



article

EKLIPSE: engaging knowledge holders and networks for evidence-informed European policy on biodiversity and ecosystem services

Allan Watt, adw@ceh.ac.uk
Centre for Ecology and Hydrology, UK
Gill Ainsworth, gilain@ceh.ac.uk
Centre for Ecology and Hydrology, UK
Estelle Balian, estelle.balian@naturalsciences.be
Royal Belgian Institute of Natural Sciences, Belgium
George Cojocar, gco@tiamasg.com
TIAMASG, Romania
Marianne Darbi, marianne.darbi@ufz.de
UFZ – Helmholtz Centre for Environmental Research, Germany
Lynn Dicks, lynn.dicks@uea.ac.uk
University of East Anglia, UK
Hilde Eggermont, h.eggermont@biodiversity.be
Royal Belgian Institute of Natural Sciences, Belgium
Eeva Furman, eeva.furman@ymparisto.fi
Finnish Environment Institute, Finland
Lise Goudeseune, l.goudeseune@biodiversity.be
Royal Belgian Institute of Natural Sciences, Belgium
Pierre Huybrecht, p.huybrechts@biodiversity.be
Royal Belgian Institute of Natural Sciences, Belgium
Eszter Kelemen, kelemen.eszter@essrg.hu
ESSRG, Hungary
Florian Koch, florian.koch@ufz.de
UFZ – Helmholtz Centre for Environmental Research, Germany
Zoi Konstantinou, zkonstantinou@ciimar.up.pt
CIIMAR, Portugal
Barbara Livoreil, barbara.livoreil@fondationbiodiversite.fr
Fondation pour la Recherche sur la Biodiversité, France
Karla Locher, karla.locher@ufz.de
UFZ – Helmholtz Centre for Environmental Research, Germany
Alexandra Lux, lux@isoe.de
Institute for Social-Ecological Research, Germany
Marion Mehring, mehring@isoe.de
Institute for Social-Ecological Research, Germany
Carsten Nesshoever, carsten.nesshoever@umweltrat.de
UFZ – Helmholtz Centre for Environmental Research, Germany
Riikka Paloniemi, riikka.paloniemi@ymparisto.fi
Finnish Environment Institute, Finland
Heli Saarikoski, Heli.Saarikoski@ymparisto.fi
Finnish Environment Institute, Finland
Isabel Sousa Pinto, ispinto@ciimar.up.pt
CIIMAR, Portugal
Marie Vandewalle, marie.vandewalle@ufz.de
UFZ – Helmholtz Centre for Environmental Research, Germany
Riku Varjopuro, riku.varjopuro@ymparisto.fi
Finnish Environment Institute, Finland
Liisa Varumo, liisa.varumo@ymparisto.fi
Finnish Environment Institute, Finland

Heidi Wittmer, heidi.wittmer@ufz.de
UFZ – Helmholtz Centre for Environmental Research, Germany
Juliette Young, jyo@ceh.ac.uk
Centre for Ecology & Hydrology, UK

The aim of EKLIPSE is to develop a mechanism to inform European-scale policy on biodiversity and related environmental challenges. This paper considers two fundamental aspects of the decision-support mechanism being developed by EKLIPSE: 1) the engagement of relevant actors from science, policy and society to jointly identify evidence for decision making; and 2) the networking of scientists and other holders of knowledge on biodiversity and other relevant evidence. The mechanism being developed has the potential not only to build communities of knowledge holders but to build informal networks among those with similar interests in evidence, be they those that seek to use evidence or those who are building evidence, or both. EKLIPSE has been successful in linking these people and in contributing to building informal networks of requesters of evidence, and experts of evidence and its synthesis. We have yet to see, however, significant engagement of formal networks of knowledge holders. Future success, however, relies on the continued involvement with and engagement of networks, a high degree of transparency within the processes and a high flexibility of structures to adapt to different requirements that arise with the broad range of requests to and activities of EKLIPSE.

key words decision-support mechanism • networks • science-policy-society interface • biodiversity

key messages

- EKLIPSE develops a mechanism to inform policy on biodiversity and related environmental challenges.
- EKLIPSE operates at a European scale, bringing together policy-makers and knowledge holders from both science and society.
- EKLIPSE promotes the networking of scientists and other holders of knowledge on biodiversity and other relevant evidence.

Why there is a need for a decision-support mechanism for evidence-informed policy on biodiversity and ecosystem services

EKLIPSE (Knowledge and Learning Mechanism on Biodiversity and Ecosystem Services) is a project funded by the European Commission under the Horizon2020 funding stream that started in 2016. Its chief aim is to establish an innovative, light, self-sustainable support mechanism for creating evidence-informed European-scale policy on biodiversity and ecosystem services by 2020. This decision-support mechanism builds on identifying relevant existing evidence and bringing together knowledge holders from both science and society to integrate and analyse this evidence, thereby creating new knowledge and identifying knowledge gaps.

The need for a decision-support mechanism for evidence-informed policy on biodiversity and ecosystem services was first explicitly identified in the EU Action Plan for biodiversity published in 2006 (European Commission, 2006). At that time, ambitious targets to reduce and even halt the loss of biodiversity were set at global and European scales. These targets clearly failed (Butchart et al, 2010; European

Commission, 2015a; 2015b) and did so in part due to the high levels of uncertainty, complexity, diverse values and the diversity of actors involved from science, policy and society with multiple stakes and often conflicting objectives over biodiversity (Sarkki et al, 2014; Saarikoski et al, 2017; Young et al, 2013a; 2013b; Young et al, 2014). While a wealth of scientific evidence and other information exists on the status and trends of biodiversity and ecosystem services, converting this into ‘actionable knowledge’ for policy development and implementation is still a challenge (Argyris, 1996; Beumer and Martens, 2015; Knight et al, 2010; Mehring et al, 2017; McNie, 2007; Owens, 2012; Rosenberg, 2007; Sharman and Holmes, 2010; Turnhout et al, 2012; Van den Hove, 2007; Vogel et al, 2007; Waylen and Young, 2014). This is largely due to mismatches between scientific aims, processes and timing, and societal or policy needs, as well as inappropriate communication approaches and, in some cases, potentially limited political will and scientific awareness (KNEU Team, 2014; Neßhöver et al, 2016). ‘Silo’ thinking in science, society and policy often results in a disconnected and piecemeal approach to biodiversity and ecosystem services, and a lack of mainstreaming in the action required to address the sustainable use of biodiversity (for example, Kay and Regier, 2000; Fairbrass and Jordan, 2004; Young et al, 2014). Relevant evidence needs around biodiversity and ecosystem services bridge more than one policy area, for example health and biodiversity, or climate change and biodiversity (Sandifer et al, 2015; Burch et al, 2014). Indeed, the challenge of the Sustainable Development Goals (SDGs) demonstrates both how linked the policy challenges of different sectors are, for example in terms of synergies and trade-offs, and how lessons need to be learned from and across all sectors on how best to inform policy and practice (Nilsson et al, 2016).

Moreover, evidence is often framed too narrowly, thus not addressing the issues, scales and values that are relevant for decision making (Young et al, 2013c; Mansfield and Haas, 2006; Primmer et al, 2017). For contested issues in particular, a consolidated view that explicitly addresses uncertainties is still lacking (Neßhöver et al, 2016). There are many diverse science-policy-society interface activities already established in the European environmental context. For example many EU-funded projects have promoted science-policy activities, networks such as ALTER-Net have begun to strengthen their efforts to support policy (Neßhöver et al, 2013) and, since 1999, the European Platform for Biodiversity Research Strategy (EPBRS) has been active through the support of two EU-funded projects (BioPlatform and BioStrat), developing research needs for biodiversity and ecosystem services. There are also many approaches to synthesise scientific knowledge on specific issues, for example the Cochrane Reviews in the public health sector, Conservation Evidence (Sutherland et al, 2014; Dicks et al, 2014) and the Collaboration for Environmental Evidence (Pullin and Stewart, 2006; Pullin et al, 2009), and a number of institutions and processes (for example, service contracts, ‘clearing houses’) provide knowledge for policy processes; however, these rarely include the variety of existing knowledge and its holders (for a complete overview of the science-policy landscape on biodiversity and ecosystem services in Europe, see Neßhöver et al, 2016). Despite these efforts, and the identification and acknowledgement of the challenges at the science-policy-society interface highlighted above, gaps persist, and knowledge generated is often not perceived as credible, relevant and/or legitimate (Sarkki et al, 2014; Young et al, 2014; Biodiversity Knowledge White Paper, 2014; Neßhöver et al, 2016).

The main underlying principle of EKLIPSE is that these gaps and challenges cannot be addressed by a closed network of experts or institutions. Rather, they require a

much more holistic approach, where relevant expertise is identified and used from a diverse set of knowledge holders from both science and society. Knowledge has been categorised in the literature in multiple and not mutually exclusive ways, from traditional ecological knowledge and scientific knowledge (Berkes et al, 2000), to distinctions between empirical, theoretical and experimental knowledge (Nutley et al, 2007), and those between organised knowledge and unorganised knowledge (Vink et al, 2013). In EKLIPSE processes, all these forms of knowledge are explored and integrated if relevant to answering policy and societal needs but, most importantly, knowledge is seen as dynamic, process-based and interactional, where we facilitate knowledge holders from different groups and backgrounds to work together with the aim of producing knowledge for mutual benefit and to address real world problems (Fazey et al, 2014; Waylen and Young, 2014; Van Kerkhoff and Lebel, 2015; Rosendahl et al, 2015; Carmen et al, 2018). This approach has been put forward as having the potential to increase the likelihood of shaping solution-orientated, policy-relevant knowledge and outputs, including new concepts, tools and practical action (Cash et al, 2003; Young et al, 2014; Carmen et al, 2015). This is achieved by encouraging all relevant actors to become actively engaged through both formal and informal networks. This paper reflects critically two fundamental aspects of the decision-support mechanism being developed by EKLIPSE: 1) to engage relevant actors from science, policy and society to jointly develop evidence to address specific decision-making knowledge needs; and 2) to strengthen the long-term networking of scientists and other holders of knowledge to ensure robust science-policy- society interfaces on biodiversity and ecosystem services. Based on these two fundamental aspects we highlight future directions for EKLIPSE in particular, and SPIs on biodiversity and ecosystem services in the EU more generally.

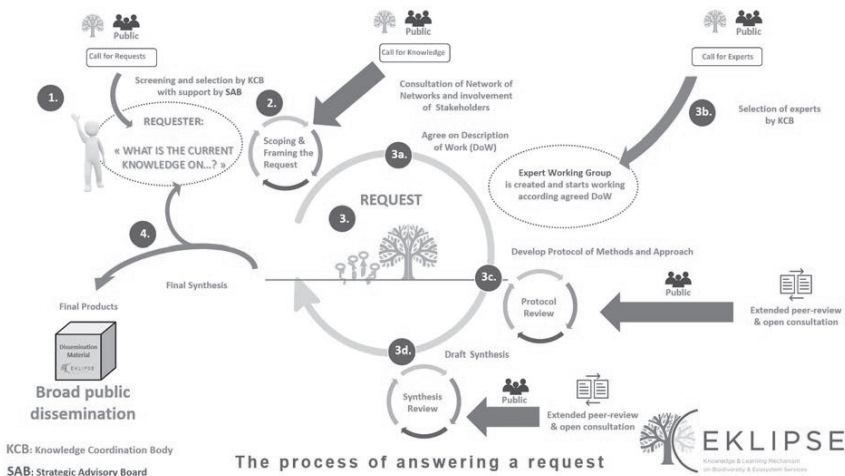
Engagement of science, policy and society

A major objective of EKLIPSE is to create a mechanism that coordinates scientists, policymakers and other societal actors to jointly provide evidence leading to better-informed decision making. The EKLIPSE project is testing a particular approach to this, based on principles of credibility, relevance, legitimacy, transparency and iterativity (Cash, 2001; Sarkki et al, 2014; 2015) learning from the feedback of the knowledge community and experience gained through a process of formative evaluation (Carmen et al, 2015; Lux and Mehring, 2016). The evaluation follows the logic of the request processes and consists of five dimensions: I. Quality of request process: offer ways to develop processable requests; II. Quality of team-building process: focus on expert groups, but also considering other participatory elements; III. Quality of knowledge syntheses processes; IV. Quality of results: assess processes of quality assurance and relevance of output with regard to initial request; V. Impact: Assessment of the immediate and potential application of results (policy impact).

The first request put to EKLIPSE, on developing an impact evaluation framework on nature-based solutions to promote climate resilience in urban areas, was received from the European Commission DG Research and Innovation (EC DG R&I). Subsequent requests have been submitted by the European Commission DG Environment (EC DG ENV). In both cases, the questions are clearly of European policy relevance. Similarly, requests from European NGOs or international NGOs operating at the European scale are likely to be of European relevance, and questions

Figure 1: EKLIPSE process of answering a policy or societal request.

Step 1. Open Call for Requests aimed at decision-makers across the EU where they can put forward a knowledge need. Step 2. Following advice and selection by the Strategic Advisory Board (SAB) and Knowledge Coordination Body (KCB) based on a set of criteria¹ the KCB liaises with the requester during a scoping phase to refine the question and identify how EKLIPSE could give added value in terms of what they need. Step 3. The KCB works with the requester to develop a Description of Work (DoW) that captures why the request is being put forward, what the requester wants from the process and the EU policy relevance of the request (3a). Once the DoW is agreed we put out a public Call for Experts on the requester's topic (3b). The EWG develops a protocol of methods and approach that describes exactly how they will answer the request and goes through an extended peer review process (3c). Next the EWG synthesises all the current knowledge and produces an end product, (e.g. a report). Then a peer-review is conducted on the knowledge synthesis to make sure the end product is robust and credible (3d). Step 4: The end product is then given to the requester and finally, it is widely disseminated and made publicly available.



Note

¹Eligibility criteria for requests are that they need to be Relevant to the European scale, relevant to ongoing or future policy processes, relevant to biodiversity and ecosystem services., not requiring new knowledge, but based on the synthesis of existing knowledge, and consortia of requesters, representing for example different countries and/or different sectors (policy, NGOs/society, research), will be encouraged.

have been submitted from, for example, ClientEarth and IUCN. National government departments, agencies and NGOs, however, are also likely to submit questions of European relevance, although these may be initially expressed in a national context. For example, EKLIPSE has received requests from the Swedish Board of Agriculture, the French Ministry in charge of the Environment, The Scottish Environmental Protection Agency and Buglife, a British conservation NGO.

The first step in answering a request is to scope and frame the request to understand what the requester actually wants to know, and discuss how EKLIPSE can make a difference. This is done through a scoping dialogue between the Knowledge Coordinating Body of EKLIPSE (KCB, that is, one of the key governance structures of EKLIPSE acting as a process facilitator and interface) and the requester (Figure 1). This stage might include an open call to networks and individuals for topical

knowledge to inform this scoping discussion, a broadening of the focus of the question to ensure that it is of European policy and stakeholder relevance, the involvement of additional actors such as EC DGs or other relevant stakeholders, and the merging of requests. The open call for knowledge, which targets those networks (see below) which are likely to hold knowledge relevant to the request, is particularly important in allowing the requester(s) the opportunity to reframe the question in light of what has already been done in, for example, recent reviews of the scientific literature. An online forum, where the results of the call for knowledge are shown, can be used to make the gathering of existing knowledge more transparent. This step is followed by an agreement on the work to be done by EKLIPSE, based on a document of work produced from this dialogue and which is used to establish an expert working group.

For most of the requests requiring knowledge synthesis, an open call for experts is then published, again targeted at networks and the broader scientific and societal community, and an expert working group, selected by the EKLIPSE KCB, takes on the task of answering the request with the support of the KCB and the EKLIPSE Secretariat. The expert working group drafts a protocol to describe its proposed work in detail, particularly the methods to be used. This step is supported by an expert group on methods, established by EKLIPSE. This group was set up initially to produce a report on methods for knowledge synthesis (Dicks et al, 2017; Haddaway and Dicks, 2018), but has been retained to support the work of the expert groups directly in the choice of methods. This specific support stems from the recognition that different requests, based on their timing, resources and available knowledge, should consciously choose the most appropriate synthesis method(s) (see also Pullin et al, 2016). The protocol is then sent out for open peer review and consultation with the public, the requester and relevant knowledge holders. Using this feedback, the expert working group revises the protocol, which is then agreed by the requester. The expert working group then uses the protocol, including the selected method(s) for knowledge synthesis, to draft a report on the request topic. This draft synthesis of knowledge goes out for a further review to the public and relevant knowledge-holders, and undergoes revision based on their feedback. The final report goes to the requester and is made publicly available.

Depending on the requests received and accepted, alternative processes can be facilitated by EKLIPSE, such as science cafés and other tools to give a voice to social actors in critical research questions, thereby promoting deliberative democracy approaches (Smith, 2003), or foresight workshops, horizon scanning approaches and web seminars. The mechanism being developed by EKLIPSE is therefore very different from the processes typically instigated by requests from decision makers and others to consultants or advisory bodies. In the latter, the terms of reference are unlikely to be significantly changed through dialogue with the requester, and the broad and diverse range of knowledge holders might not be involved in the most inclusive and effective way. In contrast, EKLIPSE promotes an in-depth dialogue between those making requests for knowledge, experts on knowledge synthesis and relevant knowledge holders throughout the process. By creating awareness of the request and the process of answering it, the mechanism being developed has the potential not only to build communities of knowledge holders (see below) but to build informal networks among those with similar interests in evidence, be they those who seek to use evidence or those who are building evidence, or both.

Supporting and connecting networks of knowledge

The major supporting objective of EKLIPSE is to promote the engagement of those networks of knowledge holders whose knowledge has a key potential impact on biodiversity, ecosystem services and related environmental challenges. The mechanism being developed by EKLIPSE seeks to identify evidence relevant to decision making by establishing dialogue between science, policy and society. Although EKLIPSE, by being inclusive, advertising opportunities and using transparent selection criteria, provides opportunities to all researchers to contribute and engage in various EKLIPSE bodies and tasks, EKLIPSE also provides an alternative to the single expert / closed advisory groups / consultant model by promoting the full engagement of the community of knowledge holders. EKLIPSE therefore follows the 'network of knowledge' concept (Neßhöver et al, 2016), aiming to identify and work closely with those formal and informal networks in society, science and policy, particularly at the European level, whose knowledge and/or activities have an impact, directly or indirectly, on biodiversity. Amongst scientific knowledge holders these networks include networks in natural sciences, for example ALTER-Net, a network of ecosystem research institutions; the BiodivERsA Partnership, a network of national and regional funding organisations promoting Pan-European research on biodiversity, ecosystem services and nature-based solutions; and INNGE, a network of next-generation ecologists. Relevant networks in social sciences include, for example, the European Society of Ecological Economics. Other knowledge holders include non-governmental organisations, and civil society organisations and networks, for example, CEEweb, a network of non-governmental organisations in Central and Eastern Europe, and ICLEI, the Networks of Local Governments for Sustainability. Members of these networks have already participated in EKLIPSE as knowledge holders, but some of these networks, particularly the non-scientific ones, are interested more in the use of evidence and some have already become requesters of knowledge to EKLIPSE (see above).

The goal of EKLIPSE is to create a long-term and sustainable mechanism generating ownership and long-term engagement by relevant policy, scientific and societal actors. To that end, it has directly involved the broad community of knowledge holders and other relevant actors from the outset. EKLIPSE facilitates the answering of requests, whilst the expert working groups are drawn from the knowledge community, giving it the opportunity to be the producer of the synthesised knowledge requested. Furthermore, the Knowledge Coordination Body of EKLIPSE, which makes key decisions such as which requests to answer, selects the members of the expert working groups and supports the work of the expert working groups, is partly composed of members of the EKLIPSE consortium and partly composed of members from outside the consortium, selected by the EKLIPSE Strategic Advisory Board. Before the end of the project, the coordination of the requests will be made up from members selected from outside the consortium. In this way, we are working towards a vision where the mechanism being built by EKLIPSE will be sustained not by project funding but rather by ownership by the networks of knowledge holders, ensuring both financial and technical support to its processes.

A critical reflection on wider engagement in science-policy interfaces

The EKLIPSE project follows an increasing awareness of the need to improve the science-policy-society interface for biodiversity in Europe (Neßhöver et al, 2013) and previous projects that sought to identify and implement good practice in the biodiversity science-policy-society interface (Young et al, 2014; Carmen et al, 2015; Tinch et al, 2018), including the ‘network of knowledge’ approach (Livoreil et al, 2016; Neßhöver et al, 2016). In less than two years, EKLIPSE has received 31 requests for knowledge and over 200 people have responded to calls for members of four expert groups, reflecting the interest of a broad range of actors to become engaged in evidence and policy needs concerning biodiversity, ecosystem services and related environmental challenges. EKLIPSE has also been successful in linking these people and in contributing to building informal networks of requesters of evidence, and experts of evidence and its synthesis. We have yet to see, however, significant engagement of formal networks of knowledge holders. Individual experts are engaging in the EKLIPSE project but not explicitly as members of existing networks. The informal network that is emerging due to the activities of the EKLIPSE project may be sufficient to sustain a future mechanism to support evidence-informed European policy on biodiversity as a new ‘community of practice’ around knowledge in action on biodiversity and ecosystem services, if funding is secured to support its core coordinating and facilitating function of engaging the knowledge community. The gravity generated by this individual involvement might also trigger a stronger engagement of formal networks once they have proof of concepts and see the benefits of such processes.

The ongoing formative evaluation organised by the EKLIPSE project shows that the EKLIPSE approach has been effective at engaging the relevant and interested networks, and individuals therein, for the different bodies within EKLIPSE. As part of the evaluation these EKLIPSE bodies (KCB, SAB, requesters (both accepted and rejected), expert group members, secretariat) were interviewed about their experiences. In general, the feedback has been positive and constructive and demonstrated a strong commitment with the issues dealt with in EKLIPSE. Future success, however, both for EKLIPSE and science-policy interfaces in general, relies on the continued involvement with and engagement of networks and knowledge holders, a high degree of transparency within the processes, and a high flexibility of structures to adapt to different requirements that arise with the broad range of requests to and activities related to knowledge needs on biodiversity and ecosystem services. In addition, it will rely on the continued support of decision makers at all scales, supporting and promoting the integration of diverse knowledge holders to address pressing societal needs and turning knowledge into action.

Acknowledgements

This work was carried out as part of the EKLIPSE (Establishing a European Knowledge and Learning Mechanism to Improve the Policy-Science-Society Interface on Biodiversity and Ecosystem Services) project funded by European Union’s Horizon 2020 Programme for research and innovation under grant agreement No 690474.

References

- Argyris, C, 1996, Actionable knowledge: design causality in the service of consequential theory, *Applied Behavioral Science* 32, 4, 390–406
- Berkes, F, Colding, J, Folke, C, 2000, Rediscovery of traditional ecological knowledge as adaptive management, *Ecological Applications* 10, 1251–62
- Beumer, C, Martens, P, 2015, Biodiversity in my (back)yard: towards a framework for citizen engagement in exploring biodiversity and ecosystem services in residential gardens, *Sustainability Science* 10, 1, 87–100
- BiodiversityKnowledge, 2014, A recommended design for 'BiodiversityKnowledge', a network of knowledge to support decision making on biodiversity and ecosystem services in Europe, http://www.biodiversityknowledge.eu/images/PDF/WhitePaper_web.pdf
- Burch, S, Shaw, A, Dale, A, Robinson, J, 2014, Triggering transformative change: a development path approach to climate change response in communities, *Climate Policy* 14, 4, 467–487
- Butchart, SH, Walpole, M, Collen, B, Van Strien, A, Scharlemann, JP, Almond, RE, Baillie, JE, Bomhard, B, Brown, C, Bruno, J, Carpenter, KE, 2010, Global biodiversity: indicators of recent declines, *Science* 328, 5982, 1164–8
- Carmen, E, Nesshöver, C, Saarikoski, H, Vandewalle, M, Watt, A, Wittmer, H, Young, J, 2015, Creating a biodiversity science community: experiences from a European network of knowledge, *Environmental Science & Policy* 54, 497–504
- Carmen, E, Watt, A, Carvalho, L, Dick, J, Garcia-Blanco, G, Grizzetti, B, Hauck, J, Izakovicova, Z, Kopperoinen, L, Liqueste, C, Odee, D, Steingröver, E, Young, JC, 2018, Knowledge needs for the operationalisation of the concept of ecosystem services, *Ecosystem Services* 29, 441–51
- Cash, DW, 2001, In order to aid in diffusing useful and practical information: agricultural extension and boundary organizations, *Science, Technology & Human Values* 26, 4, 431–53
- Cash, DW, Clark, WC, Alcock, F, Dickson, NM, Eckley, N, Guston, DH, Jäger, J, Mitchell, RB, 2003, Knowledge systems for sustainable development, *Proceedings of the National Academy of Sciences*, 100, 8086–91
- Dicks, LV, Hodge, I, Randall, NP, Scharlemann, JPW, Siriwardena, GM, Smith, HG, Smith, RK, Sutherland, WJ, 2014, A transparent process for 'evidence-informed' policy making, *Conservation Letters* 7, 119–25
- Dicks, LV, Haddaway, N, Hernández-Morcillo, M, Mattsson, B, Randall, N, Failler, P, Ferretti, J, Livoreil, B, Saarikoski, H, Santamaria, L, Rodela, R, Velizarova, E, Wittmer, H, 2017, Knowledge synthesis for environmental decisions: an evaluation of existing methods, and guidance for their selection, use and development, a report from the EKLIPSE project
- European Commission, 2006, Communication from the Commission: halting the loss of biodiversity by 2010 – and beyond – sustaining ecosystem services for human well-being, COM/2006/0216 final
- European Commission, 2015a, the mid-term review of the EU biodiversity strategy to 2020, COM(2015) 478 final
- European Commission, 2015b, The state of nature in the European Union, COM(2015) 219 final
- Fairbrass, J, Jordan, A, 2004, Multi-level governance and environmental policy, in Bache, I, Flinders, MV (eds), *Multi-level governance*. Oxford: Oxford University Press, 147–64

- Fazey, I, Bunse, L, Msika, J, Pinke, M, Preedy, K, Evely, AC, Lambert, E, Hastings, E, Morris, S, Reed, MS, 2014, Evaluating knowledge exchange in interdisciplinary and multi-stakeholder research, *Global Environmental Change* 25, 204–20
- Haddaway, N, Dicks, LV, 2018, Over-simplifying evidence synthesis? A response to Cook et al, 2017, *Biological Conservation* 218, 289–90
- Kay, JJ, Regier, HA, 2000, Uncertainty, complexity, and ecological integrity: insights from an ecosystem approach, in Crabbé, P, Holland, A, Ryszkowski, L, Westra, L (eds) *Implementing ecological integrity*, Dordrecht: Springer, 121–56
- KNEU Team, 2014, A recommended design for 'BiodiversityKnowledge', a network of knowledge to support decision making on biodiversity and ecosystem services in Europe
- Knight, AT, Bode, M, Fuller, RA, Grantham, HS, Possingham, HP, Watson, JEM, Wilson, KA, 2010, Barometer of life: more action, not more data, *Science* 329, 141
- Livoreil, B, Geijzendorffer, I, Pullin, AS, Schindler, S, Vandewalle, M, Nesshöver, 2016, Biodiversity knowledge synthesis at the European scale: actors and steps, *Biodiversity and Conservation*, 25, 1269
- Lux, A, Mehring, M, 2016, Formative evaluation strategy and framework, a report of the EKLIPSE Project
- Mansfield, B, Haas, J, 2006, Scale framing of scientific uncertainty in controversy over the endangered Steller sea lion, *Environmental Politics* 15, 1, 78–94
- McNie, EC, 2007, Reconciling the supply of scientific information with user demands: an analysis of the problem and review of the literature, *Environmental Science & Policy*, 10, 17–38
- Mehring, M, Bernard, B, Hummel, D, Liehr, S, Lux, A, 2017, Halting biodiversity loss: how social-ecological biodiversity research makes a difference, *International Journal of Biodiversity Science, Ecosystem Services & Management* 13, 1, 172–80
- Neßhöver, C, Timaues, J, Wittmer, H, Krieg, A, Geamana, N, van den Hove, S, Young, J, Watt, A, 2013, Improving the science-policy interface of biodiversity research projects, *Gaia-Ecological Perspectives for Science and Society* 22, 99–103
- Neßhöver, C, Vandewalle, M, Wittmer, H, Balian, EV, Carmen, E, Geijzendorffer, IR, Görg, C, Jongman, R, Livoreil, B, Santamaria, L, Schindler, S, Settele, J, Sousa Pinto, I, Török, K, van Dijk, J, Watt, A, Young, J, Zulka, KP, KNEU Project Team, 2016, The network of knowledge approach: improving the science and society dialogue on biodiversity and ecosystem services in Europe, *Biodiversity and Conservation* 25, 7, 1215–34
- Nilsson, M, Griggs, D, Visbeck, M, 2016, Map the interactions between sustainable development goals, *Nature* 534, 7607, 320–23
- Nutley, SM, Walter, I, Davies, HTO, 2007, *Using evidence: how research can inform public services*, Bristol: Policy Press
- Owens, S, 2012, Experts and the environment: The UK Royal Commission on environmental pollution 1970–2011, *Environmental Law* 24, 1, 1–22
- Primmer, E, Termansen, M, Bredin, YK, Blicharska, M, Garcia-Llorente, M, Berry, P, Jääskeläinen, T, Bela, G, Fabók, V, Geamana, N, Harrison, PA, Haslett, J, Cosor, G, Holst Andersen, A, 2017, Caught between personal and collective values: biodiversity conservation in European decision making, *Environmental Policy and Governance* 27, 6, 588–604
- Pullin, AS, Stewart, GB, 2006, Guidelines for systematic review in conservation and environmental management, *Conservation Biology* 20, 1647–56

- Pullin, AS, Knight, TM, Watkinson, AR, 2009, Linking reductionist science and holistic policy using systematic reviews: unpacking environmental policy questions to construct an evidence-based framework, *Applied Ecology* 46, 970–75
- Pullin, A, Frampton, G, Jongman, R, Kohl, C, Livoreil, B, Lux, A, Pataki, G, Petrokofsky, G, Podhora, A, Saarikoski, H, Santamaria, L, 2016, Selecting appropriate methods of knowledge synthesis to inform biodiversity policy, *Biodiversity and Conservation* 25, 7, 1285–1300
- Rosenberg, AA, 2007, Fishing for certainty, *Nature* 449, 7165, 989
- Rosendahl, J, Zanella, MA, Rist, S, Weigelt, J, 2015, Scientists' situated knowledge: strong objectivity in transdisciplinarity, *Futures* 65, 17–27
- Saarikoski, H, Primmer, E, Saarela, S-R, Antunes, P, Aszalós, R, Baró, F, Berry, P, Blanco, GG, Gómez-Baggethun, E, Carvalho, L, Dick, J, Dunford, R, Hanzu, M, Harrison, PA, Izakovicova, Z, Kertész, M, Kopperoinen, L, Köhler, B, Langemeyer, J, Lapola, D, Liqueste, C, Luque, S, Mederly, P, Niemelä, J, Palomo, I, Pastur, GM, Peri, P, L, Preda, E, Priess, JA, Santos, R, Schleyer, C, Turkelboom, F, Vadineanu, A, Verheyden, W, Vikström, S, Young, J, 2017, Institutional challenges in putting ecosystem service knowledge in practice, *Ecosystem Services* 29, 579–98
- Sandifer, PA, Sutton-Grier, AE, Ward, BP, 2015, Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: opportunities to enhance health and biodiversity conservation, *Ecosystem Services* 12, 1–15
- Sarkki, S, Niemelä, J, Tinch, R, van den Hove, S, Watt, AD, Young, JC, 2014, Balancing credibility, relevance and legitimacy: a critical assessment of trade-offs in science-policy interfaces, *Science & Public Policy* 41, 2, 194–206
- Sarkki, S, Tinch, R, Niemelä, J, Heink, U, Waylen, K, Timaeus, J, Young, J, Watt, A, Neßhöver, C, van den Hove, S, 2015, Adding 'iterativity' to the credibility, relevance, legitimacy: a novel scheme to highlight dynamic aspects of science-policy interfaces, *Environmental Science & Policy* 54, 505–12
- Sharman, A, Holmes, J, 2010, Evidence-based policy or policy-based evidence gathering? Biofuels, the EU and the 10 % target, *Environmental Policy and Governance* 20, 309–21
- Smith, G, 2003, *Deliberative democracy and the environment*, London: Routledge
- Sutherland, WJ, Gardner, T, Bogich, TL, Bradbury, RB, Clothier, B, Jonsson, M, Kapos, V, Lane, SN, Möller, I, Schroeder, M, Spalding, M, Spencer, T, White, PCL, Dicks, LV, 2014, Solution scanning as a key policy tool: identifying management interventions to help maintain and enhance regulating ecosystem services, *Ecology and Society* 19, 2, 3
- Tinch, R, Balian, E, Carss, D, Ezzine De Blas, D, Geamana, NA, Keune, H, Nesshöver, C, Niemelä, J, Sarkki, S, Thibon, M, Timaeus, J, Vadineanu, A, Van Den Hove, S, Watt, AD, Waylen, KA, Wittmer, H and Young, JC, 2018, Science-policy interfaces for biodiversity: Dynamic learning environments for successful impact, *Biodiversity and Conservation*, 27, 1679–702
- Turnhout, E, Bloomfield, B, Hulme, M, Vogel, J, Wynne, B, 2012, Listen to the voices of experience, *Nature* 488, 23, 454–5
- Van den Hove, S, 2007, A rationale for science-policy interfaces, *Futures* 39, 7, 807–26
- Van Kerkhoff, LE, Lebel, L, 2015, Coproduction capacities: rethinking science governance relations in a diverse world, *Ecology and Society* 20, 1, 14

- Vink, MJ, Dewulf, A, Termeer, C, 2013, The role of knowledge and power in climate change adaptation governance: a systematic literature review, *Ecology and Society* 18, 4, 46
- Vogel, C, Moser, SC, Kasperson, RE, Dabelko, GD, 2007, Linking vulnerability, adaptation, and resilience science to practice: pathways, players, and partnerships, *Global Environmental Change* 17, 349–64
- Waylen, KA, Young, J, 2014, Expectations and experiences of diverse forms of knowledge use: the case of the UK national ecosystem assessment, *Environment and Planning C: Government and Policy* 32, 2, 229–46
- Young, JC, Watt, AD, van den Hove, S, the SPIRAL project team, 2013a, Effective interfaces between science, policy and society: the SPIRAL project handbook, <http://www.spiral-project.eu/content/documents>
- Young, JC, Watt, AD, van den Hove, S, the SPIRAL project team, 2013b, A resource book on science-policy interfaces: The SPIRAL synthesis report, http://www.spiral-project.eu/sites/default/files/Synthesis-Report_web.pdf
- Young, JC, Jordan, A, Searle, KR, Butler, A, Simmons, P, Watt, AD, 2013c, Framing scale in participatory biodiversity management may contribute to more sustainable solutions, *Conservation Letters* 6, 333–40
- Young, JC, Waylen, K, Sarkki, S, Albon, S, Bainbridge, I, Balian, E, Edwards, D, Davidson, J, Fairley, R, Margerison, C, McCracken, D, Owen, R, Quine, C, Stewart-Roper, C, Thompson, D, Tinch, R, van den Hove, S, Watt, A, 2014, Improving science-policy dialogue to meet the challenges of biodiversity conservation: having conversations rather than talking at one another, *Biodiversity and Conservation* 23, 2, 387–404