SPIRAL Briefs
SCIENCE POLICY INTERFACES: RESEARCH, ACTION & LEARNING

What's so special about biodiversity?

The brief in brief

This brief, as part of the SPIRAL project, outlines the main characteristics of biodiversity, namely complexity, unknowns and uncertainties, temporal and spatial scales, irreversibility and human dependence on biodiversity. This synthetic information is aimed at both holders and users of biodiversity knowledge and decision-makers who wish to understand what makes biodiversity so different. More information can be found in other SPIRAL briefs which focus on different aspects related to biodiversity science-policy interfaces, from understanding science-policy interfaces, to help on developing and assessing them.

What do we mean by "biodiversity"?

One of the first issues we need to address in the context of science-policy interfaces for biodiversity is what we mean by "biodiversity". The definition of biological diversity provided by the Convention on Biological Diversity is *"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"*[1]. No consensual definition exists, yet this one has the merit of making explicit the different levels (genes, species and ecosystems) and the different biomes. There are great differences in how biodiversity is framed by different publics (scientists, decision-makers, general public etc). These different interpretations can impact on perceptions of biodiversity and its management. For example, while individuals may be unaware of the 'scientific' definition of biodiversity, they can still express attitudes towards biodiversity management measures that are well grounded in complex mental concepts and corresponding normative evaluations[2] but also in very practical experience. We must not assume that because different publics may not know the term, or may share a different understanding of 'biodiversity' they do not care or have strong feelings and views about it and the management of our relationships to biodiversity.

Complexity

The majority of issues relating to biodiversity are incredibly complex not only in themselves, due to the relationships between components of these systems, but also due to the multitude of inter-linkages among environmental phenomena. The complexity of studying biodiversity, and the factors that may influence it, can in some cases, as with climate change, lead to disagreement amongst scientists. This is not necessarily a problem, as it can cause healthy discussions that progress the study of biodiversity, but complexity should be acknowledged as an inherent characteristic of biodiversity.

Unknowns and uncertainties

There are many unknowns when it comes to biodiversity. Only a fraction of biodiversity is known in any detail and therefore attempting to determine the effects of human activities on known and, more importantly, unknown biodiversity is extremely difficult. A potential risk is that certain groups of organisms may receive less attention than others, particularly uncharismatic and little-known species such as soil invertebrates and microbes.

In addition to unknowns, a certain amount of uncertainty exists in all scientific research including extrinsic uncertainties (i.e. insufficient scientific knowledge) and intrinsic uncertainties inherent to the complexity and indeterminacy of socio-ecological systems and environmental issues. While scientists may in some cases be able to give a measure of uncertainty, they will never be able to remove uncertainty from the study of biodiversity or of any complex socio-ecological system for that matter.

[1] http://www.cbd.int/convention/articles/?a=cbd-02

[2] Fischer, A. & Young, J. (2007). Understanding mental constructs of biodiversity: implications for biodiversity management and conservation. Biological Conservation 136: 271-282.

Temporal and spatial scales
The evolution of, and impacts on, biodiversity extend over large temporal and spatial scales. For example, pollution from industrial emissions can be carried hundreds or even thousands of kilometres in the atmosphere before being deposited elsewhere, potentially affecting the biodiversity in those areas. Often the effects of impacts will take decades to be felt, far longer sometimes than human lifetimes[3].

Irreversibility
Another characteristic of biodiversity is that once damage is done, it may be irreversible. Extinctions are the most common manifestation of irreversibility. Famous cases of extinctions include the dodo *Raphus cucullatus*, hunted to extinction in the 17th century, and the more recent demise of the Baiji, or river dolphin *Lipotes vexillifer* from the Yantze river. It is highly likely that elements of biodiversity are being lost without our knowledge.

Dependence on biodiversity
Perhaps the most important characteristic of biodiversity from an anthropocentric point of view is that humans are wholly dependent on biodiversity for survival and well-being. Biodiversity is an essential provider of ecosystem goods such as food, raw materials, medicines, fuel, fibre and shelter. In addition, biodiversity provides us with irreplaceable ecosystem services such as water purification, nutrient cycling and pollination. Biodiversity also contributes directly to national economies and provides employment through agriculture, forestry, fishing and hunting. There are also important intrinsic values attributed to biodiversity, which can never be fully comprehended.

Where does this leave us?

The above characteristics of biodiversity show that we are dealing with a highly complex and dynamic system that we still know very little about, which is capable of providing us with a wealth of goods and services, but which is being threatened[4]. Below we highlight some preliminary suggestions[5] on ways forward in terms of science-policy interfaces for biodiversity:

- Joined-up policy, recognising that several different policy sectors 'deal with' biodiversity, and that any development is likely to impact on some aspect of biodiversity. Integration of biodiversity concerns across policy sectors is a priority. Priority sectors that need to consider biodiversity include fisheries, agriculture, transport, energy, development, etc.

- Science, just as policy, has a tendency to operate in silos. A shift is needed to look at biodiversity in a more interdisciplinary way to address the complex social and ecological issue of biodiversity change.
- Building strong indirect science-policy links is also essential. This will require considering research more holistically, looking at what stakeholders want in terms of biodiversity policy, what the impacts of environmental policy on stakeholders' activities are, and what societal changes are impacting on policy. Better understanding of the dynamics of the socio-ecological system will enable better framing of the crucial science-policy questions we need to address and answer, and will lead to science that people and biodiversity need.

Looking for more information on science-policy interfaces?
For more SPIRAL results, including separate briefs focussing on practical steps or recommendations to address some of the above challenges, see companion SPIRAL briefs at http://www.spiral-project.eu/content/documents This brief is a result of research and interactions within and around the SPIRAL project. It was written by Juliette Young (Centre for Ecology and Hydrology) and Kerry Waylen (The James Hutton Institute).

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[3] van den Hove (2000). Participatory approaches to environmental decision-making: the European Commission Climate Policy Process as a case study. Ecological Economics 33: 457-472.
[4] E.g. Millennium Ecosystem Assessment and National Ecosystem Assessment
[5] These recommendations are based on interviews carried out with science and policy actors in three case studies: the UK NEA, the implementation of the WFD, and deer management in Scotland. This information was complemented by discussions in a workshop held in June 2012. For more information on each of these case studies, please see other SPIRAL briefs.