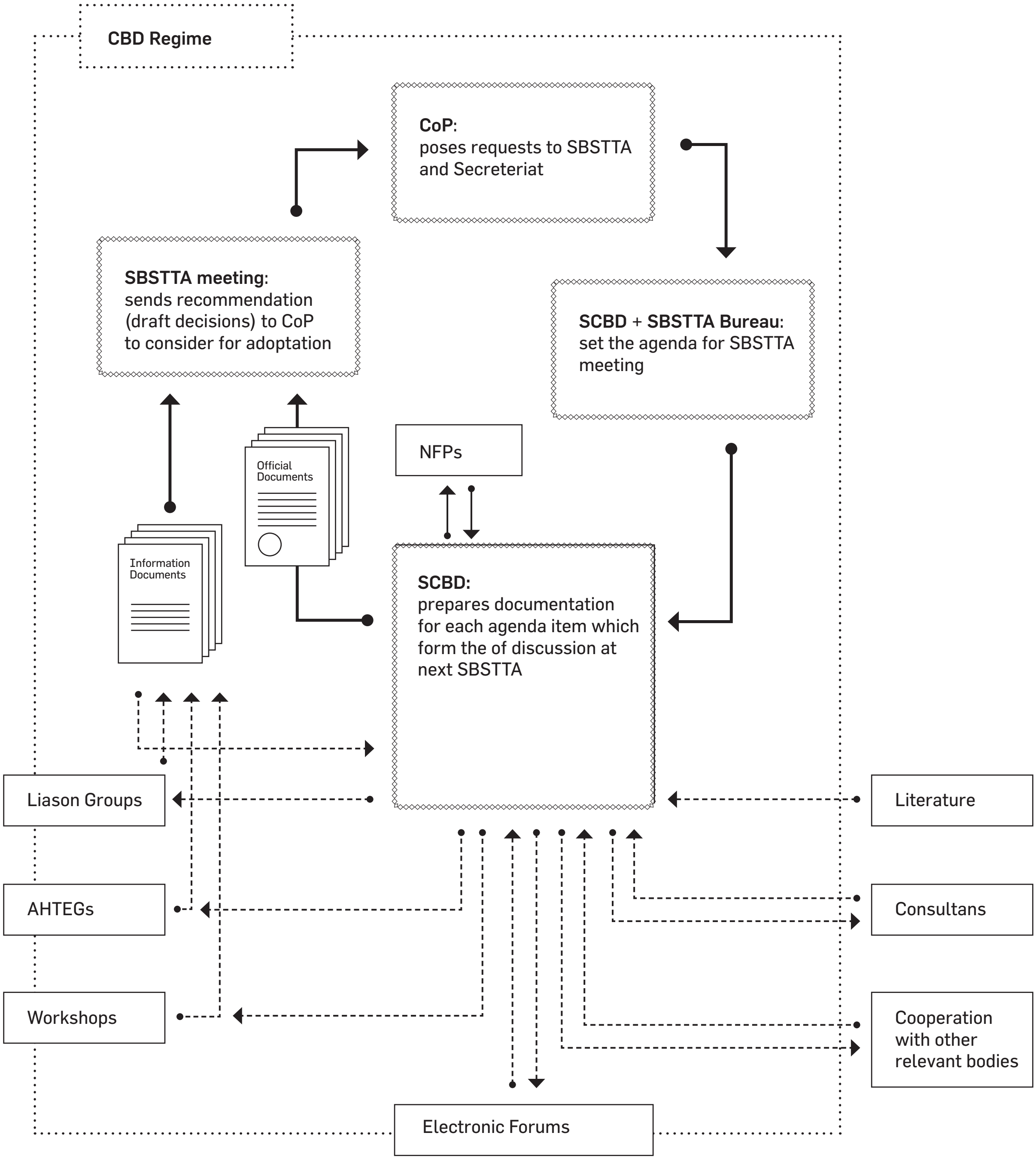

Figure 01 SBSTTA's intersessional processes.

42 Decision VIII/10, Annex III, paragraph 18.
43 Decision VIII/10, Annex III, Appendix C.

Between 1995 and 2007 SBSTTA has adopted a total of 129 sets of recommendations (or around 1300 individual recommendations) in response to requests from the Conference of the Parties (based on CBD 2006b). A review of SBSTTA's recommendations reveals that approximately 60% were endorsed as such by the CoP (CBD 2003), which makes these recommendations 'de facto decisions' of the CoP (CBD 2006a). Another 30% were either partially adopted or adopted with minor modifications. Recommendations relating to the main thematic programmes of work or cross-cutting issues under the Convention have had a high adoption rate exceeding 90%. Those recommendations not adopted dealt for the most part with either finance-related provisions, the involvement of other international fora (e.g. the MA), requests to Parties to undertake national level actions, or proposed action concerning Article 8(j) of the Convention, access and benefit sharing (ABS) and the Biosafety Protocol (CBD 2003). Some consider the high adoption rate of SBSTTA's recommendations as an indication that the Subsidiary Body fulfils its overall mandate successfully providing timely advice to the CoP (CBD 2005, 2006b)—at least regarding its task to respond in a timely manner to scientific, technical, technological and methodological questions of the CoP (Article 25, paragraph 2 (e)), which has become SBSTTA's primary focus.

However, despite SBSTTA's achievements and the appreciation of some regarding the role SBSTTA has come to play as an important step in the decision-making process of the CBD, serious concerns have been raised regarding the quality of its scientific, technological and technical advice and its effectiveness as the official science–policy interface for the CBD. As stated in the report of the 'Brainstorming Meeting of the past, present and future Chairs of SBSTTA', convened in Paris in July 2007 to identify ways and means to enhance the scientific underpinnings of the Convention by the Subsidiary Body and improve its effectiveness, "acceptance of SBSTTA recommendations by the CoP does not necessarily imply that the recommendations are scientifically credible." (CBD 2006b, p. 6) Nor does a high number of accepted recommendations say much about their relevance: "… many find that the SBSTTA could be improved so that this body can provide the Parties to the Convention with authoritative assessments […] and with policy-relevant advice that could facilitate linking scientific assessments to the mobilisation of solutions, particularly at the national level." (CBD 2006b, p. 4)

A whole range of issues impedes the quality of SBSTTA's advice. SBSTTA's overburdened workload; its limited financial resources; the nature of the requests it receives from the CoP; and the lack of interaction in between sessions are some of the issues mentioned (CBD 2006b; 2005; Le Prestre 2002; personal communications with national delegates and members of the SCBD). Most of the criticism, however, focuses on two general aspects of SBSTTA: (i) the scientific input to its meetings and (ii) the quality of debates during these meetings. As described above, the official documents prepared by the SCBD for each agenda item constitute the bulk of the scientific input to the meetings. However, although these documents are very influential in the overall process, their saliency and credibility are debatable and in fact questioned (Siebenhüner 2006; CBD 2005; personal communication with national delegates).

Only about half of the responding national delegates asked in a survey regarded the information provided by the SCBD as relevant for their work and as scientifically credible, and only about a third of the respondents perceived such information as politically neutral (Siebenhüner 2006, p. 265). For example, the official document on the issue of biofuels and their impact on biodiversity presented by the SCBD at SBSTTA 12 in 2007 (CBD 2007b) was discredited by some delegations as not credible, even biased, leading to a rejection of the draft recommendations put forward by the SCBD as a basis for negotiation (IISD 2007). All of the above has led to an increasing number of calls to strengthen scientific input into SBSTTA, "particularly in relation to identifying [policy] impacts on biodiversity and related issues and proposing policy solutions." (CBD 2006, p. 6; also see CBD 2006b; 2005.)

The quality and form of the debates at SBSTTA meetings themselves is under even more criticism. Issues put forward as causes preventing SBSTTA from being more scientific in nature are the lack of technical expertise present at SBSTTA meetings (particularly in delegations from developing countries), the consensus-driven decision-making process, and the drive towards producing draft decisions as the only output of relevance. According to the SBSTTA Chairs "it is partly this drive for "consensus" at SBSTTA that forces political perspectives to enter debate" (CBD 2006b, p. 13; also see CBD 2005) as reaching consensus often involves bargaining, negotiation and compromise of often conflicting views. Others see the negotiation of draft decisions as the reason why debates within SBSTTA have become as politicized and protracted as those of the CoP, and hence inhibiting a substantive discussion (see e.g. CBD 2006b). By some, these text negotiations of draft decision are even seen as a duplication of effort, as much of these discussions are repeated at the CoP, often even by the same people (personal communication with national delegates and members of the SCBD). The bottom line of SBSTTA's criticism is that it has become too political (CBD 2006b; 2005): "Despite its relatively clear mandate and modus operandi, SBSTTA is influenced by politically based interventions. Eventually science will be entirely squeezed out of the discussions" (stated by the past, present and future Chairs of SBSTTA in CBD 2006b, p. 6). Over the years SBSTTA has undergone several changes addressing issues identified as impeding the quality of its advice. These include among others: trying to focus agenda items on truly scientific and technical issues; 'outsourcing' issues which are considered as being 'too political' to be addressed by a 'scientific' advise body (issues related to Access and Benefit Sharing (ABS) and Traditional Knowledge, Innovations and Practices (Article 8(j)) are now being addressed in their respective subsidiary bodies); reducing the number of agenda items per meeting; selecting one or two main focus per meeting and allowing time for a more 'in-depth review'; introducing poster sessions; introducing a number of expert presentations in the sessions to enrich the normally text-based negotiations on recommendations for CoP with substantial scientific input; and encouraging SBSTTA to make recommendations that include options or alternatives, trying to avoid political debates where no consensus can be reached (CBD 2005). The objective of these efforts is best captured by the following statement, made at a side-event during SBSTTA 12 by Ashgar Fazel, the in-coming Chair of SBSTTA for 2007–2009: "… The whole story is to encourage the SBSTTA to be more scientific."

5.4 Tracking down SBSTTA's institutional nature

But is the encouragement of SBSTTA to become more scientific really the appropriate answer to improve the quality of its advice? Is the criticism that SBSTTA is too political actually correct? To be able to answer these questions we now analyse SBSTTA in light of the set of theoretical considerations presented in Section 2. In contrast to scientific bodies of some other conventions, SBSTTA has been established as an open-ended intergovernmental body subsidiary to the CoP. In terms of its legal structure SBSTTA is accountable primarily – if not solely – to the highly political CoP and ultimately to the

Parties. Prevailing throughout the Convention text and experience there is a "reluctance of the CoP to allow the SBSTTA some autonomy, that is, its eagerness not to let a scientific body make binding decisions or present the CoP with faits accomplis in terms of agenda setting." (Le Prestre 2002, p. 107) This attitude has just recently shown again when SBSTTA 12 dealt with the issue of 'biofuels', which was introduced to its agenda as a "new and emerging issue relating to the conservation and sustainable use of biodiversity". The ability of SBSTTA to identify issues for discussion without having a direct mandate from CoP has been one of the innovations made possible by the recent update of its modus operandi and is meant to allow a more rapid response to emerging and pressing issues.[44] After consultations within the SBSTTA Bureau and their respective regions, the subject of "biodiversity and liquid biofuel production" has been included as the first new and emerging issue SBSTTA was to deal with. The novelty of this approach to emerging issues, together with the fact that biofuels are highly contested (see e.g. Scharlemann and Laurance 2008), triggered considerable debate on how to deal with the topic and the official document provided by the SCBD even questioned the legitimacy of SBSTTA to address it in this form (IISD 2007). Many central points examined during the discussions had to be dropped or were placed in bracketed text, hence postponing a decision. This was due to contested quality of the support document and the contested legitimacy of the procedures applied. The discussions resulted in a process aimed at further clarifying the procedure for the identification of emerging issues, the conditions for their inclusion in the agenda of relevant meetings, and appropriate ways and means to respond to new and emerging issues.[45] These measures will likely result in a reinforcement of the political influence Parties have on SBSTTA.

Looking at the history of SBSTTA may explain why a supposedly scientific body has been institutionalised with a legal foundation which holds it accountable almost entirely to the realm of the political. Historical data actually show that the politicisation of SBSTTA began even before SBSTTA existed, as the very establishment of a scientific advice body to the Convention was already a politically contentious issue (McConnell 1996; Henne and Fakir 1999;

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[44] Laid down in Decision VIII/10, Annex III, Appendix A, paragraph d.
[45] SBSTTA Recommendation XII/8.

McGraw 2002). Despite provision for it in the text of the Convention (Article 25) many countries were reluctant to see the establishment of a scientific advice body, which could potentially interfere with issues of sovereignty and access to biodiversity and its potential products. [46] The block of developing countries, for example, only agreed to the establishment of such a body in return of the withdrawal of a list of globally important biodiversity that was to be included in the Convention text under the pressure of several developed countries, scientists and NGOs (McGraw 2002).

While there were many reasons for this reluctance towards the establishment of a scientific subsidiary body, a crucial point was that developing countries did not feel well represented in a scientific framework. This mainly for two reasons: first, because of their disadvantage in providing scientific expertise compared to developed countries, which hence often dominate such purely scientific arrangements (Karlsson et al. 2007). Second, and more importantly, their concerns regarding biodiversity were not reflected in what the dominant science had to offer (at least at that time). Generally, 'science' in the context of the Convention meant – and to a large degree still means – 'conservation biology'. Biologists, in particular (North American) conservation biologists, had had a prominent role in raising awareness about biodiversity loss and in pushing the issue on to the international political agenda (Takacs 1996). They also played a considerable role in framing the negotiation position of their respective states: "The negotiations have relied extensively on the biological sciences as both source of factual information about nature and a model for how to produce reliable knowledge." (Miller 2003, p. 316)

Scientists involved in the negotiation of the Convention, as well as most developed countries (in particular the USA), favoured a traditional conservation convention that "should concentrate on protection of ecosystems, particularly in species-rich areas, without impeding positive developments in biotechnology" (official US position to the negotiation of a convention on biodiversity, G7 London Summit 1991; in McConnell 1996, p. 54). Developing countries, however, with an estimated four-fifth of the world's biodiversity, were more concerned about potential constraints to development and limits to sovereignty such agreement would imply. "Having felt "deeply colonised" by the climate change negotiations [which had taken place only shortly before], many developing countries were determined to secure their interests through the Biodiversity Convention." (McGraw 2002, p. 13). They therefore rejected a strictly natural scientific base for the convention in favour of an approach that also recognised the social, cultural, economic and political dimensions and values of biodiversity, leading to the comprehensive agreement laid down in the CBD.

Another important aspect of the context in which SBSTTA was established is the nature of the issues with which SBSTTA has to deal. Although hailed by some "as a new generation of international legal instruments that seek to reconcile the development imperatives of the South with the environmental exigencies of the North" (McGraw 2002, p. 8, referring to Tinker 1995), the divide between the different priorities of the Convention – reflected by the three objectives of conservation, sustainable use, and access and benefit sharing – remained even after its adoption and is still clearly visible in much of the Convention's affairs. The concept of biodiversity is continuously reclaimed or rejected as belonging to many different competing knowledge domains, and the proper role of science in the Convention is still not well defined (Le Prestre 2002). Although the mandate of SBSTTA in principle encompasses not only the natural sciences, but also socio-economic, cultural, legal and political issues, hence including a wide range of social sciences and other types of knowledges, there is still a tendency to conceive SBSTTA rather as a natural scientific body. The outsourcing of issues related to Article 8(j) and ABS as being too political to be dealt with by science is one of many illustrations of this. While such a situation might be revealing a misconception of science in general, it certainly fuelled arguments and perceptions that the distinction between what is and what is not subject to scientific advice by SBSTTA is arbitrary and biased (McGraw 2002). Beyond the setting of the agenda and the scientific information provided often seen as politically influenced, the very nature of many of the issues addressed by SBSTTA is inherently political or are closely related to politically sensitive areas of policy (CBD 2005). They have implications for landuse planning, intellectual property rights, trade, technology, human health and culture. Further, "[m] any issues and concepts under discussion have no clear scientific basis but

[44] Due to the evolution of the negotiations from a traditional conservation convention to one with broader implications for the economy and other key areas of national interest, the US, the treaty's original state sponsor, ultimately became its most vocal opponent towards the end of the formal negotiations and beyond (McGraw 2002).

much clearer political overtones" (Le Prestre 2002, p. 105). Criticisms of SBSTTA lacking science and being too political, Le Prestre argues, "conveniently overlook that discussions often tend to take the form of solutions in search of problems when it is precisely the definition of the problem that needs to be discussed." (ibid., p. 105) It is the complex nature of the issue, implying all kinds of uncertainties, indeterminacies and incommensurability of values, that brings about a plurality of perspectives which cannot simply be reduced by expert knowledge (see e.g. Wynne 1992; van den Hove 2007). SBSTTA's role is commonly understood to assist decision making by cutting through this complex, messy, intractable and conflict-prone diversity of views and develop instead clear authoritative recommendations – that is its function would be to 'close down'. As elaborated above, achieving legitimate outcomes through such processes inevitably involves bargaining, negotiation, compromise and making interest- and value-laden decisions—political manoeuvring that is well beyond the scope of the scientific (Pielke 2002). Seeking to decrease the range of alternatives often to a single desired consensual draft decisions necessarily forces participants into a role of political advocates of one or another position. And despite continuous pleas to refrain from pure consensus and switch to recommendations including a range of alternatives and options, the practice of consensus-based decision-making on substantive matters remains common in SBSTTA (CBD 2005)—and this although the rules of procedure provide that "decisions of subsidiary bodies shall be taken by a majority of Parties present and voting …" (CBD 2005, p. 18). Behind this reluctance of SBSTTA to make use of its right to decide through majority voting or of recommending a range of options, is a selfunderstanding of SBSTTA's role to serve the CoP not only by providing 'credible and salient' advice (see Cash et al. 2003), but also by trying to reach "full acceptance of SBSTTA recommendations" (CBD 2006b, p. 6).[47] Ultimately in light of SBSTTA's strive to produce recommendations that are then fully or at least to a large extent endorsed as decisions by CoP – making them 'de-facto decisions' (CBD 2005) – debates at SBSTTA are prone to end up in overtly political text negotiations. Given SBSTTA's nature and background, and the fact that Parties decide whom to send, it is not surprising that participants in SBSTTA meetings are rarely selected based upon scientific and technical credentials in relation to subjects under discussion. A national delegate remembers that when they did send merely scientists in the beginning of SBSTTA, they made bad experiences as their scientists “got pulled over the table by diplomats”: “So we too armed ourselves with adequate negotiators, with adequate know-how and institutional links into politics.” (personal communication with national delegate) “Therefore, while Parties might be encouraged to include appropriate expertise of a scientific, technical and technological nature in their delegations, the presence of representatives with a political mandate is inevitable.” (CBD 2005, p.15)

To conclude, SBSTTA is a science–policy interface which is for various reasons inherently rooted at the far political end of the spectrum between very scientific and very political science–policy interfaces. As stressed by a national delegate: “Maybe we should just accept this [political nature of SBSTTA] and not desperately try to change SBSTTA into a pseudoscientific body.” (personal communication with a national delegate)

Efforts to move SBSTTA more towards the scientific end are not only likely to be in vain, they might even be counterproductive. In other words, there are good reasons in favour of a rather political role for SBSTTA. SBSTTA’s historical background, the character of the issues under discussion and the purpose it is to serve, but also the unavoidable presence of values in issue-driven science, indicate the importance of ‘the political’ within this particular CBD science–policy interface. Pushing SBSTTA towards more scientific processes would eventually lead to suppressing or shrouding often crucial and necessary political processes. Also, as stressed by Pielke (2002, p. 367): “putting the onus of problem resolution onto science brings all the messy realities of politics into the practice of science. Rather than making politics more scientific, this approach, in fact, makes science more political.” Forcing an inherently political SBSTTA into a scientific frame may in fact compromise both the chances for a (political) compromise and the valuable role scientific knowledge could provide to the decision-making processes.

Therefore we argue that it is crucial for the effectiveness of SBSTTA, and the quality of its advice, to keep room for ‘the political’. Mouffe, in her analysis of ‘the political’ states: “To take account of ‘the political’ as the ever present possibility of antagonism requires coming to terms with the lack of final

[47] This need to reach 100% of recommendations accepted is linked with the view that ‘‘nothing happens when you provide national and international decision makers with options. If participants at SBSTTA are not able to reach a consensus, they will even less so reach consensus at COP.’’ (personal communication).

ground and acknowledging the dimension of undecidability which pervades every order." (Mouffe 2005, p. 17) This leads to "… struggles between opposing hegemonic projects which can never be reconciled rationally." (Mouffe 2005, p. 21) However, "[c]onflict, in order to be accepted as legitimate, needs to take a form that does not destroy the political association." (Mouffe 2005, p. 20) In a democratic society, she concludes, this requires a debate about possible alternatives and the provision of political forms of collective identification around clearly differentiated democratic positions. For a science–policy interface like SBSTTA this means among other things (i) to recognise and allow for the articulation of different types of knowledge: e.g. scientific-, local-, indigenous, political-, moral- and institutional knowledges; (ii) to bring about communication and debate about assumptions, choices and uncertainties, and about the limits of scientific knowledge; (iii) to render explicit the values, ethics and interests of knowledge holders; and (iv) to provide room for a transparent negotiation among standpoints. [48] These conditions are ultimately met only within a political environment allowing for democratic, transparent and well-informed political discourse—and not within a strictly scientific environment which traditionally precludes not only different kinds of knowledge, but also explicit debates on values and interests.

5.5
Discussion: ways of enhancing the quality of SBSTTA as a science–policy interface

That SBSTTA is political, and should remain so for good reasons, does not mean that there is no room for improvement of the quality and effectiveness of SBSTTA as a science–policy interface. Given the above, we claim that the question however is not how to encourage the SBSTTA to be more scientific. Instead, the debate on enhancing the quality of SBSTTA should be reframed around the question "How to provide for a substantive political debate providing salient, legitimate, and scientific and technical credible advice?" In line with some of the criticism presented earlier we see the text-focused negotiation of draft decisions as one of the major obstructions to substantial debates. The question of how to change the quality of the debate is ultimately linked to what output is envisaged. Suggestions in this regard have been made by the SBSTTA Chairs: "SBSTTA should stop at conclusions and give options or request the Secretariat to package conclusions as draft decisions." (CBD 2006b, p. 9) This idea, however, has been turned down (vehemently) by Parties as disturbing established power balances between SBSTTA, the SCBD and the CoP. The actual framing of draft decisions is too important, as that Parties would leave this task to someone else; and too big would be the power of definition given to the SCBD if it were to interpret conclusions and phrase draft decisions on its own (personal communication with national delegates). Also the idea of just leaving the formulation of decisions to the CoP itself is rejected as impossible as this "could lead to a complete obstruction of the CoP, as its agendas are already incredibly overloaded—if the preparation of SBSTTA would be missing, everything would break down." (personal communication with national delegate)

A solution which would allow for issue-oriented debates at the meetings themselves but which would still provide draft decisions readily available for the CoPs, would be to separate these two phases of the process in time and space (also suggested by some national delegates at a side-event during SBSTTA 12). An effective way to achieve this might lie in shifting the text negotiation of draft decisions into the intersessional period, for example via an electronic forum to which the same rules of procedure would apply as to the meetings themselves. Then the output of SBSTTA meetings could be more something like general key statements—from which, in turn, the SCBD could draw suggestions for draft recommendations as the starting point for the discussions in the electronic forum.

Another more far-reaching way to improve the quality of SBSTTA's advice and biodiversity governance would be to improve the scientific input into SBSTTA. The quality of SBSTTA's debate and its advice crucially depends on the input used as the basis for the political debates at SBSTTA meetings. For highly political systems like the CBD regime, the question of which information enters the system and which does not is essential as it will constitute the matter of discussions and negotiation, frame an issue, and hence influence the range of possible outputs. In its function as the CBD's official science–policy interface SBSTTA serves as the most important gatekeeper regulating the

48 These are four of the normative requirements for science–policy interfaces elaborated in van den Hove (2007).

input of information into the CBD regime. Aware of this, Parties have tried to control these processes, which has resulted in an extremely cautious, if not reluctant, attitude towards input of authoritative sources from outside the auspices of the CBD—the refusal to take officially into account the Global Biodiversity Assessment (GBA), produced in 1995 by a large group of (predominately western and natural) scientists, is but one example (see e.g. Watson 2005; Le Prestre 2002). This is not to say that SBSTTA is hermetically cut off of any reasonable knowledge input—it remains somehow open to science and other knowledge claims. However, there exists no systematic process that ensures the traceability and accountability of different knowledge claims to their respective origin. Instead, the processes by which scientific and other type of knowledge is incorporated into SBSTTA are often described as not transparent, fuzzy, unsystematic, ineffective, and even biased (personal communication with national delegates; see also Le Prestre 2002). In fact, the lack of systematic collaboration of SBSTTA with other scientific organisations has been another of its frequently stated shortcomings (CBD 2006b; 2005; Miller 2003; Le Prestre 2002). "This factor is crucial because there is no external independent body of experts on the issues covered by the CBD, unlike the IPCC in the case of the UNFCCC's SBSTA. [49] In the absence of such collaboration, states and large NGOs become the source of scientific expertise." (Le Prestre 2002, p. 106) The 'grey zone' regulating SBSTTA's input has led to a politicisation of what scientific knowledge will enter SBSTTA and what not, as political advocates, tend to selectively use and misuse scientific data to support their respective agendas (Pielke 2002).

For the time being the SCBD plays the central role in the selection, compilation and provision of scientific knowledge to SBSTTA and the CBD as a whole. Based on, sometimes vaguely formulated, requests from CoP to SBSTTA (CBD 2005) the SCBD sets out the framework, approach, and tone of each official preparatory document; it provides background information on the basis of which the AHTEGs and Liaison Groups initiate their work; it selects consultants that support its work, formulates the questions to be posed in electronic forums; decides (if not prescribed explicitly by the request coming from the CoP) which are the relevant bodies to cooperate with; and relies on its own (or on each of the desk officer's) ad hoc networks of experts for the 'peer-review' of documents. There might be good reasons to strengthen the role and influence of international convention secretariats (see e.g. Siebenhüner 2006; Andresen and Skjærseth 1999; Le Prestre 2002), but whether that should include reinforcing its role as knowledge broker is questionable. The SCBD, however, while employing highly skilled professionals, is not a scientific institution. It is part of the political regime of the CBD and its primary role remains to organise and manage the Convention's processes on behalf of the Parties to which it is accountable. Thus, in fulfilling its role, the SCBD follows a political rationality rather than a scientific one—e.g. trying to balance interests between the parties. And given the consensual paradigm that underlies the negotiation processes in the CBD, this balance is often biased towards the "troublemakers". Therefore, in anticipation of what the positions of Parties might be, the information provided by the SCBD is not always offered as "free, frank and fearless" scientific information, but has already undergone a political filtering process (personal communication with national delegates and members of the SCBD).

However, as stressed above, it is essential for democratic societies to allow for debates about a whole range of possible policy alternatives. Regarding SBSTTA it might therefore be useful to consider providing insight in a more systematic way through independent, authoritative institutions from outside the CBD regime, so that the choices available to policy-makers are expanded. What SBSTTA needs in terms of input to its work is scientific knowledge which reveals "to wider policy discourses the detailed implications of different sources of information and the role of different disciplines, divergent social values and conflicting interests in conditioning disparate interpretations of the available evidence." (Stirling 2006: 101) In short: the 'plural and conditional' advice taking into account all relevant knowledge claims that Stirling sees emerging from processes that aim at the 'opening up' of policy processes, providing a range of policy choices based on context-related policy analyses.

The International Mechanism of Scientific Expertise on Biodiversity currently under discussions could provide an excellent opportunity to answer such needs (www.imoseb.net; also see Goerg et al. 2007). Systematic collaboration between such more scientific science–policy interface and SBSTTA, providing such 'plural and conditional' advice for example to the SCBD for

[49] The UNFCCC SBSTA refers explicitly to the IPCC as one of its main sources of scientific information.

the elaboration of SBSTTA's central official documents, would allow for the joint development of a so-called boundary object—one of the very effective elements of science–policy interfaces (Guston 2001; Cash et al. 2003) To reach fruitful synergies among possible institutions, an IMoSEB would have to take into account the specific needs of SBSTTA and other subsidiary bodies of scientific advice of biodiversity-related conventions and discuss how these could best be met. On the other hand SBSTTA/CBD and the other conventions [50] would have to implement procedural changes in order to ensure for a systematic input of such scientific information.

5.6
Conclusion

To summarise, we argue that to improve and highlight SBSTTA's role as a science–policy interface, it is necessary to accept the political nature and role of SBSTTA. Doing so opens a way out of the controversy and leads to alternative ways to enhance SBSTTA's effectiveness as a science–policy interface that go beyond the (so far fruitless) attempts of making SBSTTA more scientific. There are two promising ways to improve SBSTTA's quality: First, the improvement of SBSTTA's scientific foundations through engagement in more systematic institutional arrangements with more scientific-oriented science–policy interfaces outside the formal CBD regime. Such more scientific interfaces would provide plural and conditional advice e.g. in form of a range of policy options. Second, procedures should be developed and implemented allowing for a more substantive and informed political debate over such alternative policy choices during SBSTTA's meetings, better revealing underlying conflicts of values and interests. Both measures, particularly the latter, require significant reform of SBSTTA's procedures. While, in principle, SBSTTA has been given the ability to do so by being mandated to continuously "improve the quality of its advice by improving scientific, technical and technological input into, debate at, and work of, meetings of the Subsidiary Body", [51] the example of the procedural innovation for introducing new and emerging issue to SBSTTA's agenda sheds some light on how difficult such a reform might be in practice. On the other hand, the political deadlock at SBSTTA 13 and the warnings calling the SBSTTA and the CBD itself into question might stimulate the necessary urgency to engage in more fundamental reforms which would still be within the scope of the existing Article 25 and hence in accordance with the text of the Convention. In any case, finding ways and means to enhance the science–policy interface for the CBD and biodiversity governance means further discussions within and outside the CBD regime. With this paper we hope to have contributed some arguments to these important debates.

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50 Six international conventions focus on biodiversity issues: the CBD, the Convention on Conservation of Migratory Species (CMS), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the International Treaty on Plant Genetic Resources for Food and Agriculture, the Ramsar Convention on Wetlands, and the World Heritage Convention (WHC).

51 Decision VIII/10, Annex III, paragraph 4.

6

Building better science-policy interfaces for international environmental governance: Assessing potential within the Intergovernmental Platform for Biodiversity and Ecosystem Services

Koetz, T., Farrell, K.N., Bridgewater, P. (2011). Accepted for publication
in International Environmental Agreements: Politics, Law and Economics

6.1
Introduction

This article addresses implementation failure in international environmental governance: defined as 'failure to achieve aims and objectives stated in international environmental agreements'. One of the starkest recent examples is failure to fulfil the 2002 decision [52] to "achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level." While many factors influence such failures, we focus here on one key factor central to environmental governance and yet poorly understood: the role that different institutional configurations of science-policy interfaces play in either contributing toward or resolving implementation failures.

Drawing on Vatn (2005) and Young (2008), we define science-policy interfaces as institutional arrangements that reflect cognitive models and provide normative structures, rights, rules and procedures that define and enable the social practice of linking scientific and policy-making processes. They assign roles to scientists, policy-makers, other relevant stakeholders and knowledge holders and help guide their interactions according to specific principles and purposes. If both the activities of making science, viewed as the systematic pursuit of knowledge, and of making policy (politics), viewed as the process of bargaining, negotiation and compromise (Pielke 2007) are influenced by institutional structures, then, by extension their interactions should also

[52] http://www.cbd.int/2010-target (accessed 24 Jan. 2010)

be understood in institutional terms. In this paper we aim to provide better understanding of how the configuration of science-policy interface's institutional arrangements is related to the effectiveness of international environmental agreements they are intended to support.

Following Vatn (2005), we understand institutions to be comprised of the cognitive models, normative structures and behavioural constraints that shape human interactions. Cognitive models, creating common frames of references and classifying relevant behaviour, "constitute the basis for creating necessary meaning and order so that cooperation becomes possible" (Ibid, p. 206). Normative structures create "the pressure placed on individuals to fulfil certain obligations and expectations" (Ibid, p. 207) that result from common values and the identification of normatively appropriate behaviour. And behavioural constraints resemble more general, often pre-given 'rules of the game' (Ibid, p. 205).

Science-policy interfaces have always been a part of governance (Jasanoff 1990; Toulmin 1990; Gould 2003), and they have come to play a decisive role in environmental governance (Young 2004; Miller and Erickson 2006; Pielke 2007), where they "are rapidly emerging as key elements" (van den Hove 2007, p. 808). International environmental governance deals with complex, urgent realities of environmental degradation and resource conflicts. Here international tensions are the rule rather than the exception, 'facts are uncertain, values in dispute, stakes high and decisions urgent' (Funtowicz and Ravetz 1991) and conventional wisdom for organising dialogue between science and policy making is challenged in unprecedented ways (Farrell 2008). However, formal understanding regarding which science-policy interface institutions are most appropriate for which types of environmental governance situation is still very limited.

Focusing on what Young (2009) calls *institutional mismatches* - incompatibilities between the nature of a governance problem and the institutional arrangements established to address it - we suggest these may help explain why some science-policy interface configurations turn out to be ineffective. To investigate this possibility we work with the analytical categories of *credibility*, *relevance* and *legitimacy*, which Cash et al. (2003), based on the historical analyses, propose are key for judging the effectiveness of science-policy interfaces (see Figure 1): *credibility* reflects the perceived validity of information, methods and procedures provided and applied via a science-policy interface;

relevance reflects the extent to which the work carried out within a science-policy interface is responsive to the conditions and needs of the policy process; and legitimacy reflects the perceived fairness, balance and political acceptability of its outputs.

Using these ideas as a conceptual frame, we focus our analysis on the nascent Intergovernmental (science-policy) Platform on Biodiversity and Ecosystem Services (IPBES): one attempt to address *institutional mismatches* in the international biodiversity governance science-policy interface arena. We seek to identify ways in which it may be possible for changes in the configuration of the IPBES to improve its effectiveness and therewith that of international biodiversity governance.[53] Employing this combination of Vatn's definition of institutions, Young's concept of institutional mismatches and Cash et al's criteria for evaluating the effectiveness of science-policy interfaces (see Figure 1), we explore, on the one hand (i) how institutional mismatches arising with the science-policy interface arrangements set out in the Busan Outcome[54] (UNEP 2010) may impede the effectiveness of the IPBES and, (ii) on the other, to what degree the IPBES institutions specified in that agreement might serve as precedents for addressing institutional mismatches in global biodiversity governance.

53 We note that existence of an appropriate SPI does not ensure more effective environmental governance and are in agreement with van den Hove and Chabason (2009, p. 8) when they argue that, "while the existence of well-functioning SPIs is a necessary condition of biodiversity and ecosystem services governance, it is in no way a sufficient condition."

54 The Busan Outcome is an international environmental governance agreement reached at the "Third ad hoc intergovernmental and multi-stakeholder meeting on an intergovernmental science policy platform on biodiversity and ecosystem services", which took place in Busan, Republic of Korea, 7-11 June 2010 [see http://www.unep.org/pdf/SMT_Agenda_Item_5-Busan_Outcome.pdf (accessed 26 Mar., 2011)] or Appendix 1 of this article. The terms of the Busan Outcome constitute the official, internationally negotiated basis upon which the operationalisation the IPBES will proceed. They have been endorsed by the Tenth Conference of the Parties to the Convention on Biological Diversity, which met in Nagoya, Japan, 18-29 October 2010, in its Decision VI, concerning Agenda item 4.3 [see http://www.cbd.int/cop/cop-10/doc/advance-final-unedited-texts/advance-unedited-version-ipbes-en.doc (accessed 26 Mar. 2011)] and on that basis have been designated by the 65th Session of the United Nations General Assembly, in Assembly Resolution A/C.2/65/L.43, Item 19, p.4, as the principles that should guide the establishment of the IPBES [see http://daccess-dds-ny.un.org/doc/UNDOC/LTD/N10/634/99/PDF/N1063499.pdf?OpenElement (accessed 26 Mar., 2011)].

6.2 Institutional mismatches of science-policy interfaces impeding environmental governance

Alarmed by the discrepancy between commitments and action in international environmental governance, in 2009 the United Nations (UN) General Assembly commissioned a round of '[i]nformal consultations of the General Assembly on the institutional framework for the UN's environment work'.[55] Based on the results of these consultations, the Executive Director of the UN Environment Programme concluded that "the current system is inadequate to meet the environment and development challenges we are experiencing today, primarily due to lack of adequate financing, incoherence among bodies, weak linkages between science and policy, insufficient capacity at the national level to implement laws and policies, and a significant disconnect between the environmental and the economic and social spheres."[56] This statement identifies several areas for addressing implementation failures in global environmental governance, including the institutional structures of science-policy interfaces: "linkages between science and policy." Starting with a basic view of these institutions, informed by Vatn's (2005) definition, and using Young's concept of institutional mismatches, we can begin to identify obstacles to establishing more effective science-policy interface institutions to support implementation of international environmental agreements.

Following Young (2004, p. 215), since institutions are social constructions, "the[ir] establishment or refinement … involves acts of creation rather than processes of discovery." So we expect to find science-policy interface institutions "bearing the stamp of theories, discourses, ideologies, or, more generally, patterns of thought that were influential at the time of their formation (Ibid)." The combination this institutional history and the complexity of biodiversity governance places us within what Funtowicz and Ravetz (1991) call the domain of post-normal science, 'where facts are soft and values hard' (Funtowicz and Ravetz 1990). However, in global biodiversity governance creative thinking – theories, discourses and ideologies – that is being used to develop new science-policy interface institutions is still largely based on conventional assumptions that science produces hard facts and that these inform value-laden political decisions. By failing to take the complexity of this context into account the agreements shaping international environmental governance's science-policy interface institutions harbour unrealistic expectations that scientists should server as 'Truth Sayers', in spite of strong indications that here scientists can hope, at best, to be 'Honest Brokers': collaboratively engaged, with policy makers, in a constructive search for potentially suitable policy alternatives (Pielke, 2007).

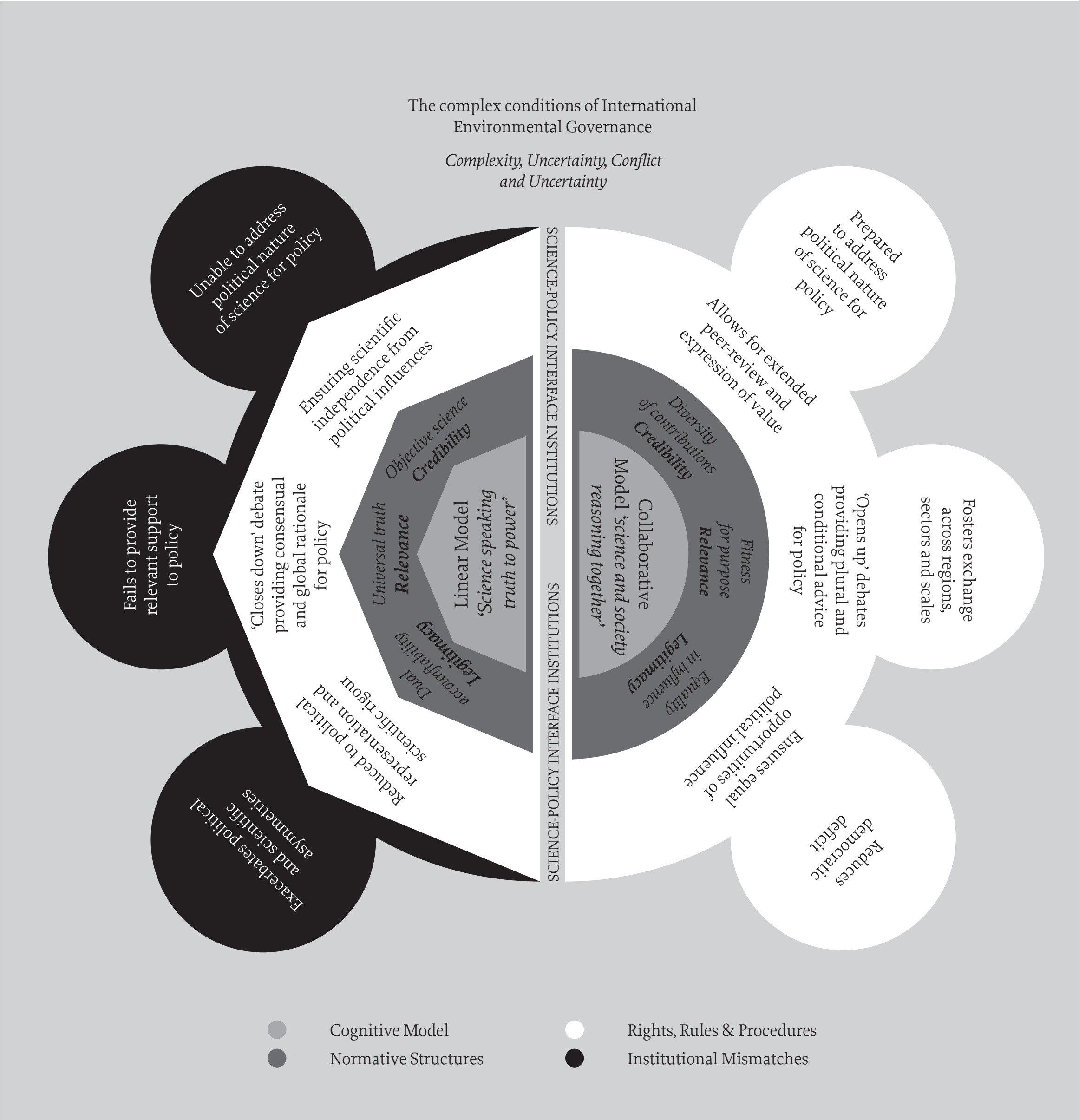

Figure 02 Mismatch and match of linear vs. collaborative Science-Policy Interface Institutions

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55 See http://www.un.org/ga/president/63/PDFs/ReportIEG100209.pdf (accessed 13 Feb. 2011)

56 http://www.unep.org/environmentalgovernance/LinkClick.aspx?fileticket=UQnLonMBYKQ%3D&tabid=341&language=en-US (accessed 13 Feb. 2011)

6.2.1
The linear model in environmental governance

The view of science-policy interrelations to be found in most international environmental agreements can be understood to follow what Pielke (2007) describes as the 'linear' cognitive model of science-policy interfaces. Following Pielke (2007, p. 12), we can distinguish between two aspects of this model: a general aspect, concerning how to make decisions about science, based on the idea that knowledge flows "from basic research to applied research to development and ultimately societal benefits" and an applied aspect, which provides guidance concerning the role of science in decision making, suggesting that consensus on science will lead to consensus in politics and so to coordinated action [6]– i.e. "that specific knowledge or facts compel certain policy responses." (Pielke 2007, p. 12)

This linear cognitive model is based on belief in a clear distinction between 'objective knowledge' and 'subjective values' (Weingart 1999) and presumes politically neutral scientists 'speak truth to power' (Weingart 1999), providing objective representations of reality, upon which decision-makers take rational decisions subsequently implemented by administrators. Science is perceived as providing clear, 'hard' and objective facts, based on evidence and universal descriptions of reality, and policy is seen as the product of a rational, technically informed, instrumental decision process that moves through the distinct stages of agenda setting, decision-making and implementation (Hill 1997). Turning to the three domains of science-policy interface effectiveness proposed by Cash et al. (2003) – credibility, relevance and legitimacy – we now consider how the normative structures that emerge from this linear model help to shape expectations about the effective of science-policy interface institutions.

Beginning with *credibility*: on what basis are (i) the methods and procedures of a linear model based science-policy interface and (ii) the information generated through its activities, perceived to be valid? Here Young (2004, p. 220) observes a "built-in preferences for knowledge claims that can be justified as products of procedures conforming to mainstream conceptions of science." According to his study of international environmental governance regimes, scientific knowledge is systematically perceived as more *credible* than, for example, traditional ecological knowledge, with greater credence granted to those "arguments … presented in the form of scientific analyses." (Young 2004, p. 221) A normative standard for determining the credibility of linear science-policy interface institutions is, then, the degree to which they rely on peer-reviewed scientific knowledge and preserve scientific independence from political influences.

Turning next to *relevance*: how is the work carried out within a linear model based science-policy interface expected to be responsive to the conditions and needs of the policy process it is intended to support? Here *relevance* depends on the extent to which institutions are able to provide consensual, objective and universalizable (i.e. globally valid) rationales for policy action (sic. Lövbrand et al 2009). Hajer and Wagenaar (2003) also observe a 'Russian doll' conception of political institutions in environmental governance that reflects linear model presumptions about relevance, where different organisational levels of governance are presumed to fit neatly one into the next and "global solutions, which are then cascaded down through national, and implicitly sub-national, arenas of governance." (Bulkeley 2005, p. 879).

Finally, with respect to *legitimacy*: how are the outputs and procedures of a linear model based science-policy interface deemed to be fair, balanced and politically acceptable? The *legitimacy* of any science-policy interface institution depends on links to the two life worlds from which it is constituted, i.e. science and politics (Guston 2001). With respect to politics, the linear model, with its origins in modern western philosophy, implicitly presumes a democratic politics. Here political legitimacy is usually established through representative or delegated power, legitimised by public consent, normally through elections (Weingart 1999). With respect to science the linear model collapses legitimacy into a more general authority, indeed responsibility, for science to 'speak truth to power.' In this way standards for judging the legitimacy of science-policy interface institutions are restricted to the matter of appropriate political representation, with the question of scientific legitimacy being referred back to domain of credibility, which is expected to ensure that what scientists speak to power is indeed the truth.

6.2.2 The complex conditions of international environmental governance

While the linear model of science-policy interrelations has served both science and politics well over the years, it is suitable only in the simplest of decision contexts (Pielke 2007) – where the issue in question "can be adequately captured using a single perspective or description and by a standard model providing a satisfactory description or general solution through routine operations." (Gallopín et al. 2001, p. 7). In contrast, international environmental governance tends to be complex, uncertain and controversial, entailing a multiplicity of legitimate perspectives and discourses laden with conflicts over facts, interests and values. These cannot be adequately represented using a single perspective or description or by a single standard model, or general solution.

Re-thinking the interrelations of science and policy in this context of complexity and uncertainty, Nowotny et al. (2001, p. 21) argue that "contemporary society is characterised – irreversibly – by pluralism and diversity" and that "the great categorisations of the human enterprise produced by successive revolutions of modernity – scientific, political, cultural, industrial – around which the contemporary world is organised now appear to be either in flux, eroded or socially contested." Although science and politics are characterised by different discursive processes, rationalities, and norms (Jasanoff and Wynne, 1998; Miller, 2001; Pohl, 2007), they are far from being sharply differentiated 'pure types' of social activities (van den Hove, 2007). Instead, scientific and political practices have been shown to interact over a whole range of domains, through the constant intermingling of processes, products and actors, to the extent that scientific knowledge and political order can be understood to co-evolve (Toulmin, 1990; van den Hove, 2007; Nowotny et al., 2001; Jasanoff and Wynne 1998).

In international environmental governance, where there is irreducible uncertainty about the facts problem and multiple legitimate perspectives concerning what is at stake, fact claims and value judgements can no longer be meaningfully distinguished from one and other (Funtowicz and Ravetz 1993). Addressing seemingly technical questions, such as which disciplines, methodologies, scales, variables, thresholds or boundaries should be employed to analyse, for example, a biodiversity management problem depends so heavily on how the problem is framed that the results of the scientific analysis cannot be treated as if they were isolated from their social-political (i.e. institutional) contexts (van den Hove 2007; Farrell, 2005; 2008). In these situations the production of scientific truth is more appropriately conceptualised as a concrete form of political power (sic Jasanoff, 1990; Farrell, 2008), wielded in complex political conditions, where there is "uncertainty in the knowledge base, differences in framing the problem, and … inadequacy of the [linear model based] institutional arrangements at the science-policy interface" (van der Sluijs et al. 2005, p. 481). Under these conditions, new institutional structures are required, because "the peer community reviewing the quality of a piece of scientific analysis is *automatically* extended [beyond the scientific community]" (Farrell (2011, p. 311 *emphasis added*).

6.2.3 Alternative models to interfacing science and policy

In recent years a number of alternatives to the linear model have emerged. [57] Two features common to all these alternatives are: (i) questioning the presumption that there is always a clear separation between facts and value and (ii) reference to some form of 'stakeholder model' (Pielke 2007, p. 14) that presumes complex interrelations between science and policy and recommends deliberation, collaborative evaluations and critiques that reach across epistemic frameworks. Here, the linear model aim of 'speaking truth to power' is replaced by the collaborative aim of 'reasoning together' [6](Jasanoff 1998).

Returning to the science-policy interface effectiveness criteria proposed by Cash et al (2003) – credibility, relevance and legitimacy – we can now consider how these apply for a collaborative model. Starting with *credibility*: on what basis are (i) the methods and procedures of a collaborative model science-policy interface and (ii) the information generated through its activities, perceived to be valid? Here respect for complexity, of both science-policy interrelations and environmental governance issues is required. As Miller and Erickson (2006, p. 300) put it, credibility can be judged here based on how well a science-policy interface performs the "stitching together [of] multiple knowledge systems that encompass divergent paradigms." This requires institutional structures and processes that provide for the presence of different knowledge claims and for negotiations regarding which assumptions, choices, uncertainties and limits will be used to develop collaborative outputs (van den Hove 2007). The credibility of science-policy interface outputs

[57] See for example, Jasanoff 1990; Latour, 2005; Nowotny et al. 2001; Pielke 2007; Funtowicz and Ravetz 1990; Kates et al 2001; van den Hove 2007; Farrell 2005.

no longer depends only on technical verification of correctness (the role of conventional scientific peer review) but also on the negotiated agreement of an extended peer community: concerned not only with factual accuracy but also with representativeness, appropriateness and relevance.

Here "science has exceedingly little capacity to reconcile differences in values" (Pielke 2007, p. 137). Credibility claims based on objectivity are replaced by claims based on usefulness: what Funtowicz and Ravetz (1992, p. 964) have called "fitness for purpose". In the complex situations of international environmental governance, characterised by conflicts over values and encumbered with inherent technical uncertainties, "policy-makers frequently need new options, and not more science" (Pielke 2007, p. 140). With this shift the credibility a science-policy interface's outputs, no longer based solely on peer-review but also on the judgements of an extended peer community (sic Funtowicz and Ravetz, 1990; 1992), becomes directly linked to its *relevance*, leading us to ask, on what basis can the responsiveness of a collaborative model science-policy interface be measured? In contrast to the linear model, which presumes the relevance of the science-policy interface to be related to generating objectively universalisable facts that assist decision makers in 'closing down' policy debates, scholars such as Funtowicz and Ravetz (1990), Pielke (2007) and Stirling (2006) suggest a need for collaborative institutions that facilitate an 'opening up' of policy development processes: providing decision makers with "plural and conditional advice: systematically revealing how alternative reasonable courses of action would appear preferable under different detailed 'framing assumptions' and showing how these dependencies relate to the real world" (Stirling 2006, p. 101). The presumption that scientific knowledge is automatically superior knowledge is replaced by the idea that all knowledge is conditional, positional and potentially relevant. Relevance no longer depends on reinforcing the scientific objectivity and universalisability of procedures and outcomes but on ensuring that they adequately represent the diversity of perspectives from which the policy problem can be viewed. As Jones (2002, p. 248) puts it: "Attention needs to be turned away from trying to ascertain 'objective conditions' through more data and better science, towards understanding the plurality of constructions, how various assertions are made, how these are related to various interests of stakeholder groups and how outcomes are affected by power relations."

As relevance becomes more closely linked to representativeness, it becomes linked to *legitimacy*. Here, we can ask, on what basis might collaborative model based institutions be perceived as fair, be balanced in their judgements and be expected to generate politically acceptable outputs? With regard to fairness, but also closely linked to the question of relevance, under a collaborative model science-policy interfaces concerned with questions of international environmental governance would need to include not only the voices of scientific experts and national representatives but also those of stateless, inter- and transnational actors with specific claims to represent *either* relevant knowledge or pertinent political viewpoints. Here substantial difficulties arise regarding how to decide who may sit at the science-policy interface table, since there is very little provision made in modern democratic theory for this type of complex, multi- and inter-scale representation (sic. Farrell 2004; 2005). While it is beyond the scope of this paper to attempt to resolve all these difficulties, which strike at the heart of modern democratic theory (sic Pellizzonni 2003; Farrell 2005), it seems clear that science-policy interface institutions based on a collaborative model would need to move beyond the objective of negotiation and consensus building, to include formal provisions for building trust among a diverse set of actors who can not be expected to achieve parity of perspective but must nonetheless, somehow concur. Institutions reflecting a collaborative model of science-policy interrelations will require more than just representative political participation and more than just 'objective' scientific advice. Drawing on Rawls (1993) and Sen (1992), Knight and Johnson (1996, p. 296-299) argue that, in discursive democracy, political equality depends upon equal opportunity of political influence. In the context of a collaborative model, we can understand this to mean equal access on the part of all actors to the aggregated resources of a science-policy interface discourse, including, for example, access to *both* best available scientific and established, relevant traditional knowledge. Here it is important to keep in mind that we are talking about a two-way project of trust and capacity building. That is to say, the legitimacy of a collaborative science-policy interface for international environmental governance would depend not only on the ability of indigenous peoples to trust and collaborate effectively with scientists and policy makers but also on the ability of scientists and policy makers to trust and collaborate effectively with indigenous peoples, showing respect and regard for their knowledge claims, in spite of perhaps having difficulties understanding them.

6.2.4
Institutional mismatches

Recalling Young's definition of institutional mismatches (i.e. incompatibilities between the nature of a governance problem and the institutional arrangements established to address it), we suggest that there is a mismatch between the operating condition and the institutional arrangements for interfacing science and policy in international environmental governance. Specifically, we propose that arrangements based on a linear model view of science-policy interrelations are being employed in complex situations that call for use of a collaborative model view, and that this undermines the credibility, relevance and legitimacy, and thus the effectiveness of the associated science-policy interfaces.

Returning once again to the attributes of credibility, relevance and legitimacy, we can now consider how this mismatch plays out in practice. Starting with credibility, one of the most fundamental problems arising at the science-policy interface in international environmental governance is an inability to address adequately the increasing politicisation of science for policy (Pielke 2007; Farrell, 2011; Hulme and Mahony 2010). Recalling the respective credibility criteria for the linear and collaborative models outlined above, it is possible to explain this inability as a symptom of the continued application of a linear model based approach under conditions that require a collaborative model response. That is to say, in spite of much rhetoric regarding the need to open up discourse, current science-policy interface institutions for international environmental governance, such as the Intergovernmental Panel on Climate Change (IPCC), still tend to reflect the presumption that it is always possible to distinguish clearly between facts and values and to preserve scientific independence from political influences. Because they exclude the possibility that the blurring of facts and values and politicising of scientific results is at times inevitable, linear model based science-policy interfaces are ill-equipped to manage the political controversies that accompany the presence of a plurality of legitimate but contradictory knowledge claims (Funtowicz and Ravetz 1993; Farrell 2005). When the inevitably political character of these science-policy interfaces is not taken into account and the credibility of the outputs continues to depend on the professional standing of the contributing scientists, real political advantage is conferred on the scientific position (sic Farrell, 2011). Under such conditions, it is hardly surprising that science becomes more and more used as a *tool of politics* as opposed to continuing to fulfil its traditional role of *informing policy*, with the result that "political battles are played out in the language of science, often resulting in political gridlock and the diminishment of science as a resource for policy-making." (Pielke 2007, p. 10)

Turning next to the question of *relevance*, again we find a more or less *de facto* continuation of the linear model as a guide for the institutional design of science-policy interface's for international environmental governance. Often the focus is on the identification of global, universal problems, with global agenda setting and general policy formulation and little detail regarding policy implementation and analysis. This is well illustrated e.g. in the recent evaluation of the fourth Global Environment Outlook (UNEP 2009b, p. 6), which finds that "shifting demands for information – from problem identification … towards providing policy options" constitute a key challenge for ensuring the report's relevance. Trying to be policy relevant but not policy prescriptive, the reports generated by these science-policy interface's tend to eschew value-laden analysis concerning how recommendations may affect people's daily lives (Pielke 2007; Norgaard 2008), focusing instead on global and universal points, which are presumed to be the appropriate domain of objective scientific advice. However, global resolution of complex issues does not automatically 'cascade' down to regional, national or local levels of social organisation, but is subject to a number of scale-related effects: e.g. differing socio-economic and political contexts lead to different interpretations of priorities and policy instruments, compliance enforcement and knowledge systems vary from place to place, leading to different approaches to implementation (Young 2006). Failure to adequately address the sub-global level in policy development can be related to linear model thinking, which presumes that scientifically based solutions are globally relevant and thereby universally applicable. Policies developed without appreciation for how they will be evaluated, interpreted and implemented in diverse knowledge cultures, and without place specific relevance often do not yield anticipated results. As Jasanoff and Martello (2004, p. 5) have emphasised, "global solutions to environmental governance cannot realistically be contemplated without at the same time finding new opportunities for local self-expression."

We also find the *legitimacy* of science-policy interfaces of international environmental governance compromised by institutional mismatches that are linked to continued reliance upon linear model based institutional designs. Here, for example, asymmetries between how science serves particular interests in the North vs. in the South (Görg et al. 2007; Karlsson et al. 2007; Biermann 2000) illustrate how linear model based claims to legitimacy, which are basically appeals to scientific objectivity, serve to reinforce particular political relations, thereby undermining collaborative legitimacy. Based on studies of the influence of global environmental assessments on international environmental negotiations (including the Global Biodiversity Assessment), Biermann (2000) argues that while there are situations where there is no bias in a number of instances the influence of these assessments has been to the disadvantage of, or oblivious to, the interests of the global South. Here reliance on the presumption that all good science is objective, equally valid and generalisable, in a situation more appropriately addressed using a collaborative model, reinforces an illegitimate distribution of power. With respect to the complex problems of global environmental governance, science has lost its claim to legitimacy based on objectivity, yet power is still being vested in those who claim this scientific form of authority, perpetuating, even exacerbating the democratic deficit of international environmental governance (Miller and Erickson 2006; Biermann 2000). Indeed, the legitimacy of many prominent international institutional arrangements for interfacing science and policy have recently been called into question in, particularly by countries of the global South, for whom, as Najam (2005) argues, legitimacy is a primary concern, as they consider themselves to be systematically disempowered, marginalized, and disenfranchised in global forums.

6.3
Attempts To Address Complex Conditions

There is growing recognition of the need to design science-policy interfaces that engage effectively with the complexity of current global environmental problems and both cognitive and procedural shifts towards new, complexity-sensitive ways of interfacing science and policy are evident in both science and in governance (e.g. Lubchenco 1997; UNEP 2009c). The institutional evolution of the IPCC over the past 30 years, for example, has included, for example, major revision of the review procedures and accommodation of more diverse regional sources of knowledge (Siebenhüner 2002; Hulme and Mahony 2010). Similarly, the Millennium Ecosystem Assessment (MA) and its follow-up initiative (ICSU 2008) have introduced mechanisms to allow for incorporation of traditional, indigenous, and practitioners' knowledge and for execution of scale-dependent analyses (Norgaard, 2007; 2008; Reid et al. 2006). Further indications of ongoing cognitive as well as structural shifts towards a more collaborative model can be seen in the more general reform of international environmental governance currently underway.[58] Important developments in this area include: (i) the Environment Watch Strategy for strengthening the scientific base of UNEP (UNEP 2009c, p. 12), and (ii) the Bali Strategic Plan for Technology Support and Capacity-Building (UNEP 2005), in which the international community agreed to provide a more coherent, coordinated and effective delivery of environmental capacity-building and technical support.

These reforms suggest a broad shift in global environmental governance, toward a more collaborative model of science-policy interrelations, where "scientists [and policy makers] use deliberative, democratic approaches in order to learn together and develop a shared understanding of complex systems" (Norgaard 2007, p. 381). However, in spite of widespread critique (Funtowicz and Ravetz 1993; Nowotny et al. 2001; Pielke 2007), the underlying assumptions of the linear model are still implicit in much of the global environmental policy discourse (Pielke 2007; Keller 2009; Owens 2005). The IPCC "has [, for example,] come under heightened scrutiny about its impartiality with respect to climate policy and about the accuracy and balance of its reports" (IAC 2010, p. xii): critiqued for being "no longer fit for purpose ... to deliver an exhaustive 'integrated' assessment of all relevant climate-change knowledge" (Hulme 2010, p. 730). Similarly, Norgaard (2008, p. 251), reflecting on his experience in the Millennium Ecosystem Assessment, proposes "the problem is that earlier, narrow concepts about the nature of science still dominate and have structured our social organisation such that our efforts to coordinate our understanding and adapt it to the problems at hand are always seriously constrained."

[58] This reform process was triggered by the 2000 Malmø Ministerial Declaration (UNEP 2000 Governing Council decision SS.VI/1; Annex), which called to review the requirements for a greatly strengthened institutional structure for international environmental governance, and the UN General Assembly resolution on the 2005 World Summit Outcome (General Assembly resolution 60/1 of September 2005, paragraph 169), setting the agenda for a UN system-wide coherence and reform.

This is an expected feature of institutional mismatch situations. Young (2008) notes that established institutional paradigms can be highly resistant to change and institutional mismatches can be difficult to eliminate – even where there is general awareness of mismatches and their consequences. He proposes three causal explanation for this persistence: (i) limited systemic knowledge gives rise to 'false analogies,' assuming that institutional arrangements that are successful in one context will work well in other settings, (ii) path dependency constrains institutional change as "stakeholders become attached to the way things are done, existing social practices become routines, and the status quo turns into the default option" (Young 2006, p. 13), and (iii) political resistance towards institutional change emerges as "some actors or interest groups may well benefit, at least in the short run, from maintaining or even nurturing the growth of misfits" (Young 2008, p. 29). In ongoing attempts to address the institutional mismatches outlined above instances of all three of types of obstruction to change can be observed.

As processes interfacing science and policy move toward more conceptual and methodological pluralism, Miller and Erickson (2006, p. 310) remind us to expect "resistance among those who see the current impasse on climate change and biodiversity loss primarily in terms of either a failure by scientists to communicate the true extent and consequences of global environmental risks effectively or the unwillingness of political leaders and public to undertake necessary economic, social, and political reforms." Norgaard (2008, p. 238) goes further, predicting "a period of great backlash where special interests are using older, narrower beliefs about science and governance to attack the new, not to replace them with the old but rather to replace rational governance with raw power politics."[59] In light of the emergence of these complex political/science conditions in international environmental governance, Farrell (2011, p. 311) argues, "the question is not if, but how peer-review relationships between scientists and non-scientists can be managed in ways that favor production of good quality descriptions of complex problems." Addressing this question, Norgaard (2008, p. 238) reminds would-be designers of science-policy interfaces "to step back and see the big picture before developing recommendations about science and environmental governance," which is what we aim to do in the following section.

6.4 The IPBES a Science-Policy Interface For International Biodiversity Governance

Against the broader background presented above, we now consider the specific case of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), which the 65th session of the UN General Assembly requested be operationalised at the earliest opportunity (summarised in Table 1).[60] Final negotiations over the modalities and institutional arrangements of the IPBES will be based on the Busan Outcome, agreed in Busan, Republic of Korea in June 2010, which reflects the results of a series of three ad hoc intergovernmental and multi-stakeholder meetings held in November 2008, October 2009 and June 2010.[61] These three meetings were convened in response to international debate on how to improve interrelations between science and policy for international biodiversity governance, which have taken place against the backdrop of continuing degradation and loss of global biodiversity (Loreau and Oteng Yeboah 2006).[62]

Key issues of this debate are reflected in a gap analysis on science-policy interface in biodiversity governance, undertaken by UNEP (2009a) and in the following comment from van den Hove and Chabason (2009, p. 3), drawn from discussion paper summarising the IPBES debate: "Over the last two decades, our understanding and framing of the biodiversity issue has shifted from an approach focusing primarily on species, habitats and conservation, to a holistic approach focusing on conservation and sustainable uses of biodiversity and ecosystem services. This shift has created new challenges both for understanding and for policy-making. In particular, it generates the need to reinforce the knowledge and support available to decision-makers in a manner adapted to the characteristics of the issue –i.e. complexity, multiple causalities, multiple scales and cross-sectorality– and to our governance and policy ambitions."

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59 On this point see also Farrell, 2008.

60 A/RES/65/162, document A/65/436/Add.7; http://www.un.org/News/Press/docs//2010/ga11040.doc.htm (accessed 12 Feb. 2011)

61 A first meeting was held in Putrajaya, Malaysia, in November 2008, a second meeting was held in Nairobi, Kenya, in October 2009, and a third meeting was held in Busan, South Korea, in June 2010. For more information on the IPBES process see http://ipbes.net.

62 A French initiative that, during 2006 and 2007, prompted a series of studies, international and regional meetings, and statements exploring the needs, scope and options of an International Mechanism of Scientific Expertise on Biodiversity (http://www.imoseb.net); and the Millennium Assessment (MA) follow-up process, which was established as a response to the recommendations of two independent evaluations of the MA.

Among the key findings of the UNEP (2009a, p. 5-7) gap analysis were: (i) missing or incompletely implemented frameworks, (ii) lack of regular processes providing periodic, timely and policy-relevant information, and (iii) insufficient coordination across the wide range of science-policy interfaces for the many multilateral environmental agreements and other bodies related to biodiversity and ecosystem services.

6.4.1
The IPBES' potential to address institutional mismatches

In the Busan Outcome (UNEP 2010), which is the official negotiated agreement reached during the final of the three ad hoc intergovernmental and multi-stakeholder meetings mentioned above, it is agreed that the IPBES should "be scientifically independent and ensure credibility, relevance and legitimacy through the peer review of its work and transparency in its decision making process" (UNEP 2010, p. 5). These presumptions, that science supporting international biodiversity governance can be independent from political influence and that conventional peer-review can ensure the credibility and legitimacy of the IPBES, reflect a continuation of linear model thinking. However, the same text also proposes that the IPBES should "use clear, transparent and scientific credible processes for the exchange, sharing and use of data, information and technologies from all relevant sources, including non-peer-reviewed literature, as appropriate" and "recognise and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems" (UNEP 2010, p. 5). This reflects an appreciation for the complexity of the IPBES context and a commitment to adopt a more collaborative approach. By establishing rules and procedures that enable the recognition and judicious use of a mix of perspectives, methodological approaches and tools, and the accommodation of non-formal, undocumented and local knowledge, a collaborative IPBES can be expected to enjoy improved *credibility* and greater *legitimacy* in the complex context of global biodiversity governance because it expands both its knowledge base and the opportunities for local communities to influence its policy recommendations.

Above we have proposed that, with regard to *relevance*, a linear model based approach to science-policy interrelations presumes that the implementation and fairness of scientifically sound recommendations is a non-issue, since 'right' solutions are presumed to be automatically appropriate. Thus, the presence in the Busan Outcome of specific attention to questions of social justice and regional implementation reflects a more collaborative approach to the question of ensuring relevance, with the Parties maintaining that biodiversity and ecosystem services are "critically important for sustainable development and current and future human well-being, particularly with regard to poverty eradication" (UNEP 2010, p. 3) and suggesting that an IPBES should "support policy formulation and implementation by identifying policy-relevant tools and methodologies" (UNEP 2010, p. 5). This call for the IPBES to give explicit attention to socio-economic aspects of biodiversity and to strategies for policy implementation suggests that it will have better chances of developing institutional structures suitable for ensuring the relevance of its outputs for the complex context of global biodiversity governance.

However, also with respect to relevance, we see in the proposed IPBES only a weak basis for developing a science-policy interface that facilitates good communication across and between the many scales and levels of the international environmental governance landscape. Although the parties to the Busan Outcome propose that "the science-policy interface on biodiversity and ecosystem services must be strengthened at all levels" (UNEP 2010, p. 3), and that an IPBES should "identify and prioritise key scientific information needed for policymakers at appropriate scales" (UNEP 2010, p. 3), including through global, regional, and as necessary sub-regional assessments (UNEP 2010, p. 5) there is still a strong tendency in the document toward a centralised approach, more in keeping with linear model based thinking that originally informed the structured of the IPCC. However, as Watson (2005, p. 472) argues, given the essential differences in the nature of the problems,[63] "different social and political structures are needed to deal with global commons issues such as climate change versus issues of global concern such as biodiversity loss." While issues such as climate change and stratospheric ozone depletion essentially require centralised global coordination to be governed effectively and equitably, for issues of biodiversity each level of governance (local, national, regional, international)

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59 Different to a *systemic* type of global change (such as climate change and stratospheric ozone depletion), where changes in the system at any locale can potentially affect its attributes anywhere else and may be caused by singular, distant and unevenly distributed human activities, global changes in biodiversity and ecosystems are for the most part *cumulative* in nature – an accumulation of changes that are local in domain which occur on a worldwide scale foremost as a consequence of widespread local human activity (e.g. economic development) (Turner et al. 1990).

requires its own set of concepts and institutions (Watson 2005; Berkes 2007). On the surface, the measures proposed in the Busan Outcome reflect an appreciation for this difference. However, since they do not commit to a setting up a collaborative science-policy interface structure, we expect relevance will be a continuing problem for the IPBES.

Finally, with respect to *legitimacy*, the Busan Outcome states that the IPBES should "recognise the unique biodiversity and scientific knowledge thereof within and among regions, and also recognise the need for the full and effective participation of developing countries and for balanced regional representation and participation in its structure and work" and that it should "integrate capacity building into all relevant aspects of its work according to the priorities decided by the panel" (UNEP 2010, p. 5). On the one hand, this constitutes a clear step in the direction of opening up the biodiversity science-policy interface to real engagement by a wide range of actors, which is in keeping with an institutional design based on a collaborative model. At present, global science-policy interfaces, relying predominantly on research results published in peer-reviewed journals of the North, "may be less 'global' than they set out to be" (Karlsson et al., 2007, p. 680),[64] with "global negotiations and policy [being] informed by what may be inappropriate Northern biased 'globalised' knowledge." Karlsson et al. (2007, p. 680) argue that this asymmetry in scientific capacity eventually contributes to the imbalance in political power in international environmental governance, where the North often dominates the political agenda. Looking back over almost two decades of biodiversity governance, there is a marked tendency to focus on biodiversity conservation, primarily a Northern preoccupation, instead of adopting a perspective directed towards sustainable use, equitable sharing of benefits and poverty eradication. The measures proposed by the IPBES have the potential to compensate for asymmetries in the abilities of different actors involved in biodiversity governance, to help ensure that all the involved actors are able to critically evaluate scientifically reasoned justifications for policy choices (Miller and Erickson 2006). However, the emphasis on capacity building is primarily in terms of training people from the global South in the methods of northern science. This is more consistent with a linear approach, adhering to the presumption that authority to speak must be derived either from political designation or scientific objectivity. In order move beyond legitimacy principles anchored in linear model thinking capacity building efforts would need to be expanded to include, for example, training in interdisciplinary science methods, knowledge brokering techniques and sensitivity to the global diversity of knowledge systems and to include, in particular, training for actors in the global North (see also UNEP 2009a).

6.4.2
Implications of the analysis

Our analysis suggests that there have been considerable efforts in designing the IPBES to embrace the complexity of what Castells (1996, p. 468) called the 'new social morphology of our [global] societies'. In many instances the proposed IPBES reflects important elements of a more collaborative model of interfacing science and policy. However, the continuing strong presence of ideas grounded in the linear model and associated structures pulls in the other direction. Despite the fact that many, if not most, of the elements of a more collaborative model are either currently being discussed, firmly rooted in decisions already taken by the international community or could build on processes and programmes that are already in place, in many ways the design of IPBES still reflects the modus operandi of the IPCC. In this respect tensions arising within the process of building the IPBES can be understood to illustrate a more general struggle to develop new science-policy interfaces that address the institutional mismatches resulting from the persistence of simplistic cognitive models of global environmental governance in the context of complex conditions.

While this need not deter the IPBES design process from yielding collaborative science-policy interface institutions, it is important to keep in mind, following Norgaard (2008, p. 247) that "new ways of relating science to governance cannot simply be grafted onto the old philosophical underpinnings of science and governance." To see how it may be possible to address and overcome these remnants of linear model thinking we can return again to Young (2006; 2008) to consider the persistence of the identified institutional mismatches. As the

[59] For example, Karlsson et al. (2007) find, when analysing scientific articles on environmental issues published in peer-reviewed journals that only thirteen per cent of these papers are based on research in ecosystems typical of the South, although such ecosystems account for more than half of the world's land area.

development of the new IPBES institutions proceeds, questions need to be asked about: (i) the prevailing systemic understanding that underlies current institutional reasoning; (ii) what alternative institutional configurations might help to break away from the systemic path dependencies associated with linear model thinking, and (iii) the political implications of institutional changes that move an IPBES toward a more collaborative structure. Acknowledging the need to understand science-policy interfaces as institutional elements within the dimensions of power, conflict and antagonism inevitably increases their complexity and politicisation. However, ignoring it will guarantee that they "both fail to live up to their potential as experiments in global democracy and also risk perpetuating deep-seated political inequalities and further exacerbating ideological divides in world affairs." (Miller and Erickson 2006, p. 312)

Take for example the IPBES's potential shortcomings concerning the mobilisation of local ecological knowledge. Here, Bannister and Hardison (2006, p. 4) suggest that the key challenge is "to move beyond merely accepting in principle the importance of traditional knowledge in policy-making related to biodiversity, to ensuring these knowledges and practices are fully considered and implemented in policy decisions in a more systematic way." Recently, the UN Permanent Forum of Indigenous Peoples organised a series of regional workshops (2006-07) on the integration of traditional knowledge into relevant science-policy interface processes, which resulted in the preparation of a guidance document on the subject (UNEP 2009a). If the IPBES were to be designed to work collaboratively it would be in a position to take up this challenge and take advantage of a wide range of tested models and sophisticated innovative approaches to engaging local and indigenous ecological knowledge in ethical, equitable and meaningful ways.

Another opportunity to break with the linear model and move toward a more collaborative structure would be to open up the global-centric character of the IPBES's currently proposed governance structure. Here, the challenge, as stated by Gupta (2008, p. 231) is "to match scales of explanations, processes, and patterns in a realistic and effective way." However, "harness[ing] scale-dependent comparative advantages" (Cash and Moser 2000, p. 116) requires not only a good understanding of the different particularities of each level and of how these relate to and complement capacities at other levels, but also the making of choices concerning which level(s) and across which scale(s) particular aspects of the biodiversity issue are to be addressed. These choices are neither unambiguous nor politically neutral but instead carry considerable influence in determining the types of problems that can be addressed, the actors to be involved, the modes of explanation that are allowed, and the solutions that are likely to be proposed (Bulkeley 2005). Moving towards a more collaborative approach would require, as has been suggested by Jasanoff and Martello (2004), effective orchestration across scales and constant translation and deliberation back and forth across relatively well-articulated global, regional, national and local knowledge-power formations.

Stepping back to look at the overall project of setting up an IPBES, and drawing on the work of Ostrom (2005) on collective-action problems, in particular her suggestion that common-pool resources are most effectively managed by *polycentric networks*, we suggest that a collaborative model based IPBES could be made up of a variety of institutional arrangements, each interfacing science and policy at different levels of governance and reaching across diverse regional and national contexts. In keeping with Ostrom's observations regarding common-pool resource management (Ostrom, 2005; Dietz et al. 2003) and Young's (2008) observations on institutions of international environmental governance more generally, Cash et al. (2003), looking at knowledge systems for environmental governance, have shown that it is often collaborative networks of a multiple interfaces, of various types, with complex, partly redundant, and often layered institutional arrangements, that constitute the most effective configurations for managing the kinds of complex interrelations indicated by a collaborative model based approach to science-policy interface design. Distributing authority, resources and capacities across multiple institutions, rather than restricting them to a single central global authority, has the potential to allow for (i) greater flexibility in design and management and for adaptation to culturally appropriate styles of reasoning (improved relevance), (ii) more contextual learning and deliberation in forums that are not as politically fraught as global governing institutions (improved credibility), and (iii) to link up global environmental governance processes to regional and local policy institutions, enhancing the potential for long-term uptake and implementation of ideas and policies (improved legitimacy) (Miller and Erickson 2006; Berkes 2007). We expect that an IPBES based on such collaborative institutional structures, relying on institutional diversity and cross-network collaboration to collect and process knowledge about biodiversity loss, would be able to deal more effectively with the complexities of global biodiversity governance challenges because it would enjoy greater credibility, relevance and legitimacy (Cash et al. 2003; see also van den Hove and Chabason 2009).

Table 05

Potential of the IPBES building a better science-policy interface for international biodiversity governance

		linear model aspects of the IPBES (based on the Busan Outcomes: UNEP 2010) presumption of independent science	**collaborative model aspects of** the IPBES (based on the Busan Outcomes :UNEP 2010)	**Examples of opportunities for further improvement**
Credibility	Aspects	presumption of independent science conventional peer-review approach	presumption that science-policy interface processes are politically and epistemologically complex commitment to rules and procedures that use of a mix of perspectives, methodological approaches and analytical and reviewing tools	Collaboration with the UN's Permanent Forum of Indigenous Peoples initiative
	Implications	impedes potential to address politicisation of science limits capacity to understand complexity of the situation	provides for developing ways to address the politicisation of science expands capacity to develop complex understanding of complex situations	fosters inclusion of diverse knowledge claims
Relevance	Aspects	strong tendency toward a centralised global structure	focus on multiple levels of governance, and key thematic areas specific attention to questions of sustainable development, economics and social justice regard for policy implementation as an key component of the SPI work	formalisation and resourcing of polycentric SPI networks across regions, sectors and scales
	Implications	impedes development of suitably complex communication structures	fosters capacity to draw on wide variety of data resources and types of knowledge fosters capacity develop information that is useful in practical, applied and operational contexts	allows for a variety of place specific institutional set-ups and management fosters contextual learning fosters communication and exchange across regions, sectors and scales
Legitimacy	Aspects	capacity building seen only as western science skills training presumption that western science is superior to all other knowledge claims	committed to facilitating effective engagement by a wide and globally representative range of actors	link up new IPBES processes to existing regional and local environmental policy institutions include training in interdisciplinary science, knowledge brokering and sensitivity to knowledge system diversity within capacity building
	Implications	fosters the continued marginalisation of local, indigenous and non-scientific perspectives	provides for equality not only of status but also of opportunity to influence policy design	enhances potential for long-term uptake and implementation of policies enhances the potential for achieving fair and balanced representations of the situations at issue

6.5 Conclusions

In this paper we set out to identify institutional mismatches in the structure of science-policy interfaces supporting global biodiversity governance, which we proposed impede the credibility, relevance and legitimacy of these institutions and thus also the effectiveness of international environmental governance. We have argued that institutional mismatches in these science-policy interfaces can be understood to come from continuing reliance on an inappropriate and simplistic linear model of science-policy interrelations and that an improvement in the effectiveness of current institutional arrangements could be expected to accompany a shift towards informing institutional design with a more complex, what we have termed collaborative, model of science-policy interrelations.

In evaluating the details of the planned IPBES we have considered its potential to address the identified institutional mismatches and have found ample evidence that the IPBES could indeed constitute an important step towards adoption of collaborative model based approach to science-policy interface institutional design. However, we have also found that remnants of linear model based thinking are still clearly present in the general institutional structures proposed for the IPBES. While the opportunity for an IPBES based on a collaborative model – i.e. a discursive, dynamic and polycentric network system of science-policy interface institutions reaching across regions, sectors and scale – is there, overcoming continuing deference to underlying assumptions implicit in the older, more simplistic linear model of science-policy interrelations will not be easy.

As Young (2008) points out, institutional reform is directed by conscious action. Efforts to address institutional mismatches involve political processes and require explicit acts of institutional reform. The upcoming series of negotiations that will establish the final structure of the IPBES constitute an opportunity to adjust the cognitive models, normative structures and procedures of current institutional arrangements for interfacing science and policy in biodiversity governance. However, resistance to moving towards reliance on a collaborative model of science-policy interrelations is still evident and ideas reflecting linear model thinking continue to persist. This seems to be leading to a situation where, while the rhetoric is based on a collaborative model approach to the design of science-policy interface institutions, the rules being established to regulate those institutions are still largely informed by thinking more in keeping with the linear approach. Hence, while there is reason to be optimistic, it seems that conscious intentional action to promote a collaborative model based approach to institutional design will be required if the persistence of the linear model is to be overcome.

7 Conclusion

In this dissertation I set out to contribute to the current debate on how to improve science-policy interfaces by addressing the questions of what science-policy interfaces are and how they work, where and why they currently fail, and what would need to be done to improve the situation. In particular, the objectives of this thesis were to:

#1 further develop a coherent theoretical framework of science-policy interfaces that is able to coherently explain their nature and dynamics and that is useful for their design and management;

#2 analyse mismatches, gaps and other shortcomings of existing science-policy interfaces in biodiversity governance in order to identify critical features where and why they currently falter or fail;

#3 explore needs and options that would be suitable to address the most prominent of these mismatches, gaps and other shortcomings and to improve science-policy interfaces in biodiversity governance.

In the following I synthesise what has been achieved with respect to these objectives, evaluate these achievements in terms of contribution to science and policy as well as in terms of shortcomings and limitations, and explore potential practical implications and interesting lines of future research.

7.1 Achievements of the thesis

7.1.1 A better understanding of science-policy interfaces

Drawing on Vatn (2005) and Young (2008), science-policy interfaces have been characterised as institutional arrangements that are established to interrelate science and policy – providing the cognitive models, normative structures, rights, rules and procedures that define and enable social practices interrelating science and policy, assign roles to scientists, policy-makers and other relevant stakeholders and knowledge holders, and guide their interactions according to given principles and purposes.

This conceptual description has enabled theoretical exploration of science-policy interfaces providing further insight regarding their nature and dynamics in a number of ways. First, the definition allows for a coherent representation of the relations between science and policy and for the institutional description/design of a whole array of science-policy interfaces of different type, size, context, function and purpose. For example, analysing SBSTTA's nature and purpose in Chapter 5, science-policy interfaces were described as ranging over a spectrum from a very scientific to predominately political nature depending on the context in and the purpose for which they are established. Going beyond understanding the position of science-policy interfaces at the 'boundary' between science and politics (as in Guston's (2001) description of science-policy interfaces as 'boundary organisations' that are to equal parts accountable to science and politics), the insight proposed here allowed to apprehend a more heterogeneous science/politics intersection space. SBSTTA, for example, was described as a rather political science-policy interface, and thus particularly apt to assist in 'closing down' policy processes and to provide the CBD with recommendations that are manageable by its Conference of the Parties. At the same time, the need for scientific science-policy interfaces suited to 'open up' policy processes (Stirling 2006) honestly brokering a range of policy alternatives (Pielke 2007) to complement institutions such as SBSTTA, has also become apparent.

Second, the conceptual framework proposed here has provided yet for another dimension to explain what science-policy interfaces are and how they work. Going beyond a description of science-policy interfaces as 'organisations' or mere 'processes', treating science-policy interfaces as sets of cognitive models, normative structures and behavioural constraints and incentives, allowed for a description of these institutions in their relevant dimensions of social construction. This, in turn, allowed for a more detailed analysis of science-policy interface in terms of discourse analysis, which, as Hajer and Versteeg (2005) have convincingly argued, is particularly fit to ask what institutions do and how they work. The comparison of the linear model and the collaborative model in Chapter 6 along these lines serves as an example of how this conceptual framework has allowed for a description of how rights, rules and procedures of two different science-policy interface options are shaped by their respective underlying cognitive models.

And third, understanding science-policy interfaces in terms of Young's (2009) description of institutions as complex dynamic systems allowed for a description and analysis of the institutional dynamics of science-policy interfaces over time. Accordingly, institutional arrangements interfacing science and policy can be understood as moving toward realising their potential or making adjustments needed to maintain their compatibility with changing circumstances just like complex dynamic systems. As in the case of SBSTTA's continuous efforts to improve its functioning, most of these changes are incremental adjustments to existing regulatory provisions, allowing a system to adapt to disturbances without changing its principal assumptions, normative structures or rules. However, as currently is the case with science-policy interfaces for biodiversity governance, when institutional mismatches begin to overwhelm the capacity of established institutional arrangements to deal with the situation without major changes to their basic structures, they can suddenly be fundamentally questioned. In terms of complex dynamic systems, such times of 'institutional stress' can be seen as presenting opportunities to introduce more constitutive changes and processes of necessary institutional (re)form that are unimaginable during normal periods.

The understanding of science-policy interfaces developed in this thesis also provides a range of normative stances that might be useful when thinking about how institutional arrangements to interface science and policy *should be* formed or reformed. First and foremost, it highlights the necessity to understand science-policy interfaces not only in epistemological, but explicitly also in political terms, and especially in terms of discursive politics (see also Miller and Erickson 2006). Given the crucial role of knowledge in discursive politics, establishing or reforming institutions that interface science and politics in emerging political spaces such as international environmental governance is not only about content, but inevitably also about credibility, acceptability and trust as principal factors that determine what Hajer (1995, p. 59) has called the 'argumentative game'. Along similar lines Cash et al. suggested (2003) credibility, relevance and legitimacy to be seen as key normative attributes ensuring the effectiveness of science-policy interfaces in general.

In discursive political settings such as that of international environmental governance, science-policy interfaces should therefore not only encompass social practices such as knowledge production and exchange (e.g. through research policy), knowledge synthesis and its dissemination (e.g. through assessments), but also the coordination to balance such practices across regions, sectors and scales, and, crucially, the building of capacities that are necessary to enable all of the above. Understood in terms of deliberative democracy and development as freedom, especially the issue of capacity building constitutes a core element of science-policy interfaces, and is not just an additional, cumbersome recognisance to parties with lesser developed means of scientific knowledge production and advice, as has often been suggested during the current debate on an IPBES.

Finally, the characterisation of science-policy interface in institutional terms also emphasises what has been suggested already elsewhere (e.g. Miller and Erickson 2006): That there is no one-size-fits-all science-policy interface for the governance of complex issues. At the end of the day, what constitutes credible, relevant and legitimate institutional arrangements interfacing science and policy, is inherently dependent on the context in and purpose for which they are established (as exemplified in Chapter 4 for the issue of participation in the case study of participatory approaches in European biodiversity governance). Instead, it is often collaborative polycentric networks of a variety of institutional arrangements, with complex, partly redundant, and often layered institutional arrangements, interfacing science and policy at and across different scales, sectors and regions that constitute the most effective institutional configurations as science-policy interface for complex issues (Cash et al. 2003; Dietz et al. 2003; and Young et al. 2008).

7.1.2
A set of critical mismatches, gaps and other shortcomings

The existence of a range of mismatches, gaps and shortcomings as regards institutional arrangements interfacing science and policy in biodiversity or environmental governance at large are known for some time now. There is growing recognition of the need to design science-policy interfaces that engage effectively with the complexity of current global environmental problems and both cognitive and procedural shifts towards new, complexity-sensitive ways of interfacing science and policy are evident in both science and in governance (e.g. Lubchenco 1997; UNEP 2009c). It was therefore not much of a surprise to find rhetorical evidence of this awareness when analysing the current discourse relevant to science-policy interfaces in biodiversity governance. Three major rhetorical shifts, which have emerged over the last two decades as responses to the some of the recognised mismatches, gaps and shortcomings, have been identified in European biodiversity governance (see Chapter 4), as well as at the global level in the debate on the reform of international environmental governance (see Chapter 6):

(i) A shift from a top-down, globalocentric and state-centred, and strictly administrative understanding to policy making towards a more multilevel, participatory and to some degree bottom-up oriented approach to policy-making.
(ii) A shift from a fragmented, disciplinary, puzzle-solving, and linear understanding of science for policy towards a more integrated, interdisciplinary, 'post-normal', non-linear type approach of science for policy.
(iii) A shift from a more conservationist-driven, and outcome-oriented approach to environmental/biodiversity governance towards a more anthropocentric, sustainable development-driven, and drivers and pressures-oriented approach to biodiversity governance.

These rhetorical shifts suggest a shift in biodiversity governance from a more linear model, suggesting that consensus on science will lead to consensus in politics and so to coordinated action, towards a more collaborative model of science-policy interrelations, where stakeholders use deliberative, democratic approaches in order to learn together and develop a shared understanding of the issues at hand. However, analyses of the ongoing policy developments in European as well as international biodiversity governance show that the underlying assumptions of the linear model are still implicit in much of the global environmental policy discourse and that these rhetorical shifts are in most cases, if at all, only just beginning to be translated into practical action – leaving many mismatches, gaps and shortcomings of science-policy interfaces for biodiversity governance still unaddressed.

Despite the rhetorical shift towards a more multilevel, participatory and to some degree bottom-up oriented approach to policy-making, much of the debate on how to improve science-policy interfaces in biodiversity governance has been focusing on the global level of governance. Indicating a more or less de facto continuation of the linear model as a guide for the institutional design of science-policy interfaces for international environmental governance, the focus often remains on the identification of global, universal problems, with global agenda setting and general policy formulation and little detail regarding policy implementation and analysis. For example, what is prominently called for in the discussion towards an IPBES is not structural institutional reform, but aggregative institutional addition, via the establishment of a new global-centric top-down intergovernmental platform modelled after the IPCC. At the same time, limited public participation and stakeholder involvement, insufficient institutional arrangements and capacity, and lack of knowledge on relevant social-ecological systems at regional, national and local level continue to be among the key constraints on biodiversity governance, in particular regarding the implementation of international policy at national and local levels (CBD 2007; UNEP 2009). The lack of institutions to sufficiently address the interfacing of science and policy at and across a whole range of levels of governance has been found to seriously impede the relevance of the current science-policy interface institutions.

Similarly the shift towards institutional arrangements that would support a more integrated, interdisciplinary, 'post-normal', non-linear type approach of science for policy. Despite intentions towards more innovative approaches, older fragmented, disciplinary and linear perceptions of interfacing science and policy prevail. As the analyses of the debates on the improvement of SBSTTA (Chapter 5) and the establishment of an IPBES (Chapter 6) have shown, the pursuit of scientific independence from political influence, in order to ensure the credibility of science-policy interfaces, continues to serve as a leitmotiv for the current debate, and the linear model continues to exist as a guiding 'myth' for science-policy interrelations and its underlying assumptions are implicit in many policy discourses (see also Pielke 2007). The relevance of science-policy interfaces is still predominantly perceived in terms of their ability to present clear consensual and objective rationale for policy action in response to the needs of global environmental agreements. And issues of legitimacy, if discussed at all, are still largely reduced to the political side of the interface essentially reducing legitimacy to scientific objectivity and good political representation. Most importantly, as the three case studies have shown in various ways, this has lead to (i) the inability of existing institutions to address the increasing politicisation of science for politics (most prominently shown in the case of SBSTTA), (ii) to difficulties in taking into account the variety of legitimate knowledge claims relevant to biodiversity governance, and (iii) the undervaluation of the importance of equal access to resources and equitable command over essential capacities that are relevant to processes interfacing science and policy.

Significant changes, however, at least in parts, have been identified regarding the shift towards a more anthropocentric, sustainable development-driven, and drivers and pressures-oriented approach to biodiversity governance. Having recognised that the conservation discourse was not sufficient to maintain the issue on the agenda, let alone to ensure that governments and people would act upon it, the discourse of biodiversity governance is gradually shifting to include more utilitarian ecosystems goods-and-service approaches. The success of the Millennium Ecosystem Assessment and his conceptual approach (MA 2005), the assessment of The Economics of Ecosystem Services and Biodiversity (TEEB 2010) and the emergence of the discourse around and implementation of Payments for Environmental Services (PES) (see e.g. Kosoy and Corbera 2010), are prominent examples of this trend. However, while this shift towards an utilitarian approach might arguably prove to be very useful to mainstream biodiversity and ecosystem services-related issues throughout other sectors of socio-economic politics, the increasing 'monetarisation' of biodiversity has been criticised as just another reductionist framing of the issue hence replacing one mono-dimensional framing 'fencing-off nature' (purely biological) with another framing (purely economic) 'selling-out on nature' (e.g., McCauley 2006; Kosoy and Corbera 2010). Meanwhile, other important issues, such as analysis of and advice on critical drivers and pressures of the degradation and loss of biodiversity and ecosystem services, or more qualitative aspects of human-nature interrelations, still remain without sufficient focus.

Young's (2008) principal causes for the resistance of established paradigms – limited systemic knowledge, institutional inertia, and political resistance – serve well to explain why institutional mismatches of science-policy interfaces are so difficult to eliminate despite a broad awareness of their existence and of their detrimental consequences. The current debate on how to improve science-policy interfaces in international biodiversity governance arguably bears elements of all three of these causes obstructing institutional innovation.

Understanding the current impasse in biodiversity governance primarily in terms of an insufficient involvement of the scientific community in the global political process is still predominant. Failure in the governance is still often attributed to failure by scientists to effectively communicate the true extent and consequences of global environmental risks, or to unwillingness on the part of political leaders and public to undertake the necessary reforms. Given the exemplary performance of the IPCC in mobilising scientific communities, public opinion, politicians and the media in the case of climate change, the IPCC is, almost by default, promoted by many as the role model for a science-policy interface in international biodiversity governance. In the IPBES debate, the 'IPCC' has essentially become what Hajer (1995) has referred to as 'story-line', in the sense that it is suggesting a common understanding of what in reality is a bewildering variety of separate, and not necessarily well-understood, discursive component parts (a large part of the scientists and delegates discussing an IPBES seem to have only a vague understanding of the history, functioning and critique of the IPCC). By employing the IPCC narrative for the IPBES debate, it is suggested that what worked well for climate change will also work well for biodiversity. But not only has the IPCC increasingly come under critique itself (e.g. for being too rigid, top-down and linear in its approach (see Hulme (2010) and Leemans (2008)), doubts also arise as to what extent the issues of climate change and biodiversity require distinct institutional arrangements. But neither of these two issues, nor their consequences as to a desirable design of an IPBES, has been given much attention during the debate studied here. Thus, while the IPCC narrative has proven to be a successful storyline, the lack of systemic knowledge regarding institutional dynamics of science-policy interfaces may well be giving rise to false institutional analogies.

This debate has shown ample evidence, also as concerns systemic inertia and political resistance suppressing institutional change. In particular moves towards conceptual and methodological pluralism in institutional arrangements (e.g. the suggestion of a 'network of networks' as principal structure, or the need to also include non-scientific knowledge) have sparked resistance and ideas grounded in the linear model and associated linear structures often continue to prevail. Earlier, narrow concepts about the nature of science and policy making still dominate and have structured the established social organisation such that efforts to actually introduce a rather non-linear approach of science for policy, or a more multilevel and participatory approach to policy making, are often treated, and quickly discarded, as (e.g., non-financeable, non-functional, or un-implementable) utopian ideas.

7.1.3
Needs and options to improve science-policy interfaces for biodiversity governance

To go beyond rhetoric and overcome the obstructions to institutional change, it is necessary to (i) better understand limiting institutional inertia and obstructive political behaviour and (ii) explore alternative institutional models, including needs and options of how these could feasibly be implemented. The thesis has contributed to both: The institutional analysis of the linear model science-policy interface in Chapter 6 has revealed some of the most systemic path dependencies. And throughout the thesis alternatives to interfacing science and policy have been elaborated. In a nutshell, what has been suggested here as a possible way forward, is the incremental formation of a dynamic, polycentric and multilevel network of science-policy interfaces that (i) builds on the institutional base that already exists, (ii) creates new institutions or reforms older ones where institutional mismatches and gaps are being revealed, and (iii) facilitates regular communication, collaboration, coordination between the various institutional nodes of the network and the other global institutions working on biodiversity governance.

As a whole, such a collaborative network of science-policy interfaces should strengthen a more discursive democratic and complex approach to decision making in biodiversity politics, for example, by: (i) promoting and establishing (links to) science-policy interfaces to foster constant dialogue, exchange and mutual evaluation across regions, sectors and scales, (ii) allowing for adequate participation of all relevant stake- and knowledge holders ensuring equitable access to relevant resources, and equitable abilities to formulate, articulate, and critically evaluate reasoned justifications for policy choices, (iii) providing the means to account for the inherently political nature of science for policy, e.g. through systematic provision of plural and conditional advice in terms of policy alternatives, and (iv) supporting more explicitly processes of policy implementation.

Further, such a network of science-policy interfaces would also need to strengthen a more collaborative approach to science for policy, for example, by: (i) integrating knowledge systems that operate from distinct assumptions, evidentiary standards, frames of meaning on a more systematic basis, (ii) allowing for acknowledgement, discussion and management of strengths and weaknesses of different knowledge claims, and (iii) promoting balanced and interdisciplinary research and education, e.g. through a place-based, long-term, networked approach to social–ecological research and monitoring.

As has been shown, many, if not most, of the options presented above are either currently being discussed, firmly rooted in decisions taken by the international community or could build on processes and programmes that are already in place. For example, already in 2000 and 2002, the CBD encouraged SBSTTA to make recommendations that include various options where no consensus can be reached (paragraph 20 of decision V/20), and Parties to develop regional, sub-regional or bioregional mechanisms and networks to support implementation of the Convention (decision VI/27 A). Also the framework of a future IPBES, outlined in the Busan Outcomes, suggests much potential for improved science-policy interfacing in biodiversity governance, emphasising the integration of a range of different knowledge types, multilevel analysis and capacity building (see Chapter 6).

Of particular relevance, I believe, are the cognitive and procedural as well as structural shifts that are emerging at UN/UNEP level regarding the reform of international environmental governance, as they provide a picture of the broader, longer-term institutional framework within which science-policy interfaces for biodiversity governance are likely to develop. Here the possibilities are exciting:

(i) UNEP's new Science Policy (currently under discussion), which, recognising the inherently political nature of scientific advice, breaks with the usually rather linear view of interfacing science and policy at UNEP, and promotes science-policy interfaces that assume a role of 'honest brokers' (Pielke 2007), where scientists are not providing absolute truths but presenting a range of alternative and innovative solutions that help to expand the scope of choices available to decision makers.

(ii) UNEP's Medium Term Strategy for 2010-2013 (UNEP 2008), with its commitment to significantly enhance the linkages between environmental sustainability and economic development as key nexus for public policy, and to strengthen regional and national governance in order to better support governments, according to their needs and priorities, to achieve sustainable development – e.g. through increased regional presence and the development and implementation of UN Development Assistance Frameworks (UNDAF).

(iii) The Environment Watch Strategy for strengthening the scientific base of UNEP (UNEP, 2009f p. 12), which, among other things, is to support the establishment of environmental and interdisciplinary networks linking "incrementally relevant thematic and geographically oriented networks at various levels, including regional, multidisciplinary, thematic and, as appropriate, national environmental information networks and partner institutions, working towards a highly connected system by 2020."

(iv) The Bali Strategic Plan for Technology Support and Capacity-Building (UNEP 2005), by which the international community agreed to provide for a framework and systematic measures for a more coherent, coordinated and effective delivery of environmental capacity-building and technical support based on national or regional priorities and needs, so that countries can participate fully in the development of coherent international environmental policy and achieve their own environmental goals, targets and objectives, as well as meeting environment-related internationally agreed development goals.

Picking up on the relevant and innovative trends of these reforms could take biodiversity governance to the centre stage and give it a leading role in advancing the necessary shift in international environmental governance.

7.2
Evaluation of the work

7.2.1
Contributions to science and policy

In this thesis I developed a theoretical framework of science-policy interfaces that contributes to a better understanding of their nature and dynamics and that is useful for their design and management. In particular the description and analysis of science-policy interfaces in terms of institutional dynamics bears the potential to contribute relevant substance to the ongoing debates in science and policy regarding the design and management of science-policy interfaces.

I have further analysed a number of mismatches, gaps and other shortcomings of a range of existing science-policy interfaces in biodiversity governance in order to identify critical features as to where and why they currently falter or fail. Among the more substantial contributions is the detailed study and problem-focused analysis of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), and the analysis of the potential within the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) in building a better science-policy interface for biodiversity governance.

Finally, within this thesis I have explored a range of needs for and suitable options to address the most pertinent mismatches and gaps providing some useful contribution to the current debate on how to improve science-policy interfaces in international biodiversity governance. Here it is probably on the contextualisation of established theoretical analysis with real-life problems and existing political opportunities, where this work might be most useful.

7.2.2
Shortcomings and Limitations

As any research, this thesis is not without its limitations and shortcomings. Limitations in terms of research process include, for example, the nature of the IPBES (IMoSEB) debate, the main subject of this study. The dynamic of this debate as a 'moving target', plus the increasing politicisation of it, have made it very difficult to develop a detailed *ex ante* research plan. When this debate took its course at the International Conference on *Biodiversity: Science and Governance* in 2005, it was, for example, all but certain that this issue would make it so far – that is, that it would ever be negotiated at UN level. I began to study something that might have ended as a flop. Nor was it clear, which would be the major focal elements (e.g., while it was to be expected that SBSTTA and its relation to a possibly established science-policy interface would become a key issue, the centrality of the issue of capacity-building emerged only later in the debate). Further, as independent researcher, not legitimised through an affiliation to any of the institutions involved, getting access to observe or participate in relevant meetings has not always been possible (e.g., it has not been possible for me to attend any of the three IPBES meetings hosted by the UN).

Another type of limitation to the research process goes back to my limited experience in social sciences, particularly qualitative social sciences. My educational background in environmental studies and natural sciences has been useful, but it took some time until I was able to grasp and apply the variety and depth of qualitative social research to a satisfying extent; and there still remains much of social research method I could learn. One rather practical example of this learning process, have been the difficulties I have experienced in switching back and forth between being a researcher and being actively involved in political practice (e.g. during the traineeship at the European Commission, or as consultant for UNEP-WCMC).

Shortcomings in terms of research results include, for example, the limited number and range of concrete case studies. The list of possible candidates is long. Just the number and variety of institutions relevant to a suggested polycentric network is bewildering, reaching from the possibilities of UNEP as global player, the potentials of the global biodiversity research programme DIVERSITAS, to the needs of regional polities such as ASEAN Biodiversity Centre (the biodiversity-related platform of the Association of Southeast Asian Nations), or the usefulness of the Clearing-House-Mechanism of the CBD as support tool to developing countries. Also a more detailed study of gaps, needs and options of science-policy interfaces regarding issues such as the use of indicators, models or scenarios would have contributed to allowing a broader and more detailed representation of the current situation. Probably most noticeable are shortcomings as regards a more detailed analysis of the issue of capacity-building and a more or less representative case study of a science-policy interface at regional or national level in the South. Many of these institutions, concepts or issues have been addressed, at least superficially, in the UNEP Gap Analysis, which I co-authored with Jerry Harrison during my stay at UNEP-WCMC, and which is included to this thesis as appendix (Appendix C). However, more detailed and solid research on any of these potential case studies would have exceeded the scope of the PhD.

7.3 Implications of results

7.3.1 Practical implications for political developments

Above all regarding the operationalisation of an IPBES this thesis might have practical implications in terms of political developments. Particularly the systematic analysis of the potential within the agreed general framework of a still to be established IPBES might provide valuable insights and food for thought for the negotiations of the more detailed institutional design of such a mechanism due to take place in October 2011 and spring 2012. But also over the coming years the IPBES is likely to continue exhibiting considerable institutional dynamism increasingly finding its place within the overall context, e.g. as regards the possible establishment of regional hubs. Beyond the proposed conceptual framework, the thesis, in particular in Chapter 6, also provides more concrete suggestions where there is potential and where faults within the current design to actually improve the science-policy interface for international biodiversity governance. It further implies the need to pay greater attention to elements of institutional inertia and political behaviour hidden within certain discourses.

Other practical implications of this work for ongoing political developments might be found in respect to SBSTTA's continuous institutional reform, not least regarding SBSTTA's relation to a new IPBES. Here too, the thesis has the potential to provide conceptual as well as practical guidance in terms of SBSTTA's institutional design, in particular regarding the 'distribution of work' between an IPBES and SBSTTA in terms of 'opening-up' and 'closing down' knowledge-based policy debates. Further, this thesis could also contribute to the establishment of a European science-policy interface on biodiversity and ecosystem services. Again Chapter 6 in more conceptual terms, but also Chapter 4 in respect to the European context, provide analyses relevant, for example, to the eventual establishment of a European hub to the IPBES.

7.3.2 Possible avenues for future research

Regarding implications for future research many topics have emerged over the course of this thesis. The list of institutions worthwhile analysing in terms of their institutional design presented in the section on shortcomings above gives a brief overview of potentially valuable case studies and analysis. Here I only select and concretise those that I believe are among the most important and interesting ones:

(i) A critical analysis of the discourse on capacity building in the context of science-policy interfaces, together with an analysis of needs and options that exist to address the issue. Based on a study of how a set of parties develops, discusses and negotiates a certain topical issue (e.g. biofuels, or tree plantations for paper pulp or carbon capture) over at least one CBD-cycle (at least 2 years), it would be interesting to investigate the capacity-building needs in more detail. These could then be compared with information provided by the National Capacity Self Assessments (NCSAs), the provisions made regarding this issue (e.g. Bali Strategic Plan) and the efforts and potentials of the UN Development Assistance Framework (UNDAF) in addressing the existing needs. Currently, the issue of capacity building, which promises to be a critical issue, is laden with misunderstandings, institutional path dependencies, and political behaviour of all sorts. A critical analysis of the discourse on capacity building in the context of science-policy interfaces, together with an analysis of needs and options that exist to address the issue, would be of great help to find agreement and more appropriate solutions as regards the implementation of this central but debated issue.

(ii) Closely linked to the issue of capacity-building is the research question of how to avoid participatory exclusions in the science-policy interface for biodiversity assessment and management, and how to include indigenous groups and federations, peasant unions, environmental NGOs, looking for an alliance between the organizations that represent the "cult of wilderness" (IUCN, WWF…) and the EJOs (environmental- and social-justice organisations). The role of NGO activists in the thousands of resource extraction conflicts around the world (defending local livelihoods and biodiversity against mining or oil companies, defending forests and mangroves) has not yet been properly brought into the analysis of the science-policy interface in biodiversity governance.

(iii) A study on scenario analysis as highly potential tool for science-policy interfaces given their strengths in integrating different knowledge claims, values and perspectives, and in presenting an analysis/assessment/debate in form of a range of plural and conditional advice. Here a comparative study of scenarios developed in the sub-global assessments under the MA follow-up regime could bring interesting insights, including on the compatibility of local and global scenarios.

(iv) Interesting are also the implications of current and future key drivers of biodiversity change in respect to the institutional design of science-policy interfaces, e.g. in light of both "peak human population" in about thirty years from now and the increasing commoditisation of biodiversity. .

(v) Finally, of particular interest are the implications of the research undertaken here for science-policy interrelations regarding other complex issues. In this regard it appears important to further study the differences and similarities between the case of biodiversity governance and issues such as food, water and energy security, and to explore the potential synergies of further integrating institutions interfacing science and policy in these fields.

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Appendix

Statements of co-author's consent

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I STATE THAT

As a **DOCTOR COAUTHOR**, I am informed that Mr. Thomas Koetz will apply for authorization to the Doctoral Committee of the Universitat Autònoma de Barcelona for presenting his doctoral thesis as a compendium of works.

And, for this reason

I STATE

TES37

That I accept the use of the following works:

Koetz, T., Bridgewater, P., van den Hove, S., Siebenhüner, B. (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 and Policy*, 11, 505–516

Koetz, T., Farrell, K.N., Bridgewater, P. (2011). Building better science-policy interfaces for international environmental governance: Assessing potential within the Intergovernmental Platform for Biodiversity and Ecosystem Services. Accepted for publication in *International Environmental Agreements: Politics, Law and Economics* on 08. April 2011.

in his doctoral thesis at the Universitat Autònoma de Barcelona, in the form of compendium of works

Signed [signature] Peel, Isle of Man 18/04/2011

Mr. Delegat del Rector per a Doctorat

Bellaterra (Cerdanyola del Vallès),..of .... of 2011

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I STATE THAT

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That I accept the use of the following works:

Rauschmayer, F., van den Hove, S., Koetz, T. (2008). Participation in EU biodiversity governance: How far beyond rhetoric? Environment and Planning C, 27, 42-58;

Koetz, T., Bridgewater, P., van den Hove, S., Siebenhüner, B. (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 and Policy*, 11, 505–516;

in his doctoral thesis at the Universitat Autònoma de Barcelona, in the form of compendium of works

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That I accept the use of the following work:

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in his doctoral thesis at the Universitat Autònoma de Barcelona, in the form of compendium of works

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Appendix B

Gap Analysis

UNITED
NATIONS

EP

UNEP/IPBES/2/INF/1

Distr.: General
19 August 2009

English only

United Nations
Environment
Programme

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

Gap analysis for the purpose of facilitating the discussions on how to improve and strengthen the science-policy interface on biodiversity and ecosystem services

The annex to the present note contains a gap analysis for the purpose of facilitating the discussions on how to improve and strengthen the science-policy interface on biodiversity and ecosystem services. It has been reproduced as received, without formal editing.

K0952635 190809

For reasons of economy, this document is printed in a limited number. Delegates are kindly requested to bring their copies to meetings and not to request additional copies.

Gap analysis for the purpose of facilitating the discussions on how to improve and strengthen the science-policy interface on biodiversity and ecosystem services[1]

Contents

[1] This report was prepared with the support of the UNEP World Conservation Monitoring Centre (UNEP-WCMC), with substantive input and comment from a wide range of governments, IGOs, NGOs and individuals.

List of Annexes

SUMMARIES OF KEY RELATED PROCESSES

BACKGROUND MATERIAL ON THE DESCRIPTION OF THE INSTITUTIONAL LANDSCAPE

BACKGROUND MATERIAL FOR ANALYSES

OTHER MATERIAL

A. Executive summary

A.1. Introduction

1. Over the past decades the international community has established a number of regimes to conserve and use sustainably biodiversity and ecosystem services. These efforts have led to the development of a considerable, continuously evolving and ever-more complex system of environmental governance. Nonetheless, notwithstanding significant progress in science and the increasing recognition of the importance of using science effectively in decision-making, biodiversity and ecosystem services continue to be used unsustainably and inequitably, and are being degraded at increasing rates.

2. The Millennium Ecosystem Assessment showed that over the past 50 years humanity has caused unprecedented losses in biodiversity and declines in ecosystem services. Of the 24 assessed ecosystem services, 60 per cent recorded a decline, with further degradation expected unless immediate action is taken. This is expected to have a negative impact on development processes in all countries, but in particular in developing countries, and is impeding the attainment of both the Millennium Development Goals and the internationally agreed target to reduce significantly the rate of biodiversity loss by 2010.

3. While there are many reasons for this situation, there is growing consensus that strengthening the interrelations between science and policy at all levels is necessary (but not sufficient) for more effective governance of biodiversity and ecosystem services. Current environmental problems, often of considerable magnitude and complexity, challenge science, politics, policy and their interrelations in unprecedented ways, confronting them with situations in which facts are uncertain, values in dispute, stakes high and decisions urgent.

4. In recent years considerable attention has been paid to tackling inadequacies in the interrelations between science and policy, insofar as this is possible within given mandates, budgets and decision-making processes, and to exploring options for a more effective science-policy interface, as in the case of the ad hoc international and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services, convened in Putrajaya, Malaysia, from 10 to 12 November 2008.[2]

5. In the Putrajaya Road Map, set out in the annex to the report of the meeting (document UNEP/IPBES/1/6), participants recognized that mechanisms to improve the science-policy interface for biodiversity and ecosystem services for human well-being and sustainable development should continue to be explored and called for a gap analysis to be undertaken with the aim of supporting future discussion by reviewing the strengths and weaknesses of existing science-policy interfaces and the coordination between them across all spatial scales. They requested a preliminary report to be made available at the twenty-fifth session of the United Nations Environment Programme (UNEP) Governing Council/Global Ministerial Environmental Forum, in February 2009. At that meeting, representatives called upon UNEP to complete the gap analysis for presentation at the next ad hoc intergovernmental and multi-stakeholder meeting, building on comments received through an open review process.

6. The full gap analysis builds on the preliminary version, incorporating the comments received during the review process and further drawing on scientific literature, policy reports, institutional research and consultations with experts.

7. In answering the mandate accorded by the Governing Council and the related discussions, the objectives of this analysis are:

a) To review the institutional landscape relevant to the discussion and to analyse the strengths and weaknesses of existing science-policy interfaces and coordination between them at the national, regional and global levels of governance;

b) To present the findings of this review and analysis in such a manner as to help to orient future discussion on strengthening the science-policy interface on biodiversity and ecosystem services.

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[2] While much of this is described in the gap analysis, particularly relevant to the current discussions on strengthening the science-policy interface on biodiversity and ecosystem services is the "assessment of assessments" reviewing the global marine assessment landscape for the purpose of determining possible options and a framework for a regular process for global reporting and assessment of the state of the marine environment. This process is currently in an advanced and critical phase, with a meeting of the Ad Hoc Working Group of the Whole convened by the General Assembly in paragraph 157 of its resolution 63/111 of 5 December 2008 to be held in New York from 31 August to 4 September. The Working Group plans to submit its proposals to the General Assembly at its sixty-fourth session.

A.2. Key findings

8. The gap analysis identified six key findings, ranging from the complexity of science-policy interfaces to the lack of coordination between the many stakeholders in covering the broad spectrum of biodiversity and ecosystem services in a comprehensive manner, which is essential for effective policymaking in the development field.

Finding No. 1: Multiple science-policy interfaces

9. A wide range of science-policy interfaces of varying types, sizes and purposes already exist for the many multilateral environmental agreements and other bodies relating to biodiversity and ecosystem services at all levels. Between them they have, to a certain extent, enriched decision-making and raised awareness of biodiversity and ecosystem services among the environmental community.

10. The specific findings are as follows:

a) *Finding No. 1.1:* The existing landscape of science-policy interfaces and interactions provides an important basis that can be built upon and strengthened;

b) *Finding No. 1.2:* The variety of existing science-policy interfaces is in part historic as institutions have been created on an ad hoc basis to deal with problems and issues as they have emerged. Much of this variety is, however, likely to be inherent, given the complexity of governance arrangements, the multiple levels of governance, the broad range of sectoral interests and the variety of purposes.

Finding No. 2: Effectiveness of science-policy interfaces

11. Notwithstanding the progress made by many of the existing science advisory bodies to improve the focus and quality of scientific inputs into policymaking processes, there is scope for further improvement in scientific independence through increased credibility, relevance and legitimacy.

12. The specific findings are as follows:

a) *Finding No. 2.1:* Most science-policy interfaces have relatively modest budgets for the size of the task that they are expected to perform, potentially limiting their ability to assess knowledge comprehensively and ensure the input of the best available science, leaving them to rely on inputs from other bodies and processes that might not be best suited to their needs;

b) *Finding No. 2.2:* Each science-policy interface works in a separate manner and each mechanism can bring its own limitations, such as the problems that can be encountered when an advisory body is responsible for providing scientific input to the policy process while acting as an initial negotiating platform.

Finding No. 3: Common and shared knowledge base

13. Although an extensive knowledge base exists to support decision-making in each of the many science-policy interfaces, shared frameworks, methodologies and basic understandings to respond to the complex nature of biodiversity and ecosystem services issues remain missing or incompletely implemented. There are also significant gaps in knowledge that need to be filled.

14. The specific findings are as follows:

a) *Finding No. 3.1*: Notwithstanding the considerable progress in and growth of the relevant sciences, some fundamental knowledge gaps exist, in particular with regard to the dynamic interactions between drivers of change, ecosystems and human well-being. This is of particular concern at the regional, national and local scales, where many of the most important interactions of this nature occur and where human well-being depends most directly on ecosystem services;

b) *Finding No. 3.2*: Although a range of institutions support the development of research strategies to meet policy needs, there is currently no process providing common and regularly reviewed guidance on a strategic approach to research to ensure that the most important needs in terms of knowledge to support more effective governance at all levels are being identified and responded to in a coordinated manner;

c) *Finding No. 3.3*: While awareness of the need to draw more systematically on a broad range of knowledge types is growing, there remains a lack of processes for ensuring the effective incorporation of types of knowledge into the knowledge base, including the incorporation of knowledge from other sectors and disciplines, non-formal knowledge and mutual learning;

d) *Finding No. 3.4*: Notwithstanding continuing efforts, there remain significant gaps in long-term observation and monitoring programmes, in particular as regards data and information on interactions between drivers of change, ecosystems and human well-being, and on particular geographic regions;

e) *Finding No. 3.5*: While progress has been made, there remain significant barriers to the effective use of existing data and knowledge resulting from institutional and technical impacts on both the availability of data and information and on the ability of users to gain access to such data and information in meaningful ways.

Finding No. 4: Policy impact

15. Various mechanisms synthesize, present and communicate knowledge to inform policy. There is, however, a lack of regular processes providing periodic, timely and policy-relevant information covering the full range of biodiversity and ecosystem service issues to the broader development community. This information and knowledge is not always translated and communicated in the most efficient way or the most useful format.

16. The specific findings are as follows:

a) *Finding No. 4.1*: As a result of the vast quantity and varying quality of differing, fragmented and sometimes even contradictory knowledge currently available, together with the lack of clear authoritative synthesis and a clear and targeted communication thereof, decisions taken are not necessarily informed by the best available knowledge;

b) *Finding No. 4.2*: Knowledge is often not presented in the form of clear policy alternatives that systematically outline the implications of policy options under detailed framing assumptions and provide better guidance in policy implications;

c) *Finding No 4.3*: In discussions on science-policy interfaces there is far more focus on identifying issues and formulating policies with regard to multilateral environmental agreements at the global level than on supporting policy implementation and policy evaluation, particularly at the national and regional levels of governance, and on the extent to which effective information and advice pertains to and is used by the development community at the lower governance levels;

d) *Finding No. 4.4:* There is a need for more integrated quantitative models, scenarios and indicators that will aid understanding of not only biodiversity and ecosystem services, but also the relevance of biodiversity and ecosystem services to human well-being;

e) *Finding No. 4.5:* Notwithstanding the range of assessments relating to biodiversity and ecosystem services, no regular periodic multi-level assessment process exists that provides the conceptual and institutional framework coherently to gather, review, synthesize, communicate and monitor information and track changes in biodiversity and ecosystem services and their consequences for human well-being at the global, regional and national levels and on the interrelation across these levels;

f) *Finding No. 4.6:* There are continuing difficulties in ensuring timely scientific advice on emerging issues of concern at and across all levels, whether in response to policymakers' requests or resulting from concerns arising from the scientific community.

Finding No. 5: Coordinated approach

17. Notwithstanding the existence of several mechanisms to improve the coordination of the wide range of science-policy interfaces for the many multilateral environmental agreements and other bodies related to biodiversity and ecosystem services, there is significant room for building on the existing experiences that would lead to better coordination between and across global and national mechanisms.

18. The specific findings are as follows:

a) *Finding No. 5.1*: There is significant potential to improve the effectiveness of science-policy interfaces through more coherent coordination within and across their various functions, integrating such aspects as research strategies, models and scenarios, assessments, knowledge-brokering and capacity-building;

b) *Finding No. 5.2*: Examples exist of thematic mechanisms such as expert groups or other collaborative arrangements that are providing valuable support to policy formulation and implementation on specific issues. Lessons can be learned from this;

c) *Finding No. 5.3*: There is a lack of coordination across sectors to allow for the constant exchange and joint creation of knowledge, leading to mismatches and duplications of information and policies relevant to the broader development community;

d) *Finding No. 5.4*: There is a lack of coordination across levels of governance to allow for the effective exchange of knowledge and experience back and forth across relatively diverse science-policy interfaces from the national to the global level that is necessary to avoid mismatches and duplications and to increase synergies between them.

Finding No. 6: Fundamental capacities

19. Numerous institutions and processes are helping to build capacity to use science effectively in decision-making at all levels. Further efforts, however, are required to integrate multiple disciplines and knowledge systems to produce relevant knowledge effectively; to translate knowledge into policy action and to coordinate these processes; and to build the capacities of developing countries to use science more effectively in decision-making and to participate fully in the science-policy dialogue.

20. The specific findings are as follows:

a) *Finding No. 6.1*: Notwithstanding continuing efforts and improvements in capacity-building supporting the various processes of interfacing science and policy, there remains a significant and widespread lack of capacity in interdisciplinary approaches for knowledge production relevant to biodiversity and ecosystem services for human well-being and governance that draw upon a variety of knowledge systems;

b) *Finding No. 6.2*: There is a widespread lack of capacity for brokering knowledge effectively so that it is used appropriately in decision-making, including by identifying the implications of various policy options;

c) *Finding No. 6.3*: There are geographical variations in capacity relevant to science-policy interfaces, with significantly reduced capacity in developing countries, and in particular the less developed countries and small island developing States, impeding these countries' full engagement in nearly all relevant processes.

B. Introduction

B.1. Mandate, objectives and methodology for the gap analysis

21. The *Ad hoc* intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services (IPBES Meeting) was convened in Putrajaya, Malaysia, from 10-12 November 2008, to consider ways and means of improving the science-policy interface on biodiversity and ecosystem services for human well-being, including possible establishment of an intergovernmental science-policy platform on biodiversity and ecosystem services (IPBES). The meeting recognised that mechanisms to improve the science-policy interface for biodiversity and ecosystem services for human well-being and sustainable development should continue to be explored, and called for a gap analysis to be undertaken with the aim of supporting future discussion, in particular at the second IPBES Meeting (scheduled for 5-9 October 2009, in Nairobi, Kenya).[3] Participants specifically requested that the gap analysis provide:

a) an analysis of the strengths and weaknesses of existing science-policy interfaces and coordination among them at all spatial scales, including the advisory bodies of biodiversity-related Multilateral Environmental Agreements and United Nations bodies; and

b) an assessment of the potential for strengthening existing science-policy interfaces, as well as the potential added value of a new mechanism complementing existing interfaces and helping to overcome the recognized weaknesses in the current system.

22. The gap analysis is based on the preliminary gap analysis submitted to the twenty-fifth session of the UNEP Governing Council/Global Ministerial Environmental Forum held 16-20 February 2009 in Nairobi;[4] the input of governments, intergovernmental organizations, non-governmental organizations, the scientific community and other relevant stakeholders that have provided comments on the preliminary gap analysis;[5] and further review of scientific literature, policy reports, institutional research, and consultation with stakeholders familiar with the different processes and mechanisms under review.

23. In preparing the gap analysis there are inevitable limitations in what can be achieved, given the breadth and complexity of the issue, and the time and resources available. In particular the following should be born in mind:

a) <u>Widely differing views of stakeholders</u>*:* Given the complexity of the issue and the wide range of perspectives, different stakeholders have views and positions on how to improve the science-policy interface (or components of it) that differ significantly from those of others. Aware of the broad range of perspectives, every effort has been taken to ensure an inclusive and balanced approach in this analysis.

b) <u>Large and varied institutional landscape</u>*:* There is a significant number and variety of relevant scientific advisory bodies and processes, and associated political and scientific institutions, differing in type, size, mandate, purpose and nature, and spanning different scales, sectors and regions. Inevitably the gap analysis cannot provide an exhaustive description of the complete landscape of interfaces, organizations and networks, and instead draws on representative experiences while endeavouring to place this in context of the whole landscape.

c) <u>Stakeholder input</u>*:* Fewer comments have been received on the preliminary gap analysis than was anticipated, despite direct request to governments and additional approaches to other stakeholders with the support of IUCN and DIVERSITAS. It is therefore hoped that the input received covers the full range of views and positions.

d) <u>Time and resources</u>*:* The preliminary gap analysis was peer reviewed and the current paper draws on those review comments, however it was not possible to provide the full gap analysis for further wide-scale peer review, although parts of it were commented on by a number of stakeholders.

24. Given the orientation provided by the IPBES meeting, and the various comments and inputs provided, this gap analysis aims to: clearly define the concepts and outline the context relevant to the discussion on

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[3] UNEP/IPBES/1/6

[4] UNEP/GC.25/INF/30

[5] A total of 739 comments were received from 54 different submissions, 21 from Governments (including the EC), six from IGOs, 12 from universities and research institutes (often individuals) and 15 from civil society organizations. A number of the comments received related to the potential outcomes rather than the gap analysis itself, but otherwise the comments have been addressed as far as possible. A copy of the comments received can be found on www.ipbes.net.

improving the science-policy interface in order to provide for a common ground of understanding; review the institutional landscape relevant to the discussion and to analyze strengths and weaknesses of existing science-policy interfaces and coordination among them at all levels; and present the findings of this review and analysis in such a manner as to help orient future discussion on strengthening existing science-policy interfaces and addressing gaps and weaknesses.

B.2. Background and context

25. Over the last few decades of the twentieth century the international community established an international regime which aimed to conserve and use sustainably biological diversity and ecosystem services. These efforts have led to the development of: a considerable, continuously evolving and ever more complex governance system, including substantial networks of actors, complex institutional settings extending across sectors and scales; a constantly growing body of decisions, policies, programmes and agreements; and a constantly growing body of knowledge on which actors draw to inform these.

26. However, despite this multiplication of policy processes and increase of knowledge production, according to the Millennium Ecosystem Assessment, biological diversity and ecosystem services continue to be used unsustainably and inequitably, and biodiversity is changing and being lost at increasing rates.[6] This is likely to have a negative impact on development processes in all countries, but in particular on developing countries, and is impeding achievement of both the Millennium Development Goals and the internationally agreed target to significantly reduce the current rate of biodiversity loss by 2010.[7]

27. Today's environmental problems, often of considerable magnitude and complexity, challenge science, politics, policy and their interrelations in unprecedented ways, confronting them with situations where facts are uncertain, values in dispute, stakes high, and decisions urgent. Ensuring an effective interface between science and policy is fundamental to good decision-making and effective governance, as the extent to which decisions lead more reliably to desired outcomes is critically influenced both by the scope of the knowledge that key actors have available to them, and the power and influence that they are able to mobilise.

28. In recent years considerable attention has been given to options for developing a more effective interface between science and policy with respect to biodiversity and ecosystem services. While much of this is described elsewhere in this document, particularly relevant to the lead up to the current discussions and the preparation of the gap analysis are the following two initiatives:

a) The International Mechanism of Scientific Expertise on Biodiversity (IMoSEB) consultative process was carried out between February 2006 and November 2007, and included six regional meetings, case studies, briefings, presentations and discussions at numerous other scientific and policy meetings, written input from a wide range of other sources, and dialogue with a number of stakeholders.[8] The consultation identified a number of key needs, and criteria for ensuring that these needs were addressed in an appropriate manner, which are summarized in Annex A. The final meeting of the International Steering Committee[9] also invited the Executive Director of UNEP to convene an intergovernmental meeting with all key stakeholders, both governmental and non-governmental, to consider establishing an efficient international science-policy interface addressing the findings of the consultation.

b) The Millennium Ecosystem Assessment (MA) follow up process was developed following completion of the MA in 2005, and taking account of the experience of the MA,[10] the recommendations of two independent evaluations of the MA conducted in 2006 and 2007[11] and discussion during the Conference of the Parties to the Convention on Biological Diversity (decisions VIII/9 and IX/15). This process aims to strategically address the following four issues: continuing to build the knowledge base through sub-global assessments; promoting the consideration of ecosystem services in decision making processes; making

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6 Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press.

7 Agreed in April 2002 by the Parties to the CBD and subsequently endorsed at the World Summit on Sustainable Development in Johannesburg and incorporated as a target under the Millennium Development Goals.

8 Information on the process, and copies of all reports and submissions, can be found at www.imoseb.net

9 Their final report can be found at www.imoseb.net/international_steering_committee_2

10 See: Millennium Ecosystem Assessment. 2003. *People and Ecosystems: A Framework for Assessment and Action*. World Resources Institute; Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press; Reid, W.V. *et al*. 2006. *Bridging Scales and Knowledge Systems: Concepts and Applications in Ecosystem Assessment*. Island Press, the Global Environmental Assessment Project lead by Harvard University (www.hks.harvard.edu/gea).

11 The GEF review was completed in 2006 (www.unep.org/eou/Pdfs/Millennium Eco Assessment Report unedited.pdf). The review conducted by the United Kingdom's Environmental Audit Committee of the House of Commons was published in 2007 (www.publications.parliament.uk/pa/cm200607/cmselect/cmenvaud/77/77.pdf)

assessment tools and methodologies widely available; and exploring needs, options and modalities for further global assessments (see Annex B).

29. Following completion of the IMoSEB consultation, and as part of the MA follow-up, the UNEP Executive Director convened the *ad hoc* intergovernmental and multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services from 10-12 November 2008 in Putrajaya, Malaysia to consider establishing an efficient intergovernmental science-policy interface on biodiversity and ecosystem services for human well-being and sustainable development. At the meeting it was agreed that no recommendations would be adopted, but that the Chair's summary, annexed to the meeting report, would serve as the outcome.[12]

30. Participants at the IPBES Meeting recognized that there were currently numerous national and international science-policy interfaces for biodiversity and ecosystem services. But there was also broad recognition that there was a need to improve the science-policy interface, which should draw on the best available knowledge. Participants recognised that mechanisms to improve the science-policy interface for biodiversity and ecosystem services for human well-being and sustainable development should continue to be explored, and:

a) recommended that the Executive Director of UNEP should report at the twenty-fifth session of the Governing Council/Global Ministerial Environment Forum on the outcome of the meeting;

b) recommended that the UNEP Governing Council should request the Executive Director to convene a second intergovernmental multi-stakeholder meeting on an intergovernmental science-policy platform on biodiversity and ecosystem services with a view to strengthening and improving the science-policy interface for biodiversity and ecosystem services for human wellbeing, including consideration of a new science-policy platform; and

c) called for a gap analysis to be undertaken with the aim of supporting future discussion by reviewing the existing mechanisms and processes, and requested that a preliminary report be made available at the twenty-fifth session of the Governing Council/Global Ministerial Environmental Forum.[13]

31. As requested, a preliminary gap analysis was provided as information document UNEP/GC.25/INF/30 to the UNEP Governing Council in February 2009. The UNEP Governing Council took note of the preliminary gap analysis, and in decision 25/10:

a) invited Governments and relevant organizations to continue to explore the mechanisms to improve the science-policy interface for biodiversity, long-term human well-being and sustainable development, taking into account the special need to develop and maintain the technical and scientific capacity of developing countries in biodiversity-related issues;

b) requested the Executive Director to undertake a further process to support these efforts aiming to report on its progress at the special session on biodiversity of the sixty-fifth session of the General Assembly and other relevant meeting; and

c) requested the Executive Director to convene a second intergovernmental and multi-stakeholder meeting at the earliest possible convenience in 2009 following the completion of the full gap analysis.

32. During review of the preliminary gap analysis, several Governments drew attention to the need to relate discussions to two further ongoing processes, so as to ensure complementarity:

a) The Assessment of Assessments and the Regular Process for Global Reporting and Assessment of the state of the Marine Environment (GRAME) are being carried out under UN General Assembly Resolution 60/30 to review available knowledge and the ways in which it is used in the marine environment, and to propose options and a future framework[14] for ensuring an adequate reporting and assessment of the state of the marine environment in order to support decision making, including aspects of building capacity, improving the knowledge base, improving networking among assessment and monitoring processes, and improving communication tools (see Annex C). The AoA/GRAME process is currently in a very advanced and critical phase, with an *Ad hoc Working Group of the Whole* 31 August - 4 September 2009, and plans to submit its proposals to the UN General Assembly in October 2009. There are obviously close parallels with IPBES, warranting tracking of the reports and outcomes of meetings later this year.

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12 Copies of reports and documents for the IPBES Meeting can be found at www.ipbes.net
13 UNEP/IPBES/1/6
14 Available at www.unga-regular-process.org

b) Moves towards increased coherence within the UN and environmental governance have been under way for a number of years, recognizing the potential for missed opportunities for synergy, and duplication of effort if this is not addressed. Discussion on increasing coherence in both the UN system and international environmental governance is likely to continue for some time, and its final outcome cannot be predicted. However it can be assumed that emphasis will remain on the need for greater coherence, that improvements in the ways in which science can be used to support decision making will continue to be recognised as a key issue, and that improvements in delivery and use of such information now will be important for whatever governance landscape exists in the future. This is discussed further in Annex D.

C. Setting the Context

33. There is significant variation in understanding of what science-policy interfaces are, how they work, and what they can achieve, and this variation in understanding is contributing to delays in consensus building and potentially hindering opportunities for full agreement on how to improve the current science-policy interface. It is not entirely clear to all of those participating what issues are being addressed, and what the scope of the discussion is.

34. In practice, there is a range of scientific advisory bodies and processes of different type, size, purpose, and spanning different levels and sectors. These can be very different in nature, some being very formal and others rather informal in character, some being closer to scientific processes while others are closer to the political process. They may also have different functions, or operate at different stages of the policy process.

35. In order to provide a common ground of understanding for discussions on mechanisms to improve the science-policy interface for biodiversity, long-term human well-being and sustainable development, it is important to define the concepts central to the gap analysis, and define to the scope.

C.1. Defining the scope of the gap analysis

36. Given the mandate to support discussions exploring the mechanisms to improve the science-policy interface for biodiversity and ecosystem services, long-term human well-being and sustainable development, the scope of the science-policy interface, and hence of the gap analysis, is taken to encompass the following with respect to biodiversity and ecosystem services:

a) all aspects of the conservation and sustainable use of biodiversity in all Earth’s environments, whether terrestrial, freshwater, coastal or marine;

b) a wide range of other relevant sectors, including agriculture, forestry and fisheries, trade, development, and poverty reduction; and

c) multiple levels of governance addressing institutions at national, regional and global levels and the interactions between them.

37. The analysis therefore implicitly or explicitly includes institutions, networks and processes related directly to biodiversity and ecosystem services governance, as well as those that address sustainable development, and others that impact one or more aspects of biodiversity and ecosystem services.

C.2. Defining concepts central to the gap analysis

38. Science can be defined as the systematic pursuit of objective knowledge, involving formalised and disciplined methods of knowledge production which include the observation, identification, description, experimental investigation, theoretical explanation and prediction of phenomena. In trying to attain objectivity, science relies on the minimisation of any kind of influence that would introduce bias in knowledge production, and on validation of results through peer-review. Science encompasses all natural and social sciences, although the various disciplines differ significantly in their methods and concepts, and this has implications for developing interdisciplinary approaches, as is discussed later.

39. In addition to disciplined scientific knowledge there are other, non-formal types of knowledge, such as local, practical or traditional knowledge, that differ from scientific knowledge in essential ways. This non-formal knowledge often rests on experience and customs, and does not separate ‘secular’ or ‘rational’ knowledge from spiritual knowledge, intuitions and wisdom. It is often highly dependent on context, dynamic, collectively held and inter-generational in nature. Nonetheless, much non-formal knowledge exists that has the potential to considerably enhance the effectiveness of policies.

40. Policies can be defined as commitments to definite courses or methods of action with broad implications, selected from among alternatives in light of given conditions, and taking account of norms, values and motives, to increase the certainty of realising desired outcomes. Policies are adopted not only by governments and

intergovernmental bodies, but are also made by companies, interest groups and other organised forms of society. In contrast, politics can be understood as the set of practices and institutions through which an order is created in the context of power and conflict, including processes of bargaining, negotiation and compromise over policy development and implementation.

41. Science and politics are characterised by different types of knowledge and processes, and as such they are treated as independent and separable human activities. However, in reality the scientific and political spheres deeply intersect with one another through the intermingling of processes, products and actors.

42. It is in this context that science-policy interfaces can be defined as structures and processes that aim to improve the identification, formulation, implementation and evaluation of policy to render governance more effective by: defining and providing opportunities for processes which encompass interrelations between science and policy in a range of domains; assigning roles and responsibilities to scientists, policy-makers and other relevant stake- and knowledge-holders within these processes; and facilitating improved coordination within and between the different stakeholder groups.

43. With this in mind, science-policy interfaces need to be understood both as a means to more effectively link knowledge to action by providing for a flow of credible, policy-relevant and authoritative information to those actors who have the influence to actually make a difference, and as core elements of international governance that have the potential to shape governance systems significantly.

44. A wide range of reviews and studies related to the use of science in policy formulation and decision making has identified relevance (or salience), credibility and legitimacy as amongst the most important attributes of effective science-policy interfaces.[15] The following definitions are consistent with those used in the Assessment of Assessments/Regular Process for Global Reporting and Assessment of the state of the Marine Environment:

a) Relevance reflects the extent to which the approach and findings of a science-policy interface are closely related to the needs of decision-making processes, and the extent to which a science-policy interface identifies key target audiences and ensures effective consultation and communication between them and the knowledge holders, and strengthens the capacity of both experts and decision-makers to interact productively.

b) Credibility reflects the perceived validity of information, methods and procedures to a defined audience, and thus the extent to data of appropriate quality and established methods are used, availability of results and methods for peer review, absence of bias, selection of knowledge holders through appropriate and transparent procedures and so on.

c) Legitimacy reflects the perceived fairness, balance, political acceptability and trust, in particular the extent to which the processes are perceived as respectful of stakeholders' contributions, concerns and their divergent values and beliefs, including the extent to which these processes provide for transparency and availability of data and information and efforts to strengthen the capacity of all interested groups to contribute.

45. In addition it is assumed that science-policy interfaces should also be efficient in the sense of being costs-effective, and building on existing experience, organizations, processes, networks and programmes. Throughout the following analysis consideration is given to these characteristics and whether they are being adequately addressed.

46. Four main categories and/or areas of work of a science-policy interface emerge from the discussion at both the IPBES Meeting in Putrajaya and the UNEP GC/GMEF:[16]

a) building a common and shared knowledge base;

b) effectively informing policy formulation and other relevant decision making;

c) providing fundamental capacity for all stakeholders and knowledge holders; and

d) facilitating a coordinated response to various issues by different actors.

[15] Cash, D.W. *et al*. 2003. Knowledge systems for sustainable development. PNAS 100 (14), 8086-8091; Farrell, E.F., Jäger, J. 2006 Assessments of Regional & Global Environmental Risks. Resources for the Future, Washington, D.C.; Assessment of Assessments Report and Summary for Decision Makers, 2009 (www.unga-regular-process.org)

[16] See UNEP/IPBES/1/6 and UNEP/GC.25/15

D. Description of the Institutional Landscape

Finding #1. A wide range of science-policy interfaces of varying types, sizes and purposes already exist for the many multilateral environmental agreements and other bodies relating to biodiversity and ecosystem services at all levels. Between them they have, to a certain extent, enriched decision-making and raised awareness of biodiversity and ecosystem services among the environmental community.

47. Throughout the last few decades there has been significant increase in the arrangements made at all levels to conserve and sustainably use biodiversity and ecosystem services. These arrangements range from legally binding treaties to disbursement of multilateral assistance, and from national policy development to setting fisheries quotas. Meanwhile there has been significant advance in science, and increasing recognition of the importance of effective use of science in decision making. Therefore, as environmental governance arrangements have proliferated, mechanisms for ensuring that these are advised by science have also developed.

48. The landscape of processes, organizations, networks, programmes and other arrangements promoting, ensuring and supporting the use of science in decision making is now large and complex, and it is in the context of that landscape that consideration needs to be made of how to most effectively improve the science-policy interface and ensure the effective incorporation of biodiversity and ecosystem service science into decision making at all levels and across all sectors.

D.1. Setting the scene

49. This section aims to describe that landscape, to identify by examples the range of individual scientific advisory bodies and processes involved, and the range of support they have available. In addition, Annexes E-J and T-W provide further descriptions of a range of examples of scientific advisory bodies and processes, and of some of the plethora of organizations, networks and programmes that support them.

Institutions and processes at global and regional levels

Finding #1.1 The existing landscape of science-policy interfaces and interactions provides an important basis that can be built upon and strengthened.

Finding #1.2 The variety of existing science-policy interfaces is in part historic as institutions have been created on an ad hoc basis to deal with problems and issues as they have emerged. Much of this variety is, however, likely to be inherent, given the complexity of governance arrangements, the multiple levels of governance, the broad range of sectoral interests and the variety of purposes.

50. The United Nations system and related governance processes have over the years demonstrated a steadily increasing interest in drawing on scientific information and advice in order to fulfil their responsibilities to advance human health, welfare, and development, while better managing and conserving the environment and natural resources. This need for scientific advice has been approached by different organs of the system, at different times, in different ways. Some of the most relevant examples include the following.

a) The Multilateral Environmental Agreements, which have each established subsidiary bodies or other mechanisms to provide scientific and technical advice, including, for example, the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the Convention on Biological Diversity (CBD), the Animal and Plant Committees of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the Scientific and Technical Review Panel (STRP) of the Ramsar Convention on Wetlands (see Annexes E-G).

b) UN Programmes such as the United Nations Environment Programme, which acts as the convener for a number of scientific advisory groups and processes, and mobilizes scientific and technical knowledge to support international environmental norm setting, activities which have over time culminated in adoption of conventions, action plans and strategies, research agendas, and political declarations (see Annex H).

c) International Commissions such as the Commission on Sustainable Development (CSD), set up under the UN Economic and Social Council (ECOSOC) to implement the Agenda 21, which relies on a wide variety of advisory inputs, most of which are provided through consultancy reports, or the Commission on Genetic Resources for Food and Agriculture which draws *inter alia* on the periodic review of *State of the World's Animal Genetic Resources for Food and Agriculture* developed through a participatory, country-driven process under the guidance of the Commission.

d) Scientific advisory groups such as the Scientific and Technical Advisory Panel (STAP) which supports the Global Environment Facility (GEF); the Joint Group of Experts on the Scientific Aspects of Marine Environment Protection (GESAMP) which advises a range of sponsoring organizations;[17] and the Intergovernmental Panel on Climate Change (IPCC), the leading body for the assessment of climate change, established in 1988 by UNEP and the World Meteorological Organization (WMO), all of which are described further in Annex H.

e) Specialized agencies, such as the UN Food and Agriculture Organization and the UN Educational, Scientific and Cultural Organization, which have a range of scientific advisory processes in addition to being responsible for specific international agreements (and their advisory processes), and in the case of FAO also for administering Commission on Genetic Resources for Food and Agriculture (see Annex H).

51. There is also an increasing number of intergovernmental arrangements at the regional level that play important roles in interfacing science and policy in biodiversity and ecosystem governance. For example, the following three organizations (see Annex J):

a) The Association of Southeast Asian Nations' (ASEAN) Centre for Biodiversity (ACB), which aims to facilitate cooperation and coordination among the Member States on the conservation and sustainable use of biological diversity in the region, focusing on issues such as information sharing and access, monitoring and assessment, and capacity building.

b) The African Union's Scientific, Technical and Research Commission (AU/STRC), established to coordinate and promote scientific and technological research and findings, and to serve as a clearing house for all scientific and technical activities of the continent through a sharpening of the overall national and regional development plans, strategies and policies in order to ensure full exploitation of national and natural resources for durable long term growth and development.

c) The European Environmental Agency (EEA) and European Environment Information and Observation Network (EIONET) of the European Union, established to support sustainable development and to help achieve significant and measurable improvement in Europe's environment through the provision of timely, targeted, relevant and reliable information to policy-making agents and the public.

52. Other key institutions which play important roles in interfacing science and policy are within or closely linked with the scientific community. Examples of such institutions include the following:

a) Organisations such as the International Council for Science (ICSU), the International Social Science Council (ISSC) and the Third World Academy of Sciences (TWAS), which among other things often represent the scientific community in, and coordinate their input to, high-level processes (see Annex J).

b) Scientific programmes, such as DIVERSITAS, the International Geosphere-Biosphere Programme (IGBP), and the International Human Dimension Programme on Global Environmental Change (IHDP), which promote and facilitate research in key areas.

c) Scientific networks, such as the Species Survival Commission (SSC) of the International Union for the Conservation of Nature (IUCN), the global network of International Long Term Ecological Research (ILTER), and information sharing networks and programmes such as the Inter American Biodiversity Information Network (IABIN) and the Global Biodiversity Information Facility (GBIF).

d) The research centres of the Consultative Group on International Agricultural Research (CGIAR), ranging from the Centre for International Forestry Research (CIFOR) to the WorldFish Centre, and from Bioversity International to the International Centre for Agricultural Research in the Dry Areas (ICARDA).

e) Specialist "boundary" organizations working in support of governance processes to improve the information available for decision making, such as the UNEP World Conservation Monitoring Centre, and the European Centre for Nature Conservation.

53. Finally there is the role played by civil society organizations and the private sector in providing support to science-policy interfaces. Some of the most relevant examples include:

a) World Business Council for Sustainable Development (WBCSD), a global association of some 200 companies which provides a platform for companies to explore sustainable development, share knowledge, experiences and best practices, and to advocate business positions on these issues in a variety of forums, working with governments, non-governmental and intergovernmental organizations (see Annex J).

[17] UN, FAO, IMO, UNESCO-IOC, WMO, IAEA, UNIDO and UNEP

b) Internationally active non-government organizations such as WWF, The Nature Conservancy (TNC), Conservation International (CI), BirdLife International and the World Resources Institute (WRI), which between them make substantive scientific input within the areas covered by their respective organizational interests and priorities.

54. In each case throughout this section it is important to remember that each of the institutions and processes referred to has its own mandate and its own governance arrangements, and their working arrangements vary widely depending on both their history and the particular mandate they have. It is therefore not surprising that this quick illustration of the institutional landscape shows that existing interfaces related to biodiversity and ecosystem services vary widely in nature, for example:

a) From institutions that are closer to political processes such as the subsidiary bodies of scientific and technical advice or the regional intergovernmental commissions to institutions that are closer to scientific processes, such as the international research programmes of DIVERSITAS, IGBP and IHDP or organisations like ICSU, ISSC and TWAS.

b) From institutions that intend to 'close down' policy processes decreasing the range of policy alternatives by developing clear authoritative recommendation as in the case of the subsidiary bodies of scientific and technical advice, to institutions that assist in 'opening up' policy processes brokering a range of policy alternatives by clearly associating scientific results with a range of choices and outcomes such as some assessment processes exploring different scenarios.

55. Together these individual science-policy interfaces and components of science-policy interfaces form a complex and continuously evolving interface between science and policy. As a result of this huge and varied landscape, there are many different approaches and messages, partly as a result of different mandates and interests, but also perhaps because there is no single frame of reference.

Institutions and processes at the national level

56. This complex landscape of internationally operating institutions and processes is complemented by similar sorts of arrangements at the national level, although the degree of complexity varies depending on national circumstances, as does the degree to which they interact with the international institutions and processes.

The special case of Multilateral Environmental Agreements (MEAs)

57. As an illustration of the workings of the science-policy interface it is worth looking more closely at the different types of arrangements used by a range of the MEA scientific advisory bodies, as is described here and in Annexes E-G. The MEAs covered are the six global biodiversity-related treaties (CBD, CITES, CMS, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Ramsar and World Heritage, and the other two "Rio Conventions" (UNFCCC and the UN Convention to Combat Desertification (UNCCD)).

58. The existing scientific advisory bodies and processes vary in quite significant ways in practice. All the biodiversity-related and Rio Conventions have formal scientific advisory bodies, with the exception of the World Heritage Convention (which draws on the advisory capacity of three independent organisations), and the International Treaty on Plant Genetic Resources for Food and Agriculture (which has not yet identified a need to establish a standing scientific advisory body, and benefits from the work of the Commission on Genetic Resources for Food and Agriculture). All of the advisory bodies report to the relevant COP, with the exception of the Ramsar STRP which reports to and is overseen by the Standing Committee.

59. The tasks of these scientific bodies and processes are convention-specific, with the bodies of most treaties focusing on scientific advice, while some are also expected to also make strong technical input. For example, the UNFCCC SBSTA is tasked to provide scientific advice, but also to promote the development and transfer of technologies, to conduct technical work on national communications and emission inventories, and to carry out methodological work in a range of specific areas.

60. The membership of the advisory bodies of MEAs is either open to all Parties (CBD, CMS, UNFCCC, UNCCD) or consists of appointed members and/or regional representatives (CITES, CMS, Ramsar). Some conventions encourage Parties to nominate experts or scientists in their delegations to the scientific bodies (national representatives at the CITES Animals and Plant Committees are primarily drawn from the national Scientific Authorities to CITES, for example), but there are no mechanisms to guarantee this will happen. The number and proportion of scientists participating in advisory bodies varies greatly between conventions and, within conventions, between one national delegation and another.

61. There are various ways for the scientific advisory bodies to draw on external scientific and technical information, and independent experts are frequently invited to contribute in one way or another. For example CMS and Ramsar can appoint scientific experts as members of the science advisory bodies for specific issues, and as previously mentioned the World Heritage Conventions uses the expertise of three independent organizations. For the UNFCCC, a completely independent external institution exists with the Intergovernmental Panel on Climate Change (IPCC) which provides advice for SBSTA to consider and make available to other Convention bodies and Parties.

62. Several conventions make use of expert groups. For example, limited duration *ad hoc* technical expert groups play a particularly important part in the CBD, where they address specific issues and provide input to SBSTTA, while the UNCCD has established a Group of Experts on Combating Desertification and Mitigating the Effects of Drought and the UNFCCC an Expert Group on Technology Transfer. In a few cases expert groups are used by more than one convention, as is the case with the Scientific Task Force on Avian Influenza and Wild Birds which is used by Ramsar, CMS and one of the CMS daughter agreements.

63. The UNCCD is the only convention that foresees in its articles the establishment of a roster of experts. The COP has faced problems in receiving information from Parties on the extent to which they have made use of the roster of experts and, through establishing the Group of Experts, has found a way to formalise the roster. The CBD established a roster of experts under SBSTTA but later discontinued its use; it was preferred to invite Parties to nominate experts for the *ad hoc* technical expert groups and other purposes. The UNFCCC continues to use a Roster of Experts.

64. In most conventions, the COP has adopted a *modus operandi* or terms of reference for the scientific body in order to clearly define its work and the way it provides scientific and technical advice. These *modus operandi* vary between the conventions in length and detail. The CMS Scientific Council has adopted its own Strategic Implementation Plan, aligned to the Strategic Plan of the Convention. Various other ways and means to improve the effectiveness of the advisory bodies have been suggested, including closer links with the scientific community and different meeting styles. For example the UNCCD has agreed to hold its future Committee on Science and Technology meetings in the form of scientific conferences led by identified institutions.

65. In addition the forward agendas of most of the scientific advisory bodies are known, or can be inferred from their strategic plans or work plans.

D.2. Potential limitations of science-policy interfaces

Finding #2. Notwithstanding the progress made by many of the existing science advisory bodies to improve the focus and quality of scientific inputs into policymaking processes, there is scope for further improvement in scientific independence through increased credibility, relevance and legitimacy.

66. In general the scientific advisory bodies and processes established by different governance bodies at whatever level have mandates and/or terms of reference that define how they work. These mandates are one of the strengths of the existing science advisory bodies just described, not least because it means that the governance bodies are likely to be listening to the advice given (even if there are other reasons why that advice is not ultimately followed). Additionally the *modus operandi* of the scientific advisory processes discussed above suggest that they are both expected to take account of scientific learning and experience, and have the potential to call on and involve scientists, which they all regularly do in one way or another.

67. As with any ongoing process it is important to regularly review and hopefully to improve the efficiency and effectiveness of scientific advisory bodies and processes, building on experience gained through practice. For example, several of the biodiversity-related treaties have initiated reviews of the effectiveness of their scientific advisory bodies. CITES established an external evaluation working group to review the scientific committees. UNCCD initiated extensive consultations on ways of improving the efficiency and effectiveness of the Committee on Science and Technology. CBD has considered suggestions for improving the workings and operations of SBSTTA on a number of occasions. Ramsar reviews the effectiveness of its STRP on an ongoing basis and has made adjustments to both membership arrangements and *modus operandi* in recent years.

68. However there are a range of recognised limitations which are common to almost the whole science-policy interface. To a large extent these occur because of the wide range of activities and relationships inherent in the complex landscape described above, and in each case the limitations could lead to mismatches, inefficiencies and duplication at all levels. These limitations are:

a) the need for a common and shared knowledge base, rather than the fragmented knowledge base currently available, which is addressed in Section E.1;

b) the need for more effective communication of policy relevant information, based on addressing clearly identified and understood needs, which is addressed in Section E.2;

c) the need for improved coordination across the many components of the science-policy interface, building on existing experience and activities, which is addressed in Section E.3; and

d) the need to build capacity at all levels to adequately address these issues both within the biodiversity sector and across sectors, which is addressed in Section E.4.

69. Meanwhile, two further distinct sets of challenges have been identified in reviewing these particular science advisory processes, those that are concerned with the increasing workload coupled with lack of (financial) resources and capacity, and those that are concerned with specific aspects of the processes employed. Some of the key concerns raised are discussed in the rest of this section, but it should be born in mind that these relate to the science-policy interface in general, and not just to the science advisory bodies and processes of the MEAs.

Capacities, budgets and agendas

Finding #2.1 Most science-policy interfaces have relatively modest budgets for the size of the task that they are expected to perform, potentially limiting their ability to assess knowledge comprehensively and ensure the input of the best available science, leaving them to rely on inputs from other bodies and processes that might not be best suited to their needs.

70. The first series of interconnecting issues which potentially result in limitations to the workings of scientific advisory bodies and processes are those concerned with their workload and resources. The challenges that can result are discussed in generic terms without specific examples, so as to avoid the potential for argument about the detail and any feeling that defensive positions need to be taken. Note that different scientific advisory bodies and processes are affected in different ways by these challenges, for some there is no problem, while for others the challenges are quite significant.

71. Agendas getting more crowded: In many cases more and more issues are being added to the agendas of those working at the interface between science and policy, in part because of increasing awareness of the relevance of biodiversity and ecosystem services to many aspects of society. This can potentially lead to:

a) an insufficient time for full discussion of issues at meetings;

b) issues not getting the level of attention that they need or deserve; and

c) delay in addressing issues.

72. Insufficient budget to prepare for issues adequately: Budgets are inevitably limited, and given the growing agendas and increasing complexity (as links to other sectors are increasingly being addressed), the budgets of most scientific advisory bodies and processes are relatively modest considering the breadth of issues they are expected to address. This can potentially lead to:

a) insufficient preparation for discussion unless additional resources can be found;

b) using what is available rather than commissioning what is required;

c) using whoever can deliver input at lowest cost, rather than whoever is best to do it; and

d) reduction in time available for consultation and peer review.

73. Unrealistic expectations: Depending on the issue of concern, research can take some time to complete, and in some cases scientific research over a period of time is essential (for example where aspects of change are being investigated). The scientific advisory bodies and processes can be severely challenged when they are set unrealistic timeframes for providing advice. This can potentially lead to:

a) insufficient preparation for discussion; and

b) using what is available rather than what is required.

74. The potential results if any of these concerns are realised are an increased risk of failure of uptake at the policy level, criticism of output and outcomes, and a dissatisfaction with the process that has led to them. This may then also lead to request for further input (which takes even more time), with concomitant delays in decision making.

Processes

Finding #2.2 Each science-policy interface works in a separate manner and each mechanism can bring its own limitations, such as the problems that can be encountered when an advisory body is responsible for providing scientific input to the policy process while acting as an initial negotiating platform.

75. The second series of issues which potentially result in limitations to the workings of scientific advisory bodies and processes are those concerned with different aspects of process. Again the challenges that can result are discussed in generic terms, and again it is important to note that different parts of the science-policy interface are affected in different ways by these challenges.

76. Science advice verses negotiation: Some scientific advisory bodies are charged with both providing scientific advice to their respective governance bodies, and with initial negotiation on the text of decisions. This can potentially lead to:

a) loss of scientific independence in the process (possibly without even realising it); and

b) negotiators predominating in meetings rather than scientists.

77. Experts and expertise: Different processes have implications for the ways in which individuals are identified and involved, and the extent to which they can (or are qualified to) contribute. In particular the following are potential limitations:

a) where experts are chosen for a panel, the choice of the right experts is crucial, as is the manner in which they then call on the expertise of others;

b) with respect to participation in meetings, whether the right people attend, and related to this how small delegations cope with the broad range of issues that can be under discussion;

c) whether additional experts, and expert organizations and processes, are able to contribute in an appropriate manner so as to increase the scientific input and review; and

d) whether sufficient and appropriate expertise is brought in from other disciplines and sectors relevant to the issues being considered.

78. Relationship to other processes and initiatives: Given many components of the science-policy interface address the needs of specific governance bodies and processes, and given the cross-sectoral nature of biodiversity, there are potential limitations in what can be achieved. In particular the following are potential concerns:

a) governance processes tending to mandate tasks independently without reference to other relevant interests and processes, which can restrict the actions of science advisory bodies;

b) scientific advisory bodies not taking other processes and initiatives sufficiently into account in their discussions and advice;

c) participants in one process being unaware of the advice given and positions taken by their direct counterparts in other processes, even when from the same government or organization;

d) overlapping areas of competence, where issues that are explored for possibly being addressed with respect to biodiversity are effectively blocked by decisions already taken in other sectors; and

e) key opportunities missed because everyone thinks it is someone else's responsibility.

79. Flexibility: Depending on their mandates, terms of reference and/or *modus operandi*, it can be difficult for some science-policy processes to quickly react to emerging issues, something that can be compounded by other limitations identified above such as crowded agendas and limited budgets. The potential result is that key issues may be dealt with later than they should if the science-policy interface is not able to respond.

80. Again the potential results if any of these concerns are realised are an increased risk of failure of uptake at the policy level, criticism of output and outcomes, and a dissatisfaction with the process that has led to them. In particular this is so if the right experts and expertise are not involved in an open and transparent manner, as there is opportunity then to question both the credibility and legitimacy of the process.

81. But at the end of the day, however good the advice, politics can result in a decision that goes against that advice for one reason or another. The example of fisheries management in the European Union is a case in point. Despite having excellent scientists, a significant amount of research, and processes which generate officially agreed advice through the intergovernmental International Council for the Exploration of the Seas

(ICES), many European fisheries are regarded by the European Commission as being unsustainable. The reasons for this are explored further in Annex W.

E. Analysis of the Science-Policy Interface

82. The analysis of the science-policy interface on biodiversity and ecosystem services addresses in turn each of the main functional components of a science-policy interface identified in the previous section: building a common and shared knowledge base which effectively supports policy; effectively informing policy and other relevant stakeholders; providing the fundamental capacity to enable full engagement in the science-policy interface, and increasing synergy and coherence through coordination of the many different actors, activities and issues.

83. The first two of these functional aspects, building a common and shared knowledge base and effectively informing policy, are really part of a single continuum of producing knowledge and effectively communicating it, but they are here considered separately in order to clarify the different roles they play and the issues concerned. Meanwhile the other two function aspects, providing fundamental capacity and coordination, are the most essential cross-cutting functional aspects of a science-policy interface. Although they are inherently part of all other functional components, due to their crucial importance each of these cross-cutting aspects are also addressed separately.

E.1. Building a common knowledge base

Finding #3. Although an extensive knowledge base exists to support decision-making in each of the many science-policy interfaces, shared frameworks, methodologies and basic understandings to respond to the complex nature of biodiversity and ecosystem services issues remain missing or incompletely implemented. There are also significant gaps in knowledge that need to be filled.

84. A knowledge base that was jointly constructed and thus common to and shared by as many of the relevant knowledge holders and stakeholders as possible would provide substantial support for the effective identification, formulation, implementation and evaluation of environmental policy at a variety of levels and across a range of governance processes.

85. Facilitating opportunities for building such a common knowledge base could therefore be seen as one of the core functions of the broader science-policy interface. The processes involved in the joint creation and management of such a common knowledge base would be highly valuable in developing and maintaining coherence across the boundaries of science, politics, business or other relevant domains of societal organisation.

86. Those elements considered essential for a knowledge base on biodiversity and ecosystem services, and which are analyzed in more detail below, include:

a) basic knowledge needs;

b) processes for the incorporation of different types knowledge;

c) guidance on research strategies and long-term observation and monitoring systems;

d) availability and accessibility to data and information;

87. In reading this section it is important to remain aware of the wide variation geographically in the availability of data, information and knowledge, the ability to generate it, and the implications of this for planning decision making at all levels. In a review of CBD national biodiversity strategies and action plans (see Annex U) it was found that lack of scientific input in development of the strategies and plans was a major concern, with potential implications for subsequent implementation. This is addressed further later, in the section on providing fundamental capacity.

E.1.1 Basic knowledge needs and guidance on research strategies

Basic knowledge needs

Finding #3.1. Notwithstanding the considerable progress in and growth of the relevant sciences, some fundamental knowledge gaps exist, in particular with regard to the dynamic interactions between drivers of change, ecosystems and human well-being. This is of particular concern at the regional, national and local scales, where many of the most important interactions of this nature occur and where human well-being depends most directly on ecosystem services.

88. Full understanding of the interactions between human activity and biodiversity and ecosystem services is essential to ensuring improvements in the conservation and sustainable use of biodiversity and ecosystem

services. Exploration of the interactions between social and ecological systems has emerged as a vibrant field of research over the last two decades,[18] and in particular the Millennium Ecosystem Assessment (MA) triggered a range of innovations and advances in the field. However, significant gaps in knowledge remain.

89. The recent report by a high-level multidisciplinary group of experts led by ICSU, UNESCO and UNU,[19] which was established by the MA follow-up process to identify key gaps in knowledge and data, to design a research agenda, and to influence the priorities of research funding agencies, has identified[20] that there is a lack of basic information both on the dynamics of social–ecological systems and the relationships of ecosystem services to human well-being. In particular they have identified that:

a) Research is needed to better understand effects of biodiversity in social–ecological context focusing on controls of ecosystem services themselves, addressing the effects of multiple drivers, structural factors including biodiversity, and human feedbacks across temporal and spatial scale; and addressing needs for information about how drivers and management interventions change ecosystem services – effects that are essential for understanding changes in ecosystem services and projecting the consequences of policies intended to improve ecosystem services.

b) Research is needed to build the empirical base for understanding thresholds of massive persistent changes in social–ecological systems, the factors that control probabilities of such changes, and leading indicators of incipient thresholds; and to develop policy approaches that build resilience for massive changes that are hard to predict and have long-lasting consequences.

c) Research is needed to improve the methodologies of quantification of tradeoffs of ecosystem services, to understand the true social value of non-marketed ecosystem services, and to derive the value of the ecosystem configurations that deliver different bundles of services.

d) Research is needed to understand how changes in ecosystem services interact with other determinants of human well-being. In addition, research is needed to understand the effect of changes in ecosystem services on wealth and poverty. Research is needed to clarify how changing flows of ecosystem services affect the most vulnerable members of society.

90. This report further states that, although some key questions relate to the impacts of global processes on ecosystems (e.g. the impact of trade and economic drivers) and the consequences of changes in ecosystems on global scale processes, research at a global scale cannot address many of the most important research challenges because *research is essential at the scale at which interactions occur among ecosystem services and between drivers and ecosystem services and between ecosystem services and people. Many of the most important interactions of this nature occur at landscape and regional scales.*

91. Also according to the report, the relative lack of knowledge at these landscape and regional scales was one of the greatest barriers encountered in the development of the MA, and is one of the key issues in the MA follow-up process (see Annex B). It is also one of the greater impediments to national implementation of environmental provisions agreed in the various MEA governance bodies, as for example, clearly shown by the extent to which countries have been able to develop and implement their National Biodiversity Strategies and Action Plans as called for by CBD Article 6 (see Annex U).[21]

92. Particularly significant is the lack of such knowledge in developing countries. For example, according to a quantitative analysis of more than 6400 environmental sciences papers published 1993–2003, only 13% of the papers are based on research in the dry sub-tropical and tropical zones, although these eco-climatic zones account for more than half of the world's land area.[22] Further, according to former UN Secretary-General Kofi Annan, "*Ninety-five percent of the new science in the world is created in the countries comprising only one-fifth*

18 Clark, W.C. 2007. Sustainability Science: A room of its own. PNAS, 104 (6): 1737-1738.

19 ICSU-UNESCO-UNU. 2008. Ecosystem Change and Humans Well Being: Research and Monitoring Priorities Based on the Millennium Ecosystem Assessment. International Council of Science.

20 Carpenter, S.R. *et al*. 2009. Science for managing ecosystem services: Beyond the Millennium Ecosystem Assessment. *Proceedings of the National Academy of Sciences* 106(5): 1305-1312.

21 See also UN/JIU/REP/2008/3; Najam, A. 2005. Developing Countries and Global Environmental Governance: From Contestation to Participation to Engagement. *International Environmental Agreements* 5: 303-21; UNEP/CBD/WG-RI/2/2/Add.1; see Annex S

22 Karlsson, S., *et al*. 2007. Understanding the North-South knowledge divide and its implication for policy: a quantitative analysis of the generation of scientific knowledge in the environmental sciences. *Environmental Science and Policy* 10(7): 668-684.

of the world's population. And much of that science […] neglects the problems that afflict most of the world's people." [23]

93. Lack of such knowledge in developing countries is not only accounted for as one of the greater challenges to policy implementation in these countries, it is also impeding the development of effective global environmental assessments that rely predominantly (or almost exclusively in the case of the IPCC) on published research results in peer-reviewed journals. Given the North-South bias in the published literature it can be argued that the resulting global assessments may currently be less 'global' than they set out to be, and that global negotiations and policy that are informed by these assessments may be inadequately addressing the perspectives of developing countries in particular.[24]

Guidance on research strategies

Finding #3.2. Although a range of institutions support the development of research strategies to meet policy needs, there is currently no process providing common and regularly reviewed guidance on a strategic approach to research to ensure that the most important needs in terms of knowledge to support more effective governance at all levels are being identified and responded to in a coordinated manner.

94. Helping to guide and/or influence the development and implementation of research strategies is of clear interest to the science-policy interface so as to help ensure future access to relevant research results and information based on them. To reach this aim, a science-policy interface would have to ensure coordination and a continuous dialogue about future research needs and strategies between those policy mechanisms and decision makers that are in need of further information, those responsible for developing research strategy, and the organization, networks, programmes and knowledge holders that would provide this information.

95. With both supply of and demand for scientific knowledge emerging from complex networks of individuals and institutions with diverse incentives, capabilities, roles, and cultures, it can be argued that more appropriate and more effective decisions about resource allocation, institutional design, programme organisation, and information dissemination science would be achieved if they were informed by knowledge about the supply of science, the demand for science, and the relationship between the two.[25]

96. Several organisations, programmes or initiatives support development of research strategies to meet policy needs in one way or the other, for example the following:

a) The International Council for Science (ICSU), with global and regional representations representing both national scientific bodies and international scientific unions, provides a forum for discussion of issues relevant to policy for international science and the importance of international science for policy issues, and undertakes, *inter alia*, planning and coordination of inter-disciplinary research to address major issues relevant to both science and society.

b) DIVERSITAS is an international programme of biodiversity science with a mission to promote an integrative biodiversity science, linking biological, ecological and social disciplines in an effort to produce socially relevant new knowledge to provide the scientific basis for the conservation and sustainable use of biodiversity. It also aims to establish national committees and collaboration with other organisations to enlarge and strengthen scientific networks to easier identify global research priorities, allocate resources, facilitate knowledge transfer, and support capacity building.

c) The International Social Science Council (ISSC), is an international non-profit-making scientific organisation with headquarters at UNESCO in Paris . It is the primary international body representing the social and behavioural sciences at a global level. The Council's role is to advance the practice and use of the social and behavioral sciences in all parts of the world, and to ensure their global representation. This involves among other things work to ensure their utilization and relevance to the problems of humankind. Such promotion includes, wherever possible, the assistance of policy development at international and national levels, and the use of high quality social science research to further economic well-being and quality of life in all parts of our globe.

d) The Academy of Sciences for the developing world (TWAS), an autonomous international organization, based in Trieste, Italy, that promotes scientific excellence for sustainable development in the

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[23] Annan, K. 2003. A challenge to the world's scientists. *Science* 299: 1485.

[24] Karlsson, S., *et al*. 2007. quoted above; Biermann, F., 2000. Science as Power in International Environmental Negotiations: Global Environmental Assessments Between North and South. Environment and Natural Resources Program, Discussion Paper no. 2000-17. Belfer Center for Science and International Affairs, Harvard University

[25] Sarewitz, D., Pielke, R. 2007. The neglected heart of science-policy: reconciling supply of and demand for science. *Environmental Science and Policy*. 10(1): 5-16.

South. Originally named "Third World Academy of Sciences", it was founded in 1983 by a distinguished group of scientists from the South to promote scientific excellence and capacity in the South for science-based sustainable development.

e) The European Platform for Biodiversity Research Strategy (EPBRS) is an example of a regional forum at which natural and social scientists, policy-makers and other stakeholders identify structure and focus the strategically important research that is essential to conservation and sustainable use of biodiversity from a European perspective.

f) The Scientific, Technical and Research Commission of the African Union (AU/STRC), established to coordinate and promote scientific and technological research and findings and to serve as a clearing house for all scientific and technical activities of the continent through a sharpening of the overall national and regional development plans, strategies and policies in order to ensure full exploitation of national and natural resources for durable long term growth and development.

97. While each of these, and many more institutions not mentioned here, contribute significantly to building a common knowledge base in one way or the other, it can be argued that gaps in understanding that exist today are evidence of the fact that those fundamental challenges cannot be adequately addressed through uncoordinated studies of individual components of isolated traditional disciplines in an *ad hoc* set of research sites scattered across the globe.[26, 27] It is suggested that what is lacking or insufficient are:

a) Processes that systematically assess and reconcile the supply and demand for science information on biodiversity and ecosystem services in order to ensure that research agendas are more relevant to science-policy needs, that research agendas and user needs are more closely matched, and that institutional constraints, and other obstacles do not prevent effective use of results.

b) Guidance on and coordination of place-based long-term social–ecological research, based on a conceptual framework that can be applied at multiple scales and accounts for interactions across scales, so as to allow for opportunities for unique place-specific research, comparisons across a network of places, and to address the connections of ecosystem processes and institutions across local, regional, and global scales.

c) Opportunities to learn from ongoing management programmes and policies to better understand the factors that influence the outcomes of programmes intended to improve ecosystem services and human well-being. Only rarely is the success of these projects evaluated by using appropriate data and indicators. There is a lack of a framework for assessing changes in social–ecological systems, by using metrics and indicators that can be collected consistently and compared across the range of cases.

98. It is also suggested that a further constraint is the lack of information tools delivering systematic reviews providing an evidence-based framework to evaluate effectiveness and support decision-making in biodiversity and ecosystem services management.[28]

E.1.2 Processes for the incorporation of different types of knowledge

Finding #3.3. While awareness of the need to draw more systematically on a broad range of knowledge types is growing, there remains a lack of processes for ensuring the effective incorporation of types of knowledge into the knowledge base, including the incorporation of knowledge from other sectors and disciplines, non-formal knowledge and mutual learning.

99. The modern world is characterized by an unprecedented fragmentation and specialization of knowledge, including scientific knowledge.[29] Yet, the knowledge needs identified in the previous sections clearly suggest the importance of drawing on a wide range of different types of knowledge and mutual learning when building the common knowledge base for sound decision-making. In this context in particular, two important issues come to fore as regards important aspects for the effectiveness of science-policy interfaces on biodiversity and ecosystem services:

a) the need to address the challenges of interdisciplinarity; and

b) the need to include other, non-formal types of knowledge.

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[26] ICSU-UNESCO-UNU. 2008. Ecosystem Change and Humans Well Being: Research and Monitoring Priorities Based on the Millennium Ecosystem Assessment. International Council of Science.

[27] Carpenter, S.R. *et al*. 2009. Science for managing ecosystem services : Beyond the Millennium Ecosystem Assessment. Proceedings of the National Academy of Sciences. 106(5): 1305-1312.

[28] Pullin, A.S., Knight, T.M. 2009. Doing more good than harm – building an evidence-base for conservation and environmental management. *Biological Conservation* 142(5).

[29] Norgaard, R.B., Baer, P. 2005. Collectively Seeing Complex Systems: The Nature of the Problem. *Bioscience* 55(11).

Interdisciplinary challenges

100. It has long been agreed that interdisciplinary approaches are essential to building the knowledge base necessary for enhancing the governance of the environment and sustainable development, and there have been significant advances in number and quality.[30] However, true and meaningful interdisciplinary research necessary for an effective science-policy interface still remains a challenge for at least the following reasons:[31]

a) Scientists in different disciplines have different perspectives and approaches. For example, it has been said that "*Most of the social scientists are discussing the means of interdisciplinarity without an end in sight whereas many natural scientists are ardently promoting an end without deeper consideration of the means involved*." [32]

b) Science is often inaccurately or incompletely homogenized, neglecting the diversity of approaches to research and the types of resulting knowledge, and at the same time it is not fully appreciated that knowledge can have different power and implications associated with it within the sciences, between natural and social sciences, and between science and societal knowledge.

c) The prevalence of earlier more disciplinary and reductionist concepts of science in the organization of society and its institutions can constrain efforts to facilitate and coordinate interdisciplinary knowledge production.

101. An analysis of interdisciplinary scientific assessment for environmental governance has emphasized the mismatch between the emerging understandings of the complexity of reality, the ways scientists have come to understand this complexity, and the way science connects to politics, policy, and management.[33] In this context, scientific advisory bodies and processes, and other components of the science-policy interface, can all play an important role in promoting interdisciplinarity.

102. The experience of the MA demonstrated that the complexity and critical importance of systemic interactions with the environment can best be understood through a collective, discursive process of scientists learning together. It is argued that such collective learning processes need to be increased, and most importantly, that these methods need to be institutionalised in a way that they are ongoing and able to inform new, more integrated governance.[34]

Local ecological knowledge

103. Even more challenging is the incorporation of local ecological knowledge.[35] It is now widely accepted that the knowledge and practices of local communities make important contributions to the maintenance of biological diversity and ecosystem services (see Annex K for a more detailed review). The key challenge now is to move beyond merely accepting in principle the importance of traditional knowledge in policy-making to ensuring these knowledges and practices are fully considered and implemented in policy decisions in a more systematic way.

104. A wide range of innovative and sophisticated approaches and examples of tools have already been developed by Indigenous organisations, Indigenous communities and those working in collaboration with Indigenous peoples to facilitate the application of local ecological knowledge and expertise in biodiversity and ecosystem services management.[36, 37]

105. However, such initiatives remain a small fraction of the practice in the formal world of research, planning, education, and decision-making. Most of the time, local ecological knowledge still remains ignored by the science-policy interface relating to biodiversity and ecosystem services management, and if it is taken into

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30 Clark, W.C. 2007. Sustainability Science: A room of its own. PNAS, 104 (6): 1737-1738.

31 MacMynowski, D. P. 2007. Pausing at the brink of interdisciplinarity: power and knowledge at the meeting of social and biophysical science. *Ecology and Society* 12(1): 20; Norgaard, R.B., Baer, P. 2005. Quoted above.

32 MacMynowski, D. P., 2007. Quoted above.

33 Norgaard, R.B. 2008. The Implications of Interdisciplinary Scientific Assessments for Environmental Governance. In Ranganathan, J., Munasinghe, M., (Eds). *Policies For Sustainable Governance of Global Ecosystem Services*. World Resources Institute.

34 Norgaard, R.B. 2008. Quoted above

35 Also variously referred to as traditional, indigenous, community, customary, or practical knowledge

36 As shown by studies of tools that have been developed by Indigenous organisations, Indigenous communities and those working in collaboration with Indigenous peoples to facilitate the simultaneous protection and application of traditional knowledge and expertise in biodiversity conservation and management.

37 At the initiative of the UN Permanent Forum of Indigenous Peoples, and working with Tebtebba, a series of regional workshops were organized in 2006-07 around the question of how to integrate traditional knowledge into relevant processes of the science-policy interface, resulting in substantial guidance relevant to the policy-making process.

account, this has largely been accomplished through the work of western-trained academics and other intermediaries, following the largely linear, extractive academic convention of documenting and publishing traditional knowledge related to biodiversity.[38]

106. However, the primary goal in incorporating traditional knowledge into biodiversity decision-making cannot be premised on a straightforward "integration" of western scientific and traditional knowledge systems and methods. Incorporating traditional knowledge and expertise into dominant western scientific and legal paradigms, without due consideration and understanding of cultural diversity as inextricably linked to biological diversity, is not only inadequate, but potentially detrimental to both biological diversity and local communities whose existences and well-being are interdependent with biological and ecological systems.[39]

107. Among the main reasons for the current lack of incorporation of local ecological knowledge into science-policy interface processes is:

a) The complexity of the issue and the fact that no one-size-fits-all solution will or can emerge for how traditional knowledge and western science can be brought together in a synergism founded on complementarity.

b) The serious levels of erosion local ecological knowledge is facing, as the peoples and communities holding local ecological knowledge themselves face a range of threats from outright annihilation to 'assimilation' into 'mainstream' society, the knowledge they hold also slips away.

c) The continuing view that local ecological knowledge is inferior to scientific knowledge and the inherent inequity in distribution of power that stands in the way of governments, academic scientists, policy makers and others seeking meaningful collaborations with Indigenous organisations and communities.

108. Instead, a meaningful incorporation of local ecological knowledge into the science-policy interface requires at least the following:

a) Recognition, tolerance and facilitation of the expression of divergent styles of reasoning, acknowledging the strengths and weaknesses of each knowledge type, providing for access to and exchanges of information and for capacity building, allowing for mutual learning, exploring ways to build synergies to fill gaps and enhance comparative advantages of different knowledge types.

b) Tested models, templates and guidance on how to engage and disengage in ethical and equitable relationships (both within and outside of communities), and storage and management of vast amounts of information in various forms and with built-in mechanisms for multilevel or tiered access and degrees of stringency in control of information flow.

c) Acknowledgement of and support to ensuring the continuation of the social, cultural, economic, political and spiritual contexts within which such knowledge arises and is meaningful. This means the full recognition of the territorial, cultural, and political rights and responsibilities of indigenous peoples and local communities,[40] and the need to avoid generalizations or extrapolations that may overlook significant regional differences or diversity and lead to erroneous outcomes.

d) A balance between the need to document and make more widely available traditional knowledge related to maintenance of biodiversity on the one hand, and the need to ensure protections against unfair or harmful exploitation of the knowledge and interrelated bio-cultural resources.

E.1.3 Long-term observation and monitoring systems

Finding #3.4. Notwithstanding continuing efforts, there remain significant gaps in long-term observation and monitoring programmes, in particular as regards data and information on interactions between drivers of change, ecosystems and human well-being, and on particular geographic regions.

109. To ensure that the common knowledge base is able to provide relevant, credible and legitimate support to decision makers, now and in the future, it is important to ensure data capture oriented to addressing the current needs of decision makers, and their anticipated future needs. Observations made over long periods of time, including remote sensing, and programmes and process that bring observations together can have particular relevance for decision making processes because of their ability to illustrate change and trends, and to be able in some cases to link these changes and trends to pressures on biodiversity and ecosystem services, and on human

38 Bannister, K., Hardison, P. 2006. Mobilizing Traditional knowledge and Expertise for Decision-Making on Biodiversity. IMoSEB Case Study.
39 Bannister, K., Hardison, P. 2006. Quoted above.
40 The UN Declaration on the Rights of Indigenous Peoples provides a good basis for such recognition.

intervention to address those pressures and changes. These can be considered by looking at three inter-related groups of activities: Earth observation; long term research activities; and monitoring programmes.[41]

110. Recognizing that increased international collaboration was essential for exploiting the growing potential of Earth observations to support decision making, the Group on Earth Observations was launched in 2005 as a voluntary partnership of governments and international organizations to coordinate efforts to build a Global Earth Observation System of Systems (GEOSS). Much progress has been made in implementation of the 10-Year Implementation Plan[42], but in reporting to the Earth Observation Summit in 2007 the GEO Secretariat admitted that considerable work still needed to be done to fully incorporate GEOSS projects into decision-making processes, despite the existence of an ever widening group of user communities.

111. The GEO Biodiversity Observation Network was established in 2007 with the intention of providing a coordinating framework working across many of the existing efforts to observe biodiversity. The intention is that such a coordinated biodiversity observation network would enable new and synthetic understanding of biodiversity and its role in maintaining the Earth system and humanity's place in it, facilitating the efforts of governments and the global community to address biodiversity loss by improving the ability to accurately monitor trends in biodiversity and to develop and test response scenarios, including addressing important gaps in observations. GEO-BON aims to address a number of known shortcomings and gaps in long-term observation and monitoring programmes, but it is still new and actively evolving.

112. Long term research at the national level, and international collaboration in long term research, is promoted by a range of international initiatives including in particular the International Long Term Ecological Research programme and the UNESCO Man and Biosphere programme. In both cases the global network comprises a range of national and regional initiatives that have associated themselves with the programmes concerned. While both programmes (ILTER and MAB) identify priorities for various aspects of research, implementation at the national level is essentially dependent on national or site-level priorities and available resources. The evaluation of MAB carried out in 2002 reported favourably on a wide range of issues, but notable was the observation that socio-economic research needed further attention, something that has also been identified as a weakness in the ILTER network.

113. Since the 2010 target was adopted in 2002 there has been a significant amount of discussion in the scientific literature on monitoring programmes,[43] particularly with respect to ensuring the availability of data for development and delivery of indicators. The essential message is that monitoring programmes need to be established and/or substantially improved so as to ensure the availability of the data necessary for tracking change in individual species and ecosystems, focusing on specific taxa and ecosystems, and ensuring geographic coverage which is currently particularly biased. Within its own area of interest, the Ramsar Convention has developed a handbook on inventory, assessment and monitoring intending to help address part of this need for wetlands, and others are taking similar steps.

114. However of particular concern is that there are few monitoring programmes currently that directly or indirectly address the delivery of ecosystem services that depend on biodiversity, or the value of biodiversity to local people. When the MA was carried out it made extensive use of the long-term data that was available on social–ecological variables, but the relative scarcity of such data made it difficult to evaluate trends and draw conclusions about relationships of social–ecological variables.[44]

115. Review of the information needs of the MA, and consideration of the gaps that needed to be addressed in the future by monitoring programmes included the following, building on what is already provided by other

[41] While the term monitoring is used, this is intended to cover both monitoring and surveillance. *Monitoring* can be defined as the collection of specific information for management purposes in response to hypotheses derived from assessment activities, and the use of these monitoring results for implementing management, while the collection of time-series information that is not hypothesis-driven can be termed *surveillance* rather than monitoring (Ramsar Resolution VI.1).

[42] The 'societal benefits that the implementation plan addresses are identified in Annex J).

[43] See for example: Green, R.E. *et al*. 2005. A framework for improved monitoring of biodiversity: responses to the World Summit on Sustainable Development. *Conservation Biology* 19: 56–65.; Pereira, H.M., Cooper, H.D. 2006, Towards the global monitoring of biodiversity change. *Trends in Ecology and Evolution* 21(3): 123-129; Dobson, A. 2005. Monitoring global rates of biodiversity change: challenges that arise in meeting the CBD 2010 goals. *Phil. Trans. R. Soc. B. 360*; Reyers, B., McGeoch, M.A.2008. A biodiversity monitoring framework for South Africa: progress and directions. *South African Journal of Science*. 103:295–300; Lengyel, S., *et al*. 2008. Habitat monitoring in Europe: a description of current practices, *Biodiversity Conservation* 17: 3327-3339.

[44] Carpenter, S.R., *et al*. 2009. Science for managing ecosystem services : Beyond the Millennium Ecosystem Assessment. Proceedings of the National Academy of Sciences 106(5). 1305-1312.

advantages to be gained if there were increased coordination, clearer political support and more secure financing, and if more attention was being paid to those knowledge gaps of particular importance for decision making processes:

a) Promoting and facilitating the use of internationally adopted standards, terminology and nomenclature so that data and information can be more easily shared and combined.

b) Ensuring that datasets and information repositories have associated metadata describing for potential users their provenance, and the methodologies used for data capture, management and manipulation.

c) Advertising the existence of datasets and information repositories more widely so as to increase their use by interested parties.

d) Promoting and facilitating increased online access to data and information (including publications) so that others are able to use them.

e) Developing and testing methods for combining data captured at different scales and using different methods so that they can be meaningfully and effectively used - so called data harmonization.

f) Developing tools that locate and/or combine data from multiple sources, and present these in ways that aim to directly support the decision making process.

g) Promoting a culture that reduces restrictions on access to data and information, encouraging organizations and individuals alike to work towards open access to data, information, expertise and knowledge.

h) Building the capacity of those managing data and information to carry out many of the tasks identified above for their own databases and information repositories.

i) Increasing coordination in improving access to data and information will substantially improve the knowledge base, particularly when combined with better understanding of the needs of policy makers.

123. Particularly important for increasing access to information are the development of national and regional information networks, the latter also facilitating and promoting the development of the former. The Inter-American Biodiversity Information Network (IABIN), for example, is beginning to play a valuable role in building capacity for data management and sharing at national and regional levels, initiated at least in part with the intention of supporting decision making. At the national level organizations such as the South African Environmental Observation Network (SAEON) and the Comision Nacional el Conocimiento y Uso de la Bioversidad (CONABIO) in Mexico are examples of networks which provide some of the same functions at the national level, helping to ensure access to data and information relevant for decision making. Both regional and national networks are actively supported by international programmes and networks which facilitate and promote increased access to data.

124. One other specific case of barriers to use of existing knowledge which it is worth emphasising further concerns access to publications, including in particular the scientific literature. The current publishing model and the costs of purchasing publications, and in many cases even of access to them over the internet, is essentially reducing access to and use of published knowledge. This particularly affects those in developing countries. There are programmes and activities addressing this, such as the increase in public access journals on the internet, online publishing, the OARE project, and specific national efforts in a range of countries, but these need further promotion and extension.

E.2. Effectively informing policy

Finding #4. Various mechanisms synthesize, present and communicate knowledge to inform policy. There is, however, a lack of regular processes providing periodic, timely and policy-relevant information covering the full range of biodiversity and ecosystem service issues to the broader development community. This information and knowledge is not always translated and communicated in the most efficient way or the most useful format.

125. Adequate synthesis, presentation and communication of the knowledge base is just as important as the creation of it, given that different rationalities, discourses and norms need to be bridged to effectively inform policy. Benefits that accrue from ensuring that policy makers have access to information from science and scientists in a form that best helps them to use it. For example, information provided is far more likely to be used if it is:

a) Context specific: the implications of scientific research are expressed in such a manner that their relevance to policy issues and decision making is readily apparent to a non-scientist;

programmes that already exist. It is noteworthy that most of these relate closely to the needs for indicators identified by other processes, which is discussed further in a later section. The identified needs[45, 46] are:

a) comprehensive time series information on changes in land cover and land use, biotic systems, and changes in use and ecological characteristics of oceans;

b) locations and rates of desertification;

c) spatial patterns and changes in freshwater quantity and quality, for ground and surface waters;

d) stocks, flows, and economic values of ecosystem services;

e) trends in human use of ecosystem services;

f) changes in institutions and governance arrangements; and

g) trends in components of human well-being.

116. With respect to long term observation and monitoring systems, coordination is essential in steps to harmonize data collection and management, including the adoption and promotion of standards and standard terminologies, and in building data sharing networks as is discussed below.

E.1.4 Availability of and accessibility to data and information

Finding #3.5. While progress has been made, there remain significant barriers to the effective use of existing data and knowledge resulting from institutional and technical impacts on both the availability of data and information and on the ability of users to gain access to such data and information in meaningful ways.

117. Data and information is fundamental to understanding status and trends in biodiversity, and the results of human interaction with biodiversity, and they are therefore essential components of biodiversity assessments, indicators and models, and provide the basis for monitoring impacts of decisions made at all levels. The spread of the Internet has been enormously helpful in improving opportunities for sharing data, information and knowledge, however, despite the Internet, despite the many programmes, networks and institutions collecting and managing data at all levels, and despite a far more clearly understood need for data and information, there remain a number of barriers to more effective use of biodiversity information, even where it already exists.

118. These barriers include: cultural barriers, which lead to an unwillingness to share data; lack of standardization, which makes it more difficult to combine data from multiple sources; insufficient incentive for those collecting and managing data to make it available to others; cost of digitization where the data concerned is still only available in hard copy; lack of information on datasets, on how data was collected and subsequently handled; and insufficient tools for providing meaningful access to data.

119. These barriers result in data availability and data access varying significantly from one part of the world to another. This is further compounded by the fact that species diversity is not fully described, that there is no broadly accepted classification of ecosystems, and that knowledge at the genetic level is even patchier than at the species or ecosystem level.

120. Having said this, many programmes, networks and institutions working at all levels are collecting and managing data for a variety of purposes, developing and promoting the use of standards, identifying ways to bring a variety of data from multiple sources together, developing increasingly sophisticated online access to data, and so on. All of this increases the data and information potentially available for supporting decision making, while recognising that significant taxonomic, thematic and geographical gaps remain.

121. However perhaps the most difficult barriers to address are the cultural barriers to sharing data and information, and to publishing it,[47,48] which range from financial issues to inter-institutional trust, and from concerns about releasing data before research is complete to publishing models which restrict access to those who have paid. There is now an increasing pressure to place data and information in the public domain, and momentum on this is increasing.

122. In the context of improving the use of data and information in decision making the following actions are key. Some are already under way to a greater or lesser extent, and some have strong champions, but there are

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45 ICSU-UNESCO-UNU. 2008. Ecosystem Change and Humans Well Being: Research and Monitoring Priorities Based on the Millennium Ecosystem Assessment. International Council of Science.

46 Carpenter, S.R. *et al*. 2009. Quoted above.

47 Costello M.J. 2009. Motivating Online Publication of Data. *BioScience*, 59:418-427

48 Smith V.S. 2009. Data publication: towards a database of everything. *BMC Research Notes* 2:113

b) Clearly expressed: the implications of scientific research are expressed succinctly, and in such a manner that the conclusions and implications are readily understood by a non-scientist;

c) Credible: arising from recognised, independent and unbiased sources, backed up by necessary research and supplementary evidence (and where appropriate caveats), and peer reviewed;

d) Appropriately communicated: delivered in the most appropriate formats and through the most appropriate channels to ensure that it is taken account of;

e) Responsive: directly responding to the identified needs of or requests from policy making bodies and decision-makers (whether by direct request or responding to know agendas); and

f) Timely: the information is delivered not only in appropriate formats, but to timetables appropriate for consideration by those developing policy and making decisions.

126. There is a long history in environmental governance of trying to ensure that policy is informed by the best knowledge available, and a variety of mechanisms of synthesizing, presenting and communicating knowledge to inform policy have emerged over time, and across scales and different regimes. However, despite the increasing role of science advice in governance, questions continue as to whether scientific advice is being delivered in the most effective way. Based on a review of previous discussion on the science-policy interface, the following elements are considered essential for synthesizing, presenting and communicating knowledge to inform policy on biodiversity and ecosystem services, and are analyzed in more detail below:

a) nature and scope of synthesis, presentation and communication of knowledge to inform policy;

b) models, scenarios and indicators;

c) assessments; and

d) early warning of emerging issue of concern.

E.2.1 Nature and scope of synthesis, presentation and communication of knowledge to inform policy

Clear and authoritative synthesis and communication of knowledge to inform policy

Finding #4.1. As a result of the vast quantity and varying quality of differing, fragmented and sometimes even contradictory knowledge currently available, together with the lack of clear authoritative synthesis and a clear and targeted communication thereof, decisions taken are not necessarily informed by the best available knowledge.

127. For essentially historic reasons "western" society is characterized by a fragmentation and specialization of knowledge, including, in particular, scientific knowledge. Dividing, reducing, or structuring the world into distinct separate realms of learning and research was key to early processes of science. This has also had an influence on governance. As scientists began to play an increasing role in calling for policy change, the structure of science became mirrored to some extent as new governance arrangements evolved, resulting in an similarly divided and fragmented institutional landscape of governance.[49] This fragmentation is particularly evident in environmental governance. In biodiversity and ecosystem services governance, institutions have been created case by case over a long period of time, resulting in an array of conventions, institutions, networks and programmes with overlapping remits and often poorly defined boundaries between them.

128. This fragmentation is also reflected in the system of institutional arrangements established to interface science and policy on matters regarding biodiversity and ecosystem services governance, and provide advice to it.[50] Not only is there a vast quantity and varying quality of differing, fragmented and sometimes even contradicting knowledge on biodiversity and ecosystem services, there is also a wide range of differing, fragmented and sometimes potentially incompatible processes established to bridge this knowledge with policy. While this range of different knowledge and institutions and their fragmentation are to some extent necessary to ensure some degree of efficiency and effectiveness in the face of the complexity of inherently interlinked global

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[49] Norgaard, R.B., Baer, P. 2005. Collectively Seeing Complex Systems: The Nature of the Problem. *Bioscience* 55(11);. Norgaard, R.B. 2008. The implications of interdisciplinary scientific assessments for environmental governance. In: Ranganathan, J., Munasinghe, M. (Eds). *Policies for sustainable governance of global ecosystem services*. Edward Elgar.

[50] van den Hove, S., Chabason, L. 2009, The debate on an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). IDDRI Discussion Papers N° 01/2009 Governance.

environmental change, it is more and more difficult to reach a shared understanding and hence to take corrective steps.[51]

129. In the absence of institutional arrangements that would ensure the provision of relevant, credible and legitimate information and advice on the issue of biodiversity and ecosystem services on which all relevant users could draw, information and advice can potentially be contested. As a result there is debate on the science in most scientific advisory bodies and processes, and the potential for States, large NGOs and other knowledge holders with vested interests to use science as a tool for politics, instead of supporting decision-making processes by providing an authoritative overview of the best available knowledge.

130. A direct outcome of this are expressed concerns that range from the workings of SBSTTA and the politicisation of debate on scientific issues,[52, 53] to the wide application of prioritization approaches used by some NGOs which are influencing conservation and development investments.[54] This is not to say that either are necessary wrong or inappropriate, but that concerns are being expressed, and that this is in part a result of not having a clear and authoritative synthesis and communication of knowledge to inform policy.

131. This is rather different to the situation in climate change governance, which relies to large extent on the Intergovernmental Panel on Climate Change (IPCC) for much of the scientific validation of concepts and information. This has considerably reduced debates over scientific credibility in processes such as the UNFCC SBSTA, because as a result of the existence of the IPCC – which predates the adoption of the UNFCCC – there is little debate on many of the scientific issues as government has already accepted the results in another forum. This is not to say that this covers all scientific issues and there is not debate, but that for many issues this is not necessary.

132. In effect, the fragmented nature of science and scientific organizations is also contributing to this for the very reason that they do not speak with one voice, and have often not found themselves able to do so. The MA is an example where they have done so, and this has substantially contributed to the very significant shift in thinking so that the world is far more concerned with ecosystem services, and links between biodiversity and human wellbeing. It therefore seems true to say that the more science and scientists can speak with one voice, and the more credible, relevant and legitimate the process or processes that enable them to do so, then the more effective the results are likely to be in informing policy development and implementation.

Issue advocacy versus brokering knowledge in form of policy options

Finding #4.2. Knowledge is often not presented in the form of clear policy alternatives that systematically outline the implications of policy options under detailed framing assumptions and provide better guidance in policy implications.

133. There is tendency to think[55] that within the science-policy interface there should be an unproblematic, linear relationship between scientists and decision makers, in which the output from one process - the production of knowledge - becomes the raw material for another - the making of policies and decisions - and in which achieving agreement on scientific knowledge will lead to political consensus and clear courses of action. The underlying assumptions of this conception, although subject to a robust and well-developed critique,[56] are implicit in much policy discourse and often supported by natural scientists and policy makers alike.

134. In this context, important efforts which aim to interfacing science and policy, such as global environmental assessments, are predominantly aimed at reaching consensus on the scientific knowledge with respect to the status, trends and predictions of the most important drivers of environmental change in order to further environmental governance efforts.

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51 Norgaard, R.B. 2007. Deliberative Economics. *Ecological Economics* 375-382; van den Hove, S., Chabason. L., 2009. Quoted above.

52 Koetz, T. e*t al*. 2008. The role of 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

53 Le Prestre, P.G. (Ed) 2002. Governing global biodiversity: The evolution and implementation of the Convention on Biological Diversity. Ashgate, Aldershot

54 Miller, C.A. 2003. Knowledge and accountability in global governance: Justice on the biofrontier. In Tetreault, M., Teske, R. (Eds) *Partial Truths: Feminist Approaches to Social Movements, Community, and Power*. University of South Carolina Press.

55 Owens, S. 2005. Making a difference? Some perspectives on environmental research and policy. *Transactions of the Institute of British Geographers* 30(3): 287-292; Pielke, R.A. 2007. *The honest broker: Making sense of science in policy and politics*. Cambridge University Press.

56 See for example Jasanoff, S. 1990. *The fifth branch: science advisors as policy makers*. Harvard University Press; or Pielke, R.A. 2007. Quoted above.

135. However, there are no unambiguous answers in science that would resolve political conflicts over complex problems of global environmental change. Processes achieving legitimate outcomes over environmental conflicts involve bargaining, negotiation and compromise. Thus in situations of political gridlock, policy-makers frequently need new options, and not more science to advance in environmental governance.[57]

136. Therefore there is a need for the scientific community to differentiate scientific results from the policy significance of those results, and to go beyond the presentation of scientifically unambiguous statements of status and trends, and engage more actively in policy analysis facilitating the creation of new and innovative policy alternatives along with expression of the implications of those alternatives where that is possible.

137. However, concerns have been raised that most scientists, even those asked to inform policy as for example in the cases of the IPCC and MA, typically eschew explicit discussions of the significance of their scientific findings for policy.[58] Seeking to be ‘policy relevant but not policy prescriptive’, scientists rarely go beyond a description of their scientific results as concerns trends, conditions and projections, do not take the next step further explaining how these findings translate into different policy alternatives, and leave the analysis of what these findings imply for policy actions to decision makers.

138. As a result, decision makers often find themselves dependent on in-house capacity within their secretariats to translate science into policy actions, or, if there is a lack of such capacity, on the interpretations provided by consultants or interest groups. Otherwise they might be unable to follow scientific information or advice with the implementation of meaningful policy. For example, not having gone the further step and translating the MA findings into a more relevant context for national governments has been seen as one of the reasons why it did not have the expected results in shaping policies, in particular as regards developing countries.

139. What is lacking are institutional arrangements within science-policy interfaces that systematically assess and communicate the significance of science for policy. Such analysis of policy, the essence of policy advice, implies the presentation of information and knowledge in terms of an honest broker of a range of policy alternatives systematically revealing how alternative policy options would appear preferable under different detailed framing assumptions and showing how these dependencies relate to the real world.[59]

140. Returning to the example of fisheries management in the European Union referred to in a previous section and discussed in more detail in Annex W, it is noted that as a result of frustration that their advice was not being followed scientists were increasingly moving away from simply being objective experts providing facts to working more closely with policymakers in approaches involving scenario-based modelling so that potential implications of decisions can be more easily understood.

Focus of policy information

Finding #4.3. In discussions on science-policy interfaces there is far more focus on identifying issues and formulating policies with regard to multilateral environmental agreements at the global level than on supporting policy implementation and policy evaluation, particularly at the national and regional levels of governance, and on the extent to which effective information and advice pertains to and is used by the development community at the lower governance levels.

141. As stated earlier, there are essentially four different areas or phases of policy to which science can contribute and which science-policy interfaces should take into account - issue identification, policy formulation, policy implementation, and policy evaluation. There is a strong tendency for scientific advisory bodies and processes at the international level to focus on issue identification and policy formulation, which takes place at the global level of governance, to the detriment of providing knowledge support to policy implementation and evaluation, which is mostly an issue to national and regional levels of governance.

142. This lesser focus on policy implementation and evaluation has the potential to considerably impede biodiversity and ecosystem service governance. For example:

a) Lack of knowledge and practice on ecosystem-based management, lack of economic incentive measures, and lack of support in mainstreaming biodiversity into other sectors were mentioned among the key challenges impeding on the implementation of the National Biodiversity Strategies and Action Plans (NBSAPs),

57 Pielke, R.A. 2007. Quoted above.
58 Pielke , R.A. 2007 The honest broker: Making sense of science in policy and politics. Cambridge University Press.
59 Pielke, R.A. 2007. Quoted above

the CBD's most important means to allow for national self-expression and key instrument for implementation (see Annex U).[60]

b) The fact that the MA did not go beyond the presentation of general findings relevant to global governance and take the next step in terms of helping countries with taking and using these findings, and to design policies at their respective scale and context, has been identified as one of the reasons for why the MA has been limited in impact.

143. In the case of biodiversity and ecosystem services, most actions will have to be taken at the local level and are not dependent upon coordinated global action,[61] a predominant focus on issue identification and policy formulation, and the relative neglect of focus on policy implementation and evaluation at national level inherent in much of the international science-policy interface, constitutes a critical gap of the current science-policy interface.

144. In trying to make a difference, certain initiatives interfacing science and policy, such as the MA follow-up strategy, have prioritized the focus on sub-global levels of governance, for example with the development of tools and mechanisms that facilitate the interpretation of scientific findings in terms of their significance for policy. Others, like the TEEB, are making a considerable effort to provide knowledge and advice on how best to mainstream biodiversity issues into other sectors. However, these efforts are only limited in scope and time, and no institutional arrangements exist that would ensure more continuous support to policy implementation and evaluation and to mainstreaming biodiversity.

145. Having said this it is not the case that there should be a total change of focus to these issues, but that it is necessary to ensure that efforts of issue identification, policy formulation, implementation and evaluation are well orchestrated within an integrative processes that reaches across all relevant scales and sectors.

E.2.2 Models, scenarios and indicators

Finding #4.4. There is a need for more integrated quantitative models, scenarios and indicators that will aid understanding of not only biodiversity and ecosystem services, but also the relevance of biodiversity and ecosystem services to human well-being.

146. Models, scenarios and indicators are increasingly being used as means of bringing data and information together from a range of different sources, and presenting them meaningfully in such a way as to inform policy processes. For example scenarios are extensively used in assessments such as the MA or GEO to present the implications of different policy approaches, and indicators are increasingly used for tracking progress in achieving targets adopted by policy processes.

Integrated models of conservation and sustainable use of biodiversity and ecosystem services

147. A model is essentially a simplified representation of how a system works, developed so as to improve understanding of the system itself, and to aid understanding of how different factors affect the behaviour of the system. Models of coupled social-ecological ecosystems are essential for research, synthesis and projection of management actions. Models can be useful tools to help provide decision makers with an understanding of likely impacts the implementation of policies might have, and can provide the basis for reviewing different options and scenarios.

148. A wide range of processes, actors, organisations, networks and products are currently involved in assessing biodiversity impacts using models and scenarios. These range from response to the *ad hoc* requests of specific assessment processes, to models developed by groups of organizations (e.g. InVEST by the University of Stanford and others; GLOBIO developed by the Netherlands Environmental Assessment Agency working in collaboration with UNEP-WCMC and GRID Arendal). Currently the most widely used model of biodiversity at the science-policy interface is GLOBIO, which is based on response relationships between species abundance and five anthropogenic pressures.

149. In a recent report on biodiversity scenarios commissioned by the CBD Secretariat for input to the Global Biodiversity Outlook 3 and prepared under the leadership of DIVERSITAS[62], the authors reviewed the projections of a range of models and associated scenarios. The report drew on the experience of six lead authors

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[60] CBD, 2007a. Synthesis and analysis of obstacles to implementation of National Biodiversity Strategies and Action Plans. UNEP/CBD/WG-RI/2/2/Add.1.

[61] Watson, R. 2005, Turning science into policy: challenges and experiences from the science–policy interface. *Phil. Trans. R. Soc.* B 360, 471–477

[62] Biodiversity Scenarios Synthesis for the Global Biodiversity Outlook 3, prepared for the CBD Secretariat under the leadership of DIVERSITAS

and 33 contributing authors from 17 countries across the world. As part of the report the authors addressed the future needs for biodiversity and ecosystem service modelling, identifying in particular that:

a) currently separate models for terrestrial, freshwater and marine biomes need to be fully integrated to take account of interactions and feedbacks among biomes;

b) models need to include feedbacks and interactions among the complex chains linking biodiversity, ecosystem functioning, and ecosystem services to socio-economic processes, and aid in understanding of “tipping points”;

c) a framework for linking biodiversity and ecosystem services to human well-being needs to be developed and incorporated in models;

d) there is the need to develop models that can map the flow of a range of ecosystem services so that the spatial disconnect between where services are produced and where people benefit is better addressed;

e) a new conceptual basis, based on risk or probability approaches, might be needed to model regulating and supporting ecosystem services;

f) models need to realistically incorporate multiple drivers to better represent global change impacts on biodiversity and ecosystem services;

g) models need to incorporate dynamics and be process-based instead of the currently available statistical, deterministic models;

h) models should be evaluated to assess their capabilities and limitations, not least because they are complex systems with many components;

i) models need further testing through systematic comparison of outputs generated by different models and by multiple simulations with the same model for past, present and future conditions; and

j) the ability of models to simulate past and present situations needs to be tested against data on past and current biodiversity and ecosystem services.

150. Meanwhile, in a report on scenarios and models for exploring future trends of biodiversity and ecosystem services changes commissioned by the European Commission, the authors[63] reviewed in detail 41 models identified through literature and internet search, and personal knowledge. Comparative information on these models is included in the project report, and information on the models was further analysed and summarised with respect to a number of characteristics. Preliminary conclusions include the following with respect to ecosystem services and human well being in particular:

a) there is no single model covering socio-economic development, policy input, environmental and land use change, and biodiversity and ecosystem services for terrestrial and aquatic systems together;

b) multi-model combinations are needed to generate comprehensive and consistent results, with economic as well as biophysical modelling of water and plant growth, and natural and agricultural systems. the availability of data for different ecosystems is a significant constraint on ecosystem service modelling, as they are generally scarce and on a very coarse scale;

c) little is known about critical thresholds/ time lags between biophysical effects and ecosystem service impacts and recovery potential, and consequently these issues/processes are not addressed in models;

d) there is a challenge in incorporating human managed lands, including various management options, as compared to natural systems;

e) models often omit feedback between environmental condition and socio-economic development, making it impossible to estimate the benefits of measures to maintain ecosystem services; and

f) none of the models cover biodiversity risks and likely associated losses of ecosystem services resulting from invasive alien species with the exception of climate change induced biome changes.

151. In addition they concluded that global models cannot practically include the small-scale heterogeneity of a landscape that is necessary for drawing conclusions on pollination and pest-control effects, and regional models have the advantage that they can account for relevant aspects of global economics and policies, and developments like climate change while they also relate to local processes and conditions. Also models with a

[63] IEEP, Alterra, Ecologic, PBL and UNEP-WCMC (2009) Scenarios and models for exploring future trends of biodiversity and ecosystem services changes. Final report to European Commission, Contract ENV.G.1/ETU/2008/0090r

smaller geographic coverage offer the possibility of including much more meaningful management and policy options. Sufficient detail is not available at the global scale and effects of options and policies can only be estimated by crude proxies and general parameter estimates.

152. These findings are highly consistent with those that arose from experience with the MA[64] where it was observed that "*explicit models of coupled social–ecological systems were essential for research, synthesis, and projection of the consequences of management actions*". The authors went on to recommend that a key research need was to improve quantitative modelling across a range of social–ecological topics, noting in particular that:

a) integrated, quantitative models of social–ecological systems do not match the scope of existing conceptual and qualitative models;

b) existing ecosystem service models were developed to address particular sectors (e.g. water supply, agriculture, fisheries) or particular intersections of issues (e.g., biodiversity and land use change);

c) models for sectors must be coupled with projections from other models of climate, demography, macroeconomic development, and other drivers to assess or project ecosystem services;

d) it would be far better to have models that correspond in scope and content to the conceptual frameworks used by the MA or future assessments; and

e) this model development should be done in a research setting, not under the stringent time constraints of an assessment.

Other reviews have come to similar conclusions.[65] Between them these reviews provide a comprehensive assessment of areas in which models need to be improved in order to increase their value in supporting decision-making processes. Comparative information on the models is provided in the referenced reports, which will all be publicly available by the last quarter of 2009.

The role of scenarios in demonstrating possible futures

153. Scenarios are plausible and often simplified descriptions of how the future may develop, based on a coherent and internally consistent set of assumptions about key driving forces and relationships, typically developed through the joint involvement of decision-makers and scientific experts[66] (). Scenarios are used as a means of presenting anticipated outcomes of different types of policy action so as to assist policy-makers in making choices, or at least helping them to understanding the potential implications of different decisions. Scenarios are informed by scientific research and opinion, and are increasingly used as a means of presenting the outcomes of research meaningfully. They do not attempt to predict the future but instead are designed to indicate what science can and cannot say about the future consequences of alternative plausible choices that might be taken in the coming years (MA 2005 as above). They help to address uncertainty in complex systems.

154. Scenarios may be classified into three different types[67], which can be characterised as:

a) baseline trend scenarios (predictive scenarios), which assume that current trends will continue in the future, and may include policy variants based on near-future decision alternatives;

b) normative scenarios (pathway or vision scenarios), which describe a desirable future or set a specific goal for the future and explore possible ways to reach that goal; and

c) explorative scenarios (forecasting or descriptive scenarios), which work the other way around, and are created to forecast the effect of specified measures (policies) on future development and conditions.

155. In an ongoing review of scenarios and models for exploring future trends of biodiversity and ecosystem services changes commissioned by the European Commission, due to be published shortly, the authors[68] reviewed a wide range of scenarios. Comparative information on these scenarios is included in the project report, and information on the scenarios was further analysed and summarised with respect to a number of characteristics. Preliminary conclusions include the following:

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64 Carpenter, S.R. *et al*. 2009. Science for managing ecosystem services: beyond the Millennium Ecosystem Assessment. *Proc Natl Acad Sci USA* 106: 1305–1312.

65 Jaeger, A., Henrichs, T. 2008. Modelling environmental change in Europe: towards a model inventory (SEIS/Forward). EEA Technical Report No 11/2008. European Environment Agency, Copenhagen.

66 Millennium Ecosystem Assessment 2005 Ecosystems and human well-being : scenarios : findings of the Scenarios Working Group, edited by Steve R.Carpenter, et al.

67 Börjeson, L. *et al*. 2006. Scenario types and techniques – towards a user's guide. *Futures 34*, 723-739.

68 IEEP, Alterra, Ecologic, PBL and UNEP-WCMC (2009) Scenarios and models for exploring future trends of biodiversity and ecosystem services changes. Final report to European Commission, Contract ENV.G.1/ETU/2008/0090r

a) the most appropriate or useful scenario approach depends on the questions to be addressed, and therefore these need to be carefully thought through and documented before trying to use a scenario approach;

b) current scenario approaches do not adequately distinguish between different types of land management, although management types are expected to have important consequences for the delivery of ecosystem services within human-managed land;

c) while for most models climate change and land use change were found to be the key input variables, the description of scenarios focuses on drivers such as technological development, human population development, economics including trade and policies, therefore there is at present a potential disconnect; and

d) socio-economic models are necessary to translate the scenario drivers to the pressures, however, deriving quantitative input variables from primarily narrative scenarios is a crucial task and the process is often not well documented.

156. These preliminary conclusions, together with those for models identified in the previous section, suggest the need for further elaboration of a range of the relationships between biodiversity and ecosystem services on one hand and socio-economic issues on the other, built on a more robust understanding of the interrelationships. This will potentially increase the value of scenarios in helping to use science in a manner that better supports the decision making processes through illustration of the implications of policy alternatives.

157. Comparative information on currently used scenarios is provided in the referenced report, which will all be publicly available by the last quarter of 2009.

Indicators of conservation and sustainable use of biodiversity and ecosystem services

158. Indicators are increasingly being used to inform policy processes, whether as part of assessment processes, or independently. This is closely related to the increased use of quantitative targets in setting policy, and the use of indicators to assess progress in meeting those targets, as well as more widely in communicating biodiversity concerns through the media (for example on threatened species).

159. Many of the international policy processes have established strategic plans and work programmes with targets relating to biodiversity, and these require appropriate indicators to track progress in their achievement. For example the table in Annex L identifies the indicator processes being used for each of the global biodiversity-related treaties, and the action under way, as well as for a number of other global and regional processes.

160. Particularly noteworthy are the efforts made in the context of assessing progress in achieving the CBD target of significant reduction in the rate of biodiversity loss by 2010. Following adoption of the target in 2002 (decision VI/26), the CBD Secretariat worked with a number of organizations to discuss the need for indicators, and these were further elaborated by SBSTTA working with an *Ad hoc* Technical Expert Group. CBD COP called on UNEP-WCMC to support the CBD Secretariat in reporting on progress, and this led to the formation of the 2010 Biodiversity Indicators Partnership (2010BIP).[69]

161. The 2010BIP is a collaboration between the many organizations and agencies developing global biodiversity indicators. Funded in part by the GEF and in part by the organizations and agencies themselves, the objectives of the partnership are to facilitate and promote: generation of information on biodiversity trends which is useful to decision makers; improved global biodiversity indicators; better links with biodiversity initiatives at the regional and national levels to enable capacity building and improve the delivery of the biodiversity indicators.

162. As is apparent from Annex L most of the global biodiversity-related agreements are now developing indicators of some form so as to better demonstrate progress in achieving their objectives. Several of the secretariats participate in the 2010BIP, and conscious efforts are being made to collaborate wherever possible and appropriate both in development of indicators, and delivery of messages based on the indicators. The table in Annex P illustrates, for example, how the Ramsar Convention's proposed indicators relate to the CBD framework, and to some of the other indicators.

163. One region has made a concerted effort to develop indicators that are consistent with the CBD framework, and are relevant and useful at both national and regional levels The project on Streamlining European 2010 Biodiversity Indicators (SEBI2010) involves a wide range of organizations and individuals across Europe in reviewing potential indicators, and in developing guidance on using them (see Annex M) for a

[69] See www.twentyten.net

brief description of the project and associated reports). Recently, as is reported in Annex M, a working group has been reviewing use of the indicators and made a number of recommendations on their use, and on future development of an improved indicator package.

164. The use of indicators is also increasing at the national level as countries appreciate their value in assessing and managing progress in meeting their own biodiversity targets. There are two sets of observations on this in Annex N, part based on observations from experiences in carrying out regional workshops on indicators in a range of developing countries, the other based on a review of comments in the CBD National Reports. From both is clear the urgent need to improve the use of indicators at the national level, and to improve the data on which both national and internationally used indicators are based.

165. In July 2009, UNEP-WCMC convened an international expert workshop with the CBD Secretariat and the support of the UK Government to review the use and effectiveness of the 2010 biodiversity indicators, and to consider implications for development of the post-2010 targets and indicators. Results of this workshop, including identification of lessons learnt and key recommendations, are included in Annex O. Discussion at the workshop focused on four key areas: sufficiency of the current 2010 biodiversity indicator set; its scientific rigour; the policy relevance of the indicators; and their effective communication.

166. It is clear from these discussions, and from the observations and recommendations arising, that indicators are seen as a valuable means of presenting data in formats that are meaningful to policy. Ideally, the set of indicators would be broad enough to address the range of biodiversity issues, small enough to be manageable, and simple enough to be applied consistently and affordably in different regions over long periods of time. At the same time countries need indicators that meet their own needs, while contributing to the global picture. In summary the key messages from the Reading meeting were that the following were needed:

a) a few head-line indicators clearly linked to the targets being addressed, based on a set of sub-indicators which can also be used in communicating meaningful storylines and clear, policy relevant messages;

b) a clearly expressed conceptual framework for the indicators which aids understanding of the links between threats to biodiversity, its state of biodiversity, ecosystem services, human well-being, and policy responses;

c) further indicators on threats to biodiversity, status of species diversity, ecosystem extent and condition, ecosystem services and policy responses, more clearly relating biodiversity to benefits for people;

d) improved national capacity for framework application, indicator development, data collection and information management, so as to improve national use of indicators and support international needs;

e) a clear strategy for using indicators in informing policy discussions, delivering multiple messages into all sectors, and demonstrating relevance of biodiversity to human wellbeing.[70]

167. The recommendations of the Reading meeting help to identify some of the key issues, but it is essential that the research and policy communities work together to continue to design a set of appropriate indicators, to implement the sustained monitoring programmes that are needed to ensure the availability of data and indicators for the long run, to develop appropriate communications strategies to ensure the indicators are used well, and to facilitate improved use of indicators at the national level.

168. A particular challenge will be in developing those indicators that aid understanding of the essential links between biodiversity and human livelihoods and wellbeing. With an increase in consideration of ecosystem services in public and private decision-making at different scales, it is apparent that indicator frameworks, as used in the Millennium Ecosystem Assessment (MA), the CBD and elsewhere, are under-developed with regard to ecosystem services. Tracking conventional biodiversity indicators alone is insufficient, and indicators will also need to be found which can demonstrate how the benefits from biodiversity and naturally functioning ecosystems are changing over time so that the policy relevance of biodiversity can be more clearly understood. Challenges that will need to be addressed include the fact that:

a) for most ecosystem services there are currently few if any suitable indicators for monitoring the actual delivery of services;

b) the indicators required will need to communicate policy relevant information readily about a complex issue of not only the status and trends of ecosystem services, but also flows;

c) there is limited or no data available for ecosystem service indicators; and

[70] These are described in more detail in Annex O, along with lessons learnt.

d) not all ecosystem services are quantifiable (for example the aesthetic benefits people receive from ecosystems differ greatly between people and are dependent on a number of different factors, for which a value or number cannot easily be assigned).

E.2.3 Assessments

Finding #4.5. Notwithstanding the range of assessments relating to biodiversity and ecosystem services, no regular periodic multi-level assessment process exists that provides the conceptual and institutional framework coherently to gather, review, synthesize, communicate and monitor information and track changes in biodiversity and ecosystem services and their consequences for human well-being at the global, regional and national levels and on the interrelation across these levels.

169. Assessments are formal efforts to gather, review and synthesize selected knowledge with a view toward making it publicly available in a form useful for decision making. In the recent years, scientific environmental assessments have grown in number, have become more comprehensive and systematic and have become the science-policy element most attention has been given to.

170. During the last decade, there has been a proliferation of assessments relating to biodiversity and ecosystem services, at global and sub-global scales. Key amongst recent global assessments of biodiversity and ecosystem services have been the Millennium Ecosystem Assessment (MA), the 4th Global Environment Outlook (GEO4), the IPCC 4th assessment report (AR4), the International Assessment of Agricultural Science and Technology for Development (IAASTD), the Comprehensive Assessment of Water Management in Agriculture (CAWMA), the 2nd Global Biodiversity Outlook (GBO2), the 2005 Forest Resources Assessment (FRA), the Global International Waters Assessment (GIWA), and the global Assessment of Peatlands, Biodiversity and Climate Change. Each of these is described briefly in Annex Q.

171. Over time the global assessments have increasingly aimed to be more integrated in the manner in which biodiversity and ecosystems services issues are assessed, and they have increasingly been designed to be relevant, credible and legitimate. However, they vary considerably in thematic focus and scope, in their design and processes, and in the ways in which biodiversity and ecosystem services are integrated. For example:

a) The thematic focus of recent global assessments varies between those focusing strictly on biodiversity assessment, such as the GBO or IUCN Red List assessments, those encompassing a broad ecosystem service assessment, such as the MA and GEO, and those focusing on a narrower range of specific ecosystem services, such as FRA, GIWA, IAASTD, LADA.

b) There have also been an increasing number of sub-global assessments conducted and planned in the last decade, at scales from continental to local communities. The MA, GIWA, GEO4 and IAASTD explicitly included sub-global (in most cases regional, and in the case of the MA some multi-scale) assessment elements.

c) Most recent and ongoing assessments evaluate both environmental and socio-economic factors. Only one of the ongoing global assessments, the GBO, additionally evaluates the implementation of a specific corresponding policy mechanism (the CBD) for its impact on biodiversity and ecosystem services.

d) Some, such as the MA, GIWA and TEEB, were designed as one-off assessments that could be repeated in the future should the demand and resources exist. Others, such as GEO, GBO, IPCC, and FRA, are part of ongoing assessment initiatives (see Annex Q).

e) Some, such as the MA, the IPCC and GEO, involve a broad spectrum of the scientific community, whilst others, such as the GBO, FRA and TEEB, are based on contributions from a more selective group of experts (see Annex Q). Also the breadth of stated target audiences varies considerably between assessments.

f) A number of recent global assessments, such as GEO4, and the IPCC 4th assessment, have been overseen by intergovernmental governance bodies, providing significant legitimacy for their findings amongst national governments. In the case of the MA and IAASTD, the assessments were overseen by a multi-stakeholder board, including governmental, non-governmental and private sector stakeholders.

172. However, despite all these advances in assessment efforts related to biodiversity and ecosystem services, there remain a range of gaps and obstacles significantly impeding the science-policy interface's ability to coherently gather, review, synthesize and communicate information on biodiversity and ecosystem services at global, regional and national level:

a) Many assessment initiatives have been limited by data and information availability. This is the case at all geographic scales for a range of ecosystem services and for biodiversity. Gaps in data for biodiversity and non-provisioning ecosystem services are particularly widespread, and in many cases prevent more comprehensive assessment being completed at global, regional, national or local scales.

b) In terms of scope and coverage of ecosystems considered by biodiversity and ecosystem services assessments, there has been relatively less assessment focussed in some key biomes and system types, including islands, mountains, wetlands and urban systems. Relatively less attention has also been given to regulating and supporting services (such as prevention of flooding or nutrient cycling), and there remain key gaps in assessing the interlinkages between biodiversity and climate change (such as the link between biodiversity and carbon sequestration).

c) There remains relatively little coherence or coordination between approaches to assessment within and between scales and thematic approaches and there is a lack of core set of common, scaleable variables for better linking assessments at different geographic scales, and with different but related thematic foci. Even those assessments that are well networked within the MA follow-up process make use of a wide variety of data and indicators within a diversity of thematic scope and geographical coverage, which complicates the synthesis of lessons across assessment initiatives, and hampers the process of drawing conclusions relating to multi-scale aspects of biodiversity and ecosystem services.

d) There is a wide variety of and little coherence within conceptual frameworks used for assessment design and implementation, although at a global scale for recent integrated assessments, and in many regional and national assessments, there has been an increasing convergence on variations of the framework developed in the MA global and sub-global assessments (an ecosystem services and human well-being focused variation of the DPSIR framework).

e) Only very few recent assessments, including the MA, IPCC, LADA and GBO, have been explicitly endorsed by those MEAs that they seek to inform. Of the assessments explicitly endorsed or otherwise officially recognized by MEAs, only the IPCC and GBO are anticipated to be repeated in the future - the remainder were conceived as one-off initiatives. Other assessments, such as GEO and GIWA have been endorsed by other decision-making, or intergovernmental fora such as the UNEP Governing Council.

173. Ongoing initiatives, such as the MA follow-up process in general (see Annex B) and the forthcoming publication of the MA methodology manual in particular, are likely to help considerably in bringing coherence to assessment process and design in the future. However, there remains the need for a common conceptual and institutional framework to coherently assess information on biodiversity and ecosystem services across all relevant sectors and at global, regional and national levels.

174. Over the recent years there has been an extensive process to review assessments in marine environments, in anticipation of a Regular Process for Global Reporting and Assessment of the state of the Marine Environment (See Annex C. Drawing from a this broad analysis of assessments, those elements that are said to most successfully lead to an effective assessment include:

a) a holistic conceptual framework that considers the multiple and interacting pressures on biodiversity and ecosystems at and across all scales;

b) regular review of assessment product to support adaptive management;

c) use of rigorous science and the promotion of scientific excellence;

d) regular and proactive analysis to ensure that emerging issues, significant changes and knowledge gaps are detected at an early stage;

e) continuous improvement in scientific and assessment capacity;

f) effective links with policy makers and other users, reflected in communication, products and formal recognition and endorsement by official policy processes;

g) inclusiveness with respect to communication and engagement with all stakeholders through appropriate means for their participation; and

h) transparency and accountability for the process and products.

E.2.4 Early warning of emerging issues of concern

Finding #4.6. There are continuing difficulties in ensuring timely scientific advice on emerging issues of concern at and across all levels, whether in response to policymakers' requests or resulting from concerns arising from the scientific community.

175. New issues for biodiversity can arise from a diversity of sources including as a result of scientific research or monitoring (e.g. the discovery of the impact of a new invasive species) or an emerging issue in the policy arena. New issues can also arise from developments in other sectors that might be important for biodiversity, such as the potential impacts of economic trends, and emerging markets.

176. It is widely known that the global community has responded too late to many environmental problems and hazards. A key feature in this has been the length of gap between problems being identified in science and a response being taken. Though adequate information may be available, information might not have been brought to the attention of appropriate decision-makers early enough, or has been discounted for one reason or another. Sometimes 'loud and late' warnings (e.g. on asbestos, the Great Lakes, sulphur dioxide and acidification) have been effectively ignored by decision-makers because of short-term economic and political interactions.[71] Costs of such inaction have been most recently highlighted by the Stern report on climate change.[72]

177. There is a growing number of initiatives that help to prioritise issues and to explore the likely significance and relevance of emerging issues relating to biodiversity and ecosystem services. Providing they are firmly based on the common knowledge base and adequately linked to decision-making processes, such initiatives provide a valuable tool in informing development of policy in identifying issues that need to be addressed, in helping assess the likely significant of emerging issues and in helping to prioritize both research priorities and policy actions. Important tools of science-policy interfaces for dealing with emerging issues of concern are: [73] horizon scanning processes, which involve the systematic examination of potential threats, opportunities and likely future developments which are at the margins of current thinking and planning (potentially including the use of scenarios), and futures techniques, by which the results of horizon scanning exercises are further explored.

178. Examples of such processes widely range in scope and in the extent to which they have specific links to policy processes, and are described further in Annex R). At the same time a number of MEAs have taken steps to improve the effectiveness of their assessment of and response to emerging policy issues (e.g. by Ramsar's STRP and the CBD SBSTTA), so that their scientific advisory bodies and processes can more effectively deal with new issues not previously on their agendas.

179. However, there remain significant challenges for processes interfacing science and policy in addressing emerging issues, which are often of complex, contentious or controversial nature:

a) Whilst some initiatives offer an independent and highly creative exploration of futures, the usefulness of such initiatives can be limited if they do not adequately communicate and link with decision making processes, if they present mixed messages, or do not answer the more urgent questions that policy makers may have – potentially reducing impact and therefore the attention the results receive.

b) Where such horizon scanning and futures processes are introduced into scientific advisory bodies and processes, care must be taken to ensure that they are not only relevant to the process, but that they are also the result of legitimate and transparent processes so that they are seen as being credible in the sense defined earlier (including issues such as independence and peer review).

c) Only very few ongoing mandated assessment processes provide flexible mechanisms to respond to demands from MEAs for targeted or rapid integrated assessments on emerging issues relating to biodiversity and the full spectrum of ecosystem services; on the contrary, the long time-scale periodicity of global assessments can preclude responding to many emerging issues in a timely manner to guide decision-making, even for those selected issues which are covered by such assessments.

180. Among the key gaps apparent from a review of current horizon scanning processes and futures techniques are the following. The implication of not addressing such gaps is a reduced preparedness for issues that might arise in the future. The key gaps are:

a) Conceptual approach: The lack of widely applicable and broadly accepted conceptual and institutional frameworks for horizon scanning and futures techniques that are responsive to the needs of decision makers and concerns of knowledge holders, are credible as regards their implementation, and are legitimately linked to policy processes.

b) Sharing of experience and results: The need for wider sharing of knowledge and experience on horizon scanning and futures techniques, by those countries and organizations that have fairly well-established

[71] EEA 2001. Late Lessons from early warnings: the precautionary principle 1896-2000. See reports.eea.europa.eu/environmental_issue_report_2001_22/en

[72] See www.hm-treasury.gov.uk/sternreview_index.htm

[73] Defra, UK definition of horizon scanning 2002. See horizonscanning.defra.gov.uk

mechanisms for identifying and assessing new issues for biodiversity and are producing useful outputs that international mechanisms could draw on.

c) Capacity: The lack of capacity at national level, in particular in developing countries, to conduct horizon scanning processes and apply futures techniques to assist in their own planning processes.

181. It is also important to ensure that when new issues emerge the scientific community is able to respond rapidly to information of scientific advisory bodies and processes rising from these emerging issues, so that they are better able to inform policy development and decision making.

182. There may also be value in exploring the potential for increased coordination between existing horizon scanning and futures initiatives supporting biodiversity science-policy processes, and for coordination in use of the outcomes of these processes. This is true across the range of scales and sectors.

183. In addition to improving the use of horizon scanning and futures techniques in identifying potential future issues, it is important to also ensure that scientific advisory bodies and processes are able to effectively use this information in their deliberations. This may involve changing their terms of reference, as happened for CBD SBSTTA in 2006 (decision VIII/10).

E.3. Increasing Synergies and Effectiveness Through Coordination

Finding #5. Notwithstanding the existence of several mechanisms to improve the coordination of the wide range of science-policy interfaces for the many multilateral environmental agreements and other bodies related to biodiversity and ecosystem services, there is significant room for building on the existing experiences that would lead to better coordination between and across global and national mechanisms.

184. It is apparent from earlier sections in this analysis that there is a wide range of institutions, processes, networks and programmes at all levels and within different sectors that address, or are relevant to, one or other part of the science-policy interface for biodiversity and ecosystem services.

185. This fragmentation is in part structural and to a certain degree unavoidable, as the issues are far reaching, cross-cutting and multi-scale, while institutions have to focus on specific missions to ensure some degree of effectiveness and efficiency.[74] Indeed, studies have shown that it is often collaborative networks of a range of science-policy interfaces of different institutional types, functions and focus with complex, partly redundant, and layered institutional arrangements that constitute the most effective way in managing complex interrelations between science and politics.[75]

186. But the fragmentation is also historical, as institutions have been created step by step to address problems as they have emerged. Particularly in the case of the issues of biodiversity and ecosystem services this has resulted in an array of conventions, institutions, networks and programmes with overlapping remits, differing objectives, interests and *modus operandi*, and often poorly defined boundaries between them. This in turn results in the potential for uncoordinated action, gaps, unnecessary duplication, and for a multitude of different messages and solutions, unless there is good coordination.

187. Coordination[76] - or promoting and facilitating improved coordination - is a crucial cross-cutting and inherent aspect of the science-policy interface. There exists a wide range of mechanisms established to improve coordination of different parts of this fragmented institutional landscape, and a range of examples are included in the following text and associated annexes. However, while in part advances have been made, lack of coherence remains in many areas, with the resulting potential for gaps, mismatches, duplications and missed opportunities.

188. One potential solution is to attempt to establish improved coordination across all aspects of biodiversity and ecosystem services, thereby ensuring significantly support for decision making. While such a solution may be desirable, a more pragmatic solution, at least in the first instance, will be to gradually improve and build on existing coordination approaches, examples of which are described in the following sections.

189. While the following text primarily uses examples from the international level, the messages are relevant at all levels.

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[74] van den Hove, S., Chabason, L. 2009. The debate on an Intergovernmantal Science-Policy Platform on Biodiveristy and Ecosystem Services (IPBES). IDDRI Discussion Papers N° 01/2009 Governance.

[75] Dietz, T. *et al*. 2003. The Struggle to Govern the Commons. *Science* 302:1907-1912; Ostrum, E. 2005. *Understanding institutional diversity*. Princeton University Press

[76] While the term coordination is used throughout, it is recognised that there are aspects of collaboration and integrated approaches that do the job just as well in many circumstances.

E.3.1 Coordination within and across functional elements of a science-policy interface

Finding #5.1. There is significant potential to improve the effectiveness of science-policy interfaces through more coherent coordination within and across their various functions, integrating such aspects as research strategies, models and scenarios, assessments, knowledge-brokering and capacity-building.

190. Given the inextricable interrelations between research, monitoring, models and scenarios, assessments capacity building and policy development on the one hand, and the partly inherent functional fragmentation of the institutional landscape on the other, coordination is not only fundamental within but also across each of the functional categories (or areas of work) of the science-policy interface.[77]

191. In each of the sections on the knowledge base, on communication of science into policy making, and on capacity building, and on the specific subsections within them, a range of organizations and/or programmes has been referred to. It is axiomatic that improved coordination between them will improve efficiency:

a) Coordination amongst those responsible for building the common knowledge base, and between them and those wanting to use the knowledge base, helps to ensure a more relevant, more credible and more legitimate knowledge base, more efficiently produced with fewer gaps and duplications.

b) Coordination amongst those drawing on the knowledge base and informing policy helps to ensure that a more consistent use is made of science in informing policy (including speaking with one voice), and a more coordinated approach to identifying the implications of different options.

c) Coordination amongst those helping to build capacity, whether by developing tools and standards, or by facilitation and training, inevitably leads to a more efficient use of resources in building capacity, and hopefully also to a more consistent and integrated approach to using science in development and implementation of policy.

192. There are good examples of ongoing efforts that address the coordination of a range of the different functional aspects of the science-policy interface, among the most relevant of which are the MA and the MA follow-up process (Annex B), and the proposals for the Regular Process in the marine environment (Annex C). These addressed and continue to address all the aspects of a science-policy interface in that within a specified policy area they provided a knowledge base, policy oriented products based on that knowledge base, and capacity building to help others augment the knowledge base and derive further products.

193. There are other examples of organizations, programmes or networks that *de facto* coordinate activities that contribute to the science-policy interface, therefore contributing to improving its effectiveness.

a) Indicators: The 2010 Biodiversity Indicators Partnership is providing a degree of coordination across those organizations working on biodiversity indicators, bringing together UN initiatives, MEAs, IGOs, international active NGOs and university scientists.

b) Long term research: The International Long Term Ecological Research network is promoting and facilitating site-based research and monitoring programmes, drawing on the experience of research sites and networks in a wide range of member countries, and the scientists that work there.

c) Access to data: The GEO Biodiversity Observation Network and the Global Biodiversity Information Facility are both working with a wide range of organizations to facilitate increased access to biodiversity data so that it can be more easily used.

d) Research policy: Policy research platforms such as the European Platform for Biodiversity Research Strategy provide fora at which natural and social scientists, policy-makers and other stakeholders identify structure and focus the strategically important research for the conservation and sustainable use of biodiversity.

194. These are not the only examples, and not necessarily the best examples, but in each case there is an organization or a group organizations that is working together through a network, partnership or collaborative effort to improve the current situation, to reduce gaps, and to reduce duplication of effort. This is experience that can be built upon in fostering and creating opportunities for increased coordination.

195. At a higher level within the biodiversity-related MEAs, there are ongoing efforts to increase coordination and sharing of experience that address in part the coordination of the different functional aspects of the science-policy interface (although the science-policy interface is not necessarily their primary focus). Among the most relevant are the following, which are described in more detail in Annex I):

[77] See also Watson, R., Gitay, H. 2007. Science-policy interface: The role of scientific assessments. IMoSEB Case study.

a) Biodiversity Liaison Group (BLG): The purpose of the BLG, which consists of the heads of the secretariats of the global biodiversity-related agreements, is to enhance coherence and cooperation in the implementation of those conventions in general. In summary, the BLG has addressed a small number of items related to the conventions' use of science, such as the 2010 biodiversity target and the related 2010 biodiversity indicators, and the use of standardized species nomenclature and taxonomy. It has also discussed possible ways for all participating MEAs to contribute to related activities, such as the *Global Biodiversity Outlook*. It has therefore provided some of the impetus for ensuring a more coordinated approach to issues where there are strong scientific interests, and could potentially so more in the future.

b) Meetings of the Chairs of the Scientific Advisory Bodies of Biodiversity-related Conventions: These can be seen as complementary to those of the BLG, from which they have been mandated. The first meeting in 2007 and was attended by representatives of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), IUCN, UNFCCC, UNEP, the GEF Scientific and Technical Advisory Panel, and WWF International in addition to representatives of CBD, CITES, CMS, Ramsar Convention and World Heritage Convention. These meetings provide a forum for initiating discussion on areas of cooperation and collaboration on the scientific issues of the various convention processes and their translation into policy. The meetings so far have identified a small number of issues where the biodiversity-related conventions could cooperate in improving the scientific advice to their bodies and to Parties, including mapping the guidance developed by the individual conventions and coordination in the requests for scientific advice on various topics.

196. Most of the initiatives described demonstrate the potential of increased coordination, and examples of approaches and structures that can be built upon.

E.3.2 Coordination within thematic areas

Finding #5.2. Examples exist of thematic mechanisms such as expert groups or other collaborative arrangements that are providing valuable support to policy formulation and implementation on specific issues. Lessons can be learned from this.

197. Steps to improve coordination can be particularly effective when focussed on specific topics, themes or issues, and this is usually the case where a strong network or consortium already exists that can take the issue forward, or is formed specifically to do so.

198. Invasive alien species are widely seen as one of the key threats to biodiversity, and have been discussed on several occasions by the scientific advisory bodies of a number of conventions including all of the global biodiversity-related agreements. As is described in more detail in Annex T, the Global Invasive Species Programme was established to gather the best minds and organizations working on issue of invasive alien species, to consolidate available scientific and management information, to raise awareness of the issue and to present best management practices. Through the use of thematic working groups GISP focused on key issues such as pathways, management, socioeconomics, while simultaneously engaging national agencies and experts through a series of regional workshops. This model helped to funnel information developed by the international working groups down to the national level, while raising national level priorities and capacity needs to the global level. Information from both efforts was also channelled into the CBD. GISP has not been the only contributor (the IUCN Invasive Alien Species Group has also been significantly involved), but having a group coordinating inputs has played a significant role in helping to shape discussions and decisions within the CBD in particular. GISP have also been involved in discussions under other conventions, also bringing a degree of synergy.

199. There is a range of other examples where specific initiatives provide coordination across a range of organizations, networks and programmes working on a particular theme, and deliver information or analysis relevant to policy development and implementation. Examples include the following.

a) Synthesis and review: The Scientific Committee on Problems of the Environment (SCOPE) is an interdisciplinary worldwide network of natural and social scientists and scientific institutions focused on environmental issues, using workshops and consultations to provide synthesis and review on current and potential environmental issues intended to help inform policy and decision making.

b) Research: The International Council for the Exploration of the Sea (ICES) is a network of more than 1600 scientists from 200 institutions which coordinates and promotes marine research on the marine environment in the North Atlantic. Their advice supports, amongst other things, policy development on fisheries (discussed in more detail in Annex W) and implementation of the OSPAR Convention.

c) Access to data: ReefBase, which is a project of the WorldFish Centre, works with a wide range of coral reef scientists and institutions to improve the sharing and use of data, information and knowledge in support of research and management of coral reefs. In doing so it works actively with both the Global Coral Reef Monitoring Network and the International Coral Reef Action Network.

200. The point is not what each of these organizations or processes does, but the fact that there are many examples of coordination that can be built upon. Meanwhile organizations and programmes such as ICSU, DIVERSITAS and IUCN have a range of thematic working groups, networks and committees. Some of these are established for short periods of time to address particular issues, others, such as the IUCN Commissions, are long standing and well known.

201. Given the nature of biodiversity, the complex governance landscape and the relatively independent nature of the different governance bodies, it is inevitable that the needs of one policy making body are not completely different from the needs of other governance bodies, yet no obvious mechanism exists to review the needs of a range of governance bodies and their advisory bodies and advise on research priorities based on an integrated review. However there are the following examples of where such cooperation and collaboration has occurred and is beneficial, and where the experience can be built upon.

a) Inland waters: There is agreement between the CBD and the Ramsar Convention regarding how they cooperate on the issue of inland waters, leading to coordinated programming and decision making, and to a certain extent collaboration on how science is used to support these processes.

b) Species taxonomies: There is agreement between CITES and CMS to work towards standardization in species taxonomies so as to move away from the current situation where the taxonomies used differ. This will include jointly approaching relevant scientists for advice, and drawing on the same literature.

c) Wildlife diseases: The Ramsar Convention, CMS and the African-Eurasian Waterbird Agreement (AEWA) all support and participate in the work of the Scientific Task Force on Avian Influenza and Wild Birds, with the strong endorsement of their governing bodies.

202. At a higher level there are processes which improve inter-institutional cooperation of key thematic issues, and these can also have implications for improving the science-policy interface. For example, the Collaborative Partnership on Forests (CPF), which is a voluntary arrangement among 14 international organizations and secretariats with substantial programmes on forests (see Annex I), has a range of initiatives which are concerned with increasing collaboration in order to deliver improved management, conservation and sustainable management of forests.

203. Again, most of the initiatives described demonstrate the potential of increased coordination, and examples of approaches and structures that can be built upon. Perhaps an analysis of the overlaps between different mandates of, for example, the biodiversity-related MEAs could provide the basis for identifying those areas where increased coordination would provide most effective?

E.3.3 Coordination across different sectors

Finding #5.3. There is a lack of coordination across sectors to allow for the constant exchange and joint creation of knowledge, leading to mismatches and duplications of information and policies relevant to the broader development community.

204. The conservation and sustainable use of biodiversity is relevant to a wide range of different sectors from forestry to fisheries, and provides services ranging from carbon storage to protection of water supplies. Meanwhile many other sectors have a potential impact on biodiversity, whether transport, energy or mining. Data and information on biodiversity can therefore be of as great an importance to decision making in these sectors as is it in the biodiversity sector. The difference this time is that the case for taking account of impacts on biodiversity is rather less well understood, and the need for effective communication is rather higher.

205. There are some well established and successful examples of cross-sectoral coordination relevant for the science-policy interface on biodiversity and ecosystem services, some fixed term with time-bound mandates, and others ongoing. These include, for example, between the MEAs the following (all except the first being described further in Annex I):

a) An *Ad hoc* Technical Expert Groups on Biodiversity and Climate Change established under the CBD to provide biodiversity related information to the UNFCCC through the provision of scientific and technical advice and assessment on the integration of the conservation and sustainable use of biodiversity into climate change mitigation and adaptation activities, in particularly as regards the mechanism for reducing emissions from deforestation and degradation in developing countries (REDD) currently being discussed in the context of the successor agreement to the Kyoto Protocol (see also Annex Von REDD).

b) The Joint Liaison Group (JLG), a joint body of the CBD, UNFCCC and UNCCD, established in 2001 as an informal forum for exchanging information, exploring opportunities for synergistic activities and increasing coordination. The JLG comprises the officers of the conventions' scientific subsidiary bodies, the Executive Secretaries, and members of the secretariats.[78] In summary, the JLG of the Rio Conventions has addressed a wide range of issues of relevance to the three conventions, including several relating to the coordination of scientific advice, such as collaboration among the scientific advisory bodies to the conventions, and cooperation in the development of advice, methodologies and tools (see Annex I).

206. Meanwhile there are other examples of coordinatory bodies within the UN system, again not usually specifically focus on the science-policy interface, but certainly relevant to if appropriate issues are brought to their attention:

a) The Environmental Management Group (EMG), a UN System-wide coordination body[79] established under the auspices of UNEP to serve as a platform (i) to identify, address and resolve collectively specific problems, issues and tasks on the environmental and human settlements agenda and (ii) to provide a forum for an early discussion and sharing of information on emerging problems and issues in the field of environment and human settlements geared at finding collectively the most effective coordinated approach to the solution of new tasks (see Annex I).

b) The UN Chief Executives Board (CEB), which furthers coordination and cooperation on a whole range of substantive and management issues facing UN system organizations. CEB has established three High Level Committees, including the High Level Committee on Programme (HLCP) promoting global policy coherence and the UN Development Group (UNDG) promotes coherent and effective oversight, provision of guidance and capacity building with country level partners, coordination of UN development operations at country level (see Annex I).

c) The Common County Assessment/UN Development Assistance Framework processes, which aims to bring about a more coordinated UN approach to supporting achievement of national objectives within each country. Under which UNEP and UNDP have started to assist developing countries in preparing national reports on the implementation of MEAs; establishing thematic committees and coordinating; and sharing best practices among bodies using GEF funding such as the National Capacity Self-Assessments (NCSA), the National Dialogue Initiative and UNDP Country Support Programme.

207. In a way the Millennium Development Goals (MDGs), aimed at reducing poverty, improving the quality people's lives and ensuring environmental sustainability, draw attention to cross-sectoral needs in achievement of targets on which partnerships are formed and policy responses formulated for progress towards sustainable development, especially in developing countries, and which involve cooperation across intergovernmental organisations (WHO, UNDP, UNEP, the World Bank), MEA secretariats, international NGOs, and global and regional business groupings. Substantial constraints similar to those faced by MEA implementation in developing countries apply to meeting MDGs at national level. They include poor integration of environment and development policies, lack of horizontal structures for inter-ministerial consultation and cooperation, and the lack of regional framework to coordinate sharing of experience from implementation and new policy responses.

208. There also exist a range of specific and *ad hoc* cross-sectoral institutional arrangements between various different UN bodies and agencies. For example, the joint work of WHO and UNEP regarding the interrelations between ecosystems and human health. Following the MA findings highlighting the link between the quality of ecosystems and human health, WHO and UNEP jointly agreed to use these recommendations as basis to inform policy in a cross-sectoral spirit. Since then, regional policy fora at ministerial level have discussed the issue involving ministers responsible for both health and environment.[80] The initiation and consolidation of such coordination mechanisms within the UN that bring science together to inform policy have the potential to foster synergetic national policies both on health and the environment.

209. The Committee on Trade and Environment (CTE), was established under the World Trade Organization (WTO), with a twofold broad mandate: to identify the relationship between trade and environmental measures, and to make appropriate recommendations in harmonising WTO rules with the principle of sustainable development. The CTE has greatly contributed to the identification and understanding of the complex relationships between trade, environmental and development measures such as seen in the Doha Round. The

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78 Some of the meetings were attended by the Ramsar Convention Secretariat.

79 Its membership consists of UN specialized agencies, programmes, economic commissions, funds and other UN bodies as well as UN/UNEP-administered and non-UN/UNEP-administered Secretariats of MEAs.

80 First Inter-Ministerial Conference on Health and Environment in Africa, Libreville, Gabon, 26-29 August 2008

Committee co-operates with international organisations and leading international NGOs in building capacity of developing countries to manage WTO negotiations on environmental services. However, it would appear that the CTE still has a relatively low profile with WTO, and this may explain why current limited progress towards environmental policy and action remains.

210. The Organization for Economic Co-operation and Development (OECD) aims to provide a setting where governments compare policy experiences, seek answers to common problems, identify good practice and coordinate domestic and international policies, with a particular focus on democracy and the market economy. The OECD Working Group on Economic Aspects of Biodiversity (WGEAB) has been actively working with the CBD on issues such as incentive measures and access and benefit sharing of genetic resources, and also on valuation. Working together the CBD and OECD can approach an issue from different perspectives, and communicate support on addressing issues at the national level through different channels, increasing cross-sectoral reach

211. However, despite these and many other coordination and networking efforts there are still considerable gaps in cross-sectoral coordination relevant to interfacing science and policy at the global level, and these are almost certainly reflected at the national level in many parts of the world. Key concerns that lack of coordination can bring about are:

a) the sometimes *ad hoc* and late in time nature of such interrelationships, as in the case of cross-sectoral collaboration related to REDD;

b) the lack of sufficient reference to socio-economic perspectives in discussion on biodiversity and ecosystem services on a regular basis, and the lack of reference to the relevance of biodiversity and ecosystem services in other sectors even when biodiversity is directly relevant;

c) the lack of full understanding of the value of biodiversity, a gap that is partly addressed by, for example, ongoing follow-up to the MA at the sub-global level and The Economics of Ecosystems and Biodiversity (TEEB) project; and

d) the small scope and relatively low priority of environmental issues as compared to development and trade related issues in discussions at all levels.

212. In fact the currently ongoing discussions on REDD provide an interesting example of the need for cross-sectoral collaboration and coordination, because of the opportunities for synergies it brings. As is described further in Annex V in improving conservation and management of tropical forests there is potential to simultaneously address not only the carbon agenda of the UNFCCC, but also biodiversity conservation and sustainable use, poverty and human livelihoods, water conservation and quality management, and so on. Annex V describes some of this evolving collaboration, in particular as it relates to the science-policy interface.

E.3.4 Coordination at and across levels of governance

Finding #5.4. There is a lack of coordination across levels of governance to allow for the effective exchange of knowledge and experience back and forth across relatively diverse science-policy interfaces from the national to the global level that is necessary to avoid mismatches and duplications and to increase synergies between them.

213. Although levels of governance overlap and interlink in many ways, they are essentially different. Institutional arrangements are considerably influenced by a range of scale-dependent features, including: differences in the broader socio-economic and political setting in which institutional arrangements operate; differences in the policy instruments and compliance systems available; and differences in the type of knowledge systems that actors use.[81] In other words, depending on the level at which particular aspects of biodiversity and ecosystem services are addressed, the types of problems that can be addressed, the actors involved, the modes of explanation that are needed, and the solutions that are likely to come about will change significantly.[82]

214. Given the multi-level nature of biodiversity and ecosystem services, effective governance has to accommodate different concepts and principles at each level, and at the same time provide a conceptual and institutional framework that allows for coherence across levels to reduce redundancies, gaps and mismatches on the one hand, and to increase synergies on the other.

[81] Young, O. 2006. Vertical interplay among scale-dependent environmental and resource regimes. *Ecology and Society* 11(1): 27; Berkes, F. 2007. Community-based conservation in a globalized world. PNAS, 104(39): 15188–15193.

[82] Bulkeley, H. 2005 Reconfiguring environmental governance: Towards a politics of scales and networks. *Political Geography* 24: 875-902; Brenner, N. 2001. The limits to scale? Methodological reflections on scalar structuration. *Progress in Human Geography* 25(4): 591-614.

215. Scientific advisory bodies and processes at national, regional and global level are central elements in such a conceptual and institutional framework, fostering networking, coordination and orchestration across levels of governance, potentially providing the mechanisms not only for the coordination of the interface between science and policy at a given level and context, but also in terms of the nodes in a network of science-policy interfaces necessary for the constant dialogue and translation from national to global scale.

216. It is worth noting her that coordination between levels should be seen not only in terms of working together to apply processes (e.g. indicators, assessments, data capture) that are meaningful in a cross-scalar way, and the associated guidelines, tools, and so on, but also in terms of people interrelating so that lessons are learnt, and moves towards consistency are made. The positive benefit of people working together should not be under-estimated.

217. There is a range of different institutional arrangements engaged, at least in part, in interfacing science and policy at regional and national levels. Relevant institutions at the regional level include a set of regional intergovernmental bodies such as the ASEAN-ACB, AU/STRC, CCAD, CEC, EEA, the regional offices of ICSU, which assisting in strengthening science and capacity-building in developing countries and promoting their increased participation in ICSU programmes and activities, and regional information networks such IABIN and others. Relevant institutions at the national level include the various MEA focal points, relevant government agencies and other national non-state actors.

218. However, despite this range of different institutional arrangements at global, regional and national levels, arrangements that coordinate (or network) the range of institutions at a given level are still largely missing, especially in many parts of lesser developed areas of the world. This may in part be due to the lack of a widely accepted conceptual and institutional framework for systematically and coherently addressing the different levels of governance and the interrelations in between them in and adequate manner.

219. There are no globally concerted efforts to systematically address the coordination of the science-policy interface on biodiversity and ecosystem services across scales. Partial approaches that exist include:

a) thematic approaches, such as the MA and its follow-up, which are supporting and guiding processes which involve a range of sub-global activities, with the guidance provided helping moves towards the outputs and outcomes being cross-scalar in nature;

b) regional approaches, such as the EPBRS on development of research strategies, or SEBI2010 which is working toward indicators scalable from national to regional level, both of which are intended to increase collaboration and understanding across scales; and

c) functional approaches, such as moves to create distributed databases, and tools that draw on data and information from across a range of scales, as is the case with GBIF, for example, working with a wide range of data at national and institutional levels.

220. Each of these is an example that can be built upon and promoted further.

E.4. Providing Fundamental Capacity

Finding #6. Numerous institutions and processes are helping to build capacity to use science effectively in decision-making at all levels. Further efforts, however, are required to integrate multiple disciplines and knowledge systems to produce relevant knowledge effectively; to translate knowledge into policy action and to coordinate these processes; and to build the capacities of developing countries to use science more effectively in decision-making and to participate fully in the science-policy dialogue.

221. The capacity for enabling full, equitable and active participation of all relevant stakeholders and knowledge-holders is crucial for ensuring the effectiveness of the science-policy interface on biodiversity and ecosystem services and their governance. But capacity is constantly changing and evolving, and capacity-building, be it at individual, institutional or systemic levels, is inherently a continuous effort. Providing the capacity fundamental for an effective science-policy interface requires at least the following three aspects be addressed:

a) the capacity for the production of relevant knowledge to contribute to the common knowledge base, and for the effective communication of this knowledge to decision makers and larger public;

b) the capacity for effective use of this knowledge and other knowledge in the formulation of and critical reflection on policy choices and their implementation; and

c) the capacity for effectively brokering knowledge so that it is used appropriately in decision making, including through identification of implications of different policy options.

222. Two issues are addressed further in this section, the broad need for building capacity for interdisciplinary approaches to knowledge production and the more effective brokering of knowledge, and the critical concern of geographical differences in capacity.

Improved production and use of knowledge

Finding #6.1. Notwithstanding continuing efforts and improvements in capacity-building supporting the various processes of interfacing science and policy, there remains a significant and widespread lack of capacity in interdisciplinary approaches for knowledge production relevant to biodiversity and ecosystem services for human well-being and governance that draw upon a variety of knowledge systems.

Finding #6.2. There is a widespread lack of capacity for brokering knowledge effectively so that it is used appropriately in decision-making, including by identifying the implications of various policy options.

223. In an earlier section it was noted that an analysis of interdisciplinary scientific assessment for environmental governance emphasized the mismatch between the emerging understandings of the complexity of reality, the ways scientists were coming to understand this complexity, and the way science connects to politics, policy, and management.[83]

224. It would therefore appear that there are significant gaps in capacity for using interdisciplinary approaches for knowledge production relevant to biodiversity and ecosystem services for human well-being and governance. At individual, institutional or systemic level there is need to improve the capacity to approach the production of knowledge in more interdisciplinary terms, in particular as concerns:

a) capacity of individuals to address complex phenomena in an interdisciplinary manner, reflecting the need for more interdisciplinary understanding to be taught and practiced; and

b) institutional capacity to encourage and allow for scientists and other knowledge holders to collaborate, promoting collective and discursive learning and knowledge-producing processes.

225. Such efforts should build on and learn from the existing interdisciplinary approaches gradually being discussed and developed within a number of the organizations already referred to in this paper, and also adding to their capability and potential.

226. It was also identified earlier that there was a need for the scientific community to go beyond the presentation of scientifically unambiguous statements of status and trends, and engage more actively in policy analysis facilitating the creation of new and innovative policy alternatives along with expression of the implications of those alternatives where that is possible. There is therefore also a need for a more systematic approach to ensuring capacity at all levels to interpret and broker knowledge in the interface between science and policy.[84] This would suggest that:

a) training and practice is also needed to develop interpretation and knowledge brokering skills in researchers and relevant staff in government departments and agencies; and

b) tools and needed to which support and enable all relevant actors to broker knowledge and interface science and policy need to be developed.

227. To some extent such needs are being addressed by existing institutions such as ICSU (see Annex J) and the MA and its follow-up strategy (see Annex B). Interdisciplinarity and knowledge brokering are also key elements of the proposed GRAME and UNEP's proposed science strategy. However, many of these efforts have been *ad hoc* and one off, and are limited in scope or resources, and a more systematic approach to build capacity building on interdisciplinarity and knowledge brokering is needed.

E.4.1 The North-South capacity divide

Finding #6.3. There are geographical variations in capacity relevant to science-policy interfaces, with significantly reduced capacity in developing countries, and in particular the less developed countries and small island developing States, impeding these countries' full engagement in nearly all relevant processes.

228. There are many institutions, programmes and processes supporting capacity building in developing countries and countries with economies in transition, including UNDP, the World Bank, UNEP and FAO, GEF

83 Norgaard, R.B. 2008. The Implications of Interdisciplinary Scientific Assessments for Environmental Governance. In Ranganathan, J., Munasinghe, M., (Eds). *Policies For Sustainable Governance of Global Ecosystem Services*. World Resources Institute.

84 Holmes, J., Clark, R. 2008. Enhancing the use of science in environmental policy-making and regulation. *Environmental Science and Policy* 11: 702-711

and a wide range of other multilateral and bilateral development assistance agencies, most of the MEAs, as well as some assessment processes. For example:

a) The UN Development Assistance Framework (UNDAF),[85] which describes how UN agencies and programmes working at the national level can coherently respond to the priorities identified in national development frameworks supporting countries in achieving MDG-related national priorities;

b) The UNEP Bali Strategic Plan for Technology Support and Capacity-building,[86] providing for a framework and systematic measures for technological support and capacity building based on national or regional priorities and needs,

c) The UNDP/GEF National Capacity Self-Assessment (NCSA) programme for environmental management,[87] established to identify capacity needs of developing countries to effectively meet the challenges of national and global sustainable development and environmental governance, and to strategically enhance their capacity

229. Many of these and other capacity-building efforts relate to strengthening of abilities also relevant for the science-policy interface on biodiversity and ecosystem services. Other initiatives include the work of ICSU and the MA follow up strategy referred to in the previous section. However, despite these efforts, there remain significant gaps in capacity relevant for the science-policy interface on biodiversity and ecosystem services in developing countries, and the capacity divide continues to be a severe obstacle to equitable participation of developing countries and those with economies under transition in the processes relevant to the science-policy interface on biodiversity and ecosystem services.[88]

230. According to a review of a representative sample of completed National Capacity Self Assessments (NCSAs),[89] a significant number of developing countries continue to lack among other things the personal and institutional capacity:

a) for effective reconciliation of demand and supply of policy relevant scientific knowledge, as they often lack academies of sciences or scientific councils vital to provide guidance and coordination for the identification of knowledge needs, and research programmes;

b) for effective production of policy relevant scientific knowledge, as they often lack sufficient individual, institutional and financial capacity for conducting research, show gaps in inventory data collection and documentation, and have inadequate management and assessment of knowledge and information;

c) to effectively communicate knowledge to decision makers and larger public, including the lack of institutional capacity for assessing and contributing to policy-making effectively, and lack of institutional frameworks that incorporate all stakeholders; and

d) to effectively use knowledge in formulation policy choices and implementation, as they often lack sufficient individual, institutional and financial capacity to understand and effectively use provided knowledge.

231. The analysis of existing capacity-building efforts suggests that the gaps related to capacity for building and effectively using the science in policy setting and decision making rest at least in part on:

a) a lack of focus and priority providing clearer definition of the knowledge and research needed, clearer understanding of how this will support decision making, and increased priority afforded to capacity development in these areas;

b) insufficient long-term capacity building strategies established to support long-term processes of sustainably building capacity needed to fully engage in all relevant processed interfacing science and policy reaching from public education, to research programmes, to specific training of decision-makers; but above all

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85 http://www.undg.org/?P=232

86 UNEP/GC/23/6/Add.1

87 GEF/C.22/8, Strategic Approach to Enhancing Capacity Building

88 Karlsson, S. *et al*. 2007. Understanding the North-South knowledge divide and its implication for policy: a quantitative analysis of the generation of scientific knowledge in the environmental sciences. *Environmental Science and Policy* 10(7): 668-684; Najam, A. 2005. Developing Countries and Global Environmental Governance: From Contestation to Participation to Engagement. *International Environmental Agreements: Politics. Law and Economics* 5(3); UN/JIU/REP/2008/3

89 For this review a sample of 27 (out of 80) completed NCSAs was reviewed for common capacity building constraints identified as priority under biodiversity thematic assessment. See Annex S for further details.

c) a lack of coordination among existing capacity building efforts on the priorities and objectives identified to enhance the capacity needed to fully engage in all relevant processed interfacing science and policy.

232. The pronounced lack of capacity in developing countries has considerable implications for the effectiveness of the science-policy interface on biodiversity and ecosystem services. Not only does this affect the decision making processes at the national level, and ability to, for example, fully and effectively implement MEAs at the national level (see for example Annex U on CBD national biodiversity strategies and action plans), it also reduces national potential to contribute to the common knowledge base, and potentially also to fully participate in scientific advisory bodies and process at regional and global levels.

233. More profoundly, in an international governance system that aims to rely on scientific knowledge to make political claims through scientific advisory bodies and processes, developing country can be disadvantaged with respect to the expression and negotiation of their environmental perspectives and interests.[90] Given that the legitimacy of the global environmental processes seems to be a major concern of many developing countries,[91] this underlines the absolute importance of ensuring an equitable capacity of all relevant stakeholder and knowledge holders.

[90] Karlsson, S. *et al*. 2007, and Najam, A. 2005. quoted above; Biermann F. 2000. Science as Power in International Environmental Negotiations: Global Environmental Assessments Between North and South. Environment and Natural Resources Program, Discussion Paper 2000-17. Belfer Center for Science and International Affairs, Harvard University.

[91] UNEP/GC.25/INF/37; Najam, A. 2005. Quoted above.