British Ecological Society/Cambridge Conservation Initiative Annual Symposium

Making a Difference in Conservation: Improving the Links between Ecological Research, Policy and Practice

Conference report: impressions of the spoken and unspoken word.

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This sell-out event brought over 250 delegates together from all over the world to explore the relationships between evidence, policy and practice. The constant 'buzz', swapping of contact details, excellent talks, workshops, panel discussions, question-answer sessions and social media chatter all testify to a hugely successful event. The plenary sessions were recorded and presentations will be available on the BES website.

This report is in two parts. The first aims to present an overview based on what was said, drawing out the main themes that emerged across the presentations. The second aims to sketch out what was not said: picking up points that there was little time to explore or expand upon, including assumptions and the importance of world-views in filtering the evidence that is used to support policy and practice. To use an analogy from photography, we aim to present both the positive and negative photographic prints as a basis to progress the discourse about policy and practice to shape ecology and society.

In his opening remarks, Bill Sutherland reminded us why the subject of this conference is so important. There are conservation successes. Land is protected, sometimes it is well managed. We have legislation and sometimes it works. But we are still often amateurish in linking policy and evidence effectively, relying more on expert opinion than global experience of what works. Policy is a values-based activity. There are mismatches between policy, science and evidence, strikingly expressed in the choices made about the allocations of resources to support agri-environment measures. The testing of policy is inadequate, and even when we have evidence of what doesn't work those measures continue to be funded. The relationships between biodiversity and ecosystem service raise levels of concern globally and locally. Yet potential funders do not find the case for conservation action compelling. Bill suggested that a great deal could be achieved by adding up the marginal gains based on what works and using the latest technologies, and that new ideas and approaches should be applied and tested at the small scale, to find out what works by testing hypotheses. More provocatively, Bill reminded us that there are some high level questions that need answers. Do protected areas work? What is the impact of removing predatory species? We need to slice-up the policy process to get a better understanding of how it works, and so how to improve it.

The spoken word - key themes

Policy

In slicing-up policy, it is apparent that it isn't easy to define the term, nor does it operate as a tried-and-tested and replicable process. The relationship between policy and evidence is complex. The rhetoric of 'evidence-based-policy', 'sound science' and 'pro-science' is unhelpful (Susan Owens) and tells us more about power relations (Andy Stirling) than it does about the role of evidence in policy. Andrew Miller suggested 'evidence *informed* policy', involving judgement, as a more accurate portrayal. Moreover, science is equally multi-faceted and only one part of evidence. In turn, evidence is only one of many factors that

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shape policy. Susan Owens argued that the idea that science is distinct from policy is an unhelpful framing, a fallacy of linear rational thinking. A more sophisticated understanding of the science/policy space is required, which the conference went some way to explore.

Values

Several speakers (e.g. Ian Boyd, Susan Owens) described policy as a values-based activity. Ian Bateman went further to argue that all values are human values, including the non-use values (sometimes called intrinsic values) that some people hold for some species and habitats. Two inescapable facts about values are that human wants vastly exceed available resources and that for every action there is an opportunity cost – every decision to do something is a decision not to do something else. Where actions require effort, or resources, we are constantly making value judgements about what is important.

Several contributors observed that world-views play an important role in filtering the evidence and facts that support policy and practice. Andy Stirling argued that as part of the social fabric, which world-views prevail is a function of power relations, and this includes the different aspects of science. John Beddington noted that selection and cherry-picking of evidence is inevitable, but Chief Scientific Advisers should never be asked to find evidence to support policy.

Democracy and representativeness

Using science to influence policy, or decision-making is part of a democratic process. Susan Owens asked what that relationship should look like. Public reaction limits what can be done. Andy Stirling argued that science itself aligns closely to the virtues of democracy by countering power through ideals rooted in universality, communitarianism, openness, scepticism, experiment and peer review all of which promote the democratisation of knowledge. He urged us to embrace the transformative power of a scientific culture with these ideals as a social movement, rather than science as a part of the establishment.

Andrew Miller argued that lobbying is a vital part of a democracy, provided the person lobbying is not in someone else's pocket. He and Fiona Fox urged scientists to engage with MPs both as professionals and as constituents to inform the debate. Fiona Fox was concerned that the proposed rules on lobbying for Government grants could have a disproportionate and unintended impact on university science, because of its highly risk averse culture.

Overwhelmingly, contributors argued that scientists need to work closely with policymakers, whilst retaining their independence and capacity to challenge (Georgina Mace). We must be wary of science and policy becoming too close and acting as a cabal. This point was reinforced by Fiona Fox in arguing that rather than science seeking to speak with *one* voice to counter disinformation propagated by well-organised sceptics through social media, most or all scientists should engage to more fully represent the range of views and thereby enliven rather than suppress informed debate. Juliette Young arrived at a similar conclusion, arguing that conflict should not be suppressed by closing down opposing views, but framed as an opportunity for societal debate bringing forward a range of viewpoints in a negotiated settlement. This was not to suggest that the process is easy or that everyone always agrees, but that people can agree to differ through a well-structured process and move on from conflict. A 'solution' that involves winners and losers will always resurface as a conflict.

John Beddington agreed that the process for nominating people to groups such as the Scientific Advisory Group for Emergencies (SAGE) is not open or transparent, but the advice is. The selection process is less important than securing individuals who excel in science and are able to communicate it. Fiona Fox noted that it is important that scientists, such as

CSAs are able to work closely with Government 'behind closed doors', but not in signing confidentiality clauses that limited their engagement with the media and hence informing the public discourse. Ian Boyd argued that advisers need to be distinct from government and able to challenge.

Science and policy

Andy Stirling observed a strong tendency for scientists to see the role of science in policy as one of 'speaking truth to power', pointing to the prevailing linear model applied to the science-policy interface.

Several contributors stated that a key role for science lies in defining the problem. Ian Boyd suggested that by examining problems from the root cause upward, science could help to define the character of the problem. Defining the problem frames the issue and is the first step towards a solution. There are many ways to frame problems, for example badgers present a social problem (behaviour of farmers) more than an epidemiological problem (but it is the latter that has framed the issue so far and the perceived need for a cull). In systematic reviews, the framing of the question by the user community is crucial (Andrew Pullin).

The concerns of scientists and practitioners differ, and Rob Freckleton provided a typology (Table 1).

Table 1. A typology of science and practice.

Science is concerned with:	**Practitioner concerned with:**
Probabilities	Outcomes
Qualified conclusions	Certainties
Problem oriented	Service oriented
Discovering drivers	Mission driven
Replication	Situational

Lynn Frewer highlighted a similar challenge in considering how best to organise public participation. An interest in quantification would lead to a large well-structured sample to give a reliable average view (replication), but much smaller group discussions (e.g. 8 people) can yield richer more nuanced views (situational), which could be equally valuable although highly variable. In practice both are used together, the approach being informed by what is likely to progress understanding of the specific issue.

Georgina Mace proposed three roles for science in policy: advice and guidance (what works and what doesn't); new science and understandings; and, challenge (holding policymakers to account), with scientists as independent arbiters. All three interact as a system. Interventions in one part can have unintended consequences (e.g. ring fencing funds for research while imposing organisational cuts elsewhere). Andrew Pullin argued that the more widespread use of systematic reviews would enable them to be used to scrutinise policy decisions on how and why the evidence was or was not used.

Des Thompson observed that policy makers respond to events and need quick answers that are relevant to prevailing problems. Scientists need to understand the question that is being asked (not the one they wish had been asked) and whether they are being asked to provide a view, an opinion, evidence or a judgement.

Several contributors suggested an important role of science in communicating the long view to politicians, and outlining the consequences of action or inaction on issues. Bonnie Wintle described horizon scanning as a process to eke out signals that deserve attention. Early detection of threats and opportunities allows early intervention, with signals validated using

Delphi techniques (the 'wisdom of crowds'). In describing a specific example to agree priorities for Antarctic research, Chuck Kennicutt observed that horizon scan successes can be difficult to judge because of long lag times between the horizon scan and its use. He also noted the challenge of getting contributors to take the long view, typically limited to a six-year funding horizon, which is potentially problematic for dealing with long-term issues such as sea level rise.

Evidence and the limitations of science

Ian Boyd reminded us of the limitations of science, summarised by Bill Sutherland in 20 things that policymakers need to know about science, including no measurement is exact, bias is rife, and correlation is not necessarily causation. There is an equally important rejoinder from Chris Tyler in the 20 things scientists should know about policy, including policy is difficult, policymakers can be experts too, and there is more to policy than science.

What we choose to measure or record depends on our understanding of the world, but our understanding develops as we interpret the results (Lucy Bastin). And as our understanding develops so we change what we measure or record, and so on. Maintaining long-term runs of data can be a challenge.

In discussing which methods to use, E-J Milner Gulland urged delegates to focus on the question, to inform the choice of methods. The optimum method depends on the question and the resources and, for example whether you are interested in causation or correlation, subjective or objective evidence, effect size etc. She recommended several new methods including co-design and co-production (facilitated by scientists but designed by local people for their interests), conflict resolution (shifting the mindsets of conservationists), modelling (undervalued in policy/practice, partly because they are poorly presented), predictive conservation science (predict-implement-monitor-review including its application to behavioural economics), experiment (be creative and innovative), and share in new ways (social media etc). Don't just focus on the end-users, involve them in the design of the study.
Be creative and imaginative. Both she and Gemma Harper urged a mix of methods and a diversity of thinking from different disciplines to view the problem from different angles.

Lucy Bastin promoted the role of open decision making and big data. Open policy involves being curious and a willingness to challenge. It includes citizen science. One of the challenges of using big data is to identify what is relevant. It is important to clarify what is being measured and why. Fitness for purpose informs the tolerances and acceptable quality and hence the alignment and collation of data.

Gemma Harper noted that the delivery of policy is concerned with the social context, giving science and social science equal weight in the development and implementation of policy. There is a need to equalise sources of knowledge.

Not all knowledge is scientific, as amply demonstrated in Pernilla Malmer's presentation. Increasing value is being placed on indigenous local knowledge systems (ILKS) – covering sustainable governance, policy and decisions, biodiversity and ecosystems and the evidence base, for example in the IPBES assessment processes. Knowledge exchange can take three forms: integration of one knowledge system into another; connecting parallel knowledge systems and world views, each with separate validation systems; and, co-production and co-design of knowledge. A striking finding was that in participatory monitoring systems (e.g. monitoring of natural resources by local communities) the time from monitoring to influencing decision making is 0-1 year compared with 3-27 years for science-based monitoring**.** Six principles guide effective knowledge exchange: trust, reciprocity, equity, respect, transparency and free prior informed consent.

Practice

Malcolm Ausden observed that virtually all of our landscapes are cultural and require lots of intervention especially where natural processes are not working. Monitoring is needed to evidence success of these interventions. In the RSPB, reserve managers draw mainly on personal experience, advice from line managers and from internal ecologists. Actions on reserves are highly situational (context/issue/site specific) and managers need to apply their experience and 'other knowledge' to recommended actions. A high degree of intuition is required to juggle a wide range of local factors. A consequence of this is that many variables are at play and there is no simple hypothesis to test.

Hugh Possingham challenged us to consider the value of information and hence when to act and not to act – and the opportunity cost of doing so. He argued that it is pointless to monitor change that we are powerless to influence (such as some aspects of climate change). Organisations typically spend 5-20% of their resources on monitoring – Malcolm Ausden gave a figure of 11% for the RSPB – but these sums are usually arbitrary instead of being based on an analysis of the likely benefits arising from the associated costs.

Where possible, actions should be based on evidence of what works (e.g. Bill Sutherland, Andrew Pullin), but John Altringham highlighted several examples from conservation measures for bats where actions are being undertaken (e.g. bat gantries) even after studies and global synopses showing that they do not work. Evidence of what works is weak or absent in many cases and current practice leads to poor evidence gathering, and poor uptake of new evidence. This is cause for widespread concern across conservation practice.

Risk and uncertainty

The management of or approach to uncertainty is closely related to the consequences of events, or risk. Rob Freckleton noted that uncertainty is pervasive in ecology at all scales in space and over time, especially with models. Uncertainty can be associated with data, models, science outputs and practice. There are process, measurement and statistical errors that feed models, contributing to errors in the choices made between them. The key to dealing with uncertainty in making decisions is to be aware of the consequences – does it matter? What are the costs and risks of making the 'wrong' decision? Are the biases that arise from uncertainty important? Is more (and how much more) information required to inform a better decision – and what is the value of that information? It is important to build the outcomes and users into the work from the outset to inform the management of uncertainty, and to understand the risk appetite of the users.

Andy Stirling argued that not all uncertainty can be quantified, but that power relations within science means that the non-quantifiable elements are simply overlooked. Precaution is one of the positive principles of science and should be invoked, especially for 'qualitative uncertainty' over 'quantitative risk'. Qualitative uncertainty (closer to Rumsfeld's 'unknown unknowns') cannot be measured or quantified, or at least the errors in doing so are so large that the quantification leads to a misguided sense of control and knowledge. Charles Godfray argued that while the interpretation and application of the precautionary principle is contested, science has an important role in exploring the potential consequences of action and inaction.

John Beddington agreed that risk frameworks are useful to evaluate ecological issues, because they allow the consequences to be explored, for example the extent to which the loss of biodiversity should be slowed or reversed could be informed by analysing the consequences of such loss – there is a close analogy with climate change and the issue is at

least as severe. The National Risk Register presents a range of low-likelihood high-impact events, and considers them in isolation, but their impact could be understated if attention is not given to the possible context in which they occur or the possibility of overlapping low-likelihood high-impact events.

Bias

Many contributors were concerned about bias. Charles Godfray discussed some of the main ones, drawing on Nuzzo (2015). Conscious bias is relatively obvious and easy to deal with. Unconscious bias is more of a challenge, as studies in the behavioural sciences show as well as wider concerns across several disciplines about replication. Unconscious bias is inescapable. It is linked to world-views and we need to develop our awareness of it through dialogue. Confirmation bias or 'hypothesis myopia' involves selecting evidence to suit preconceived view. Statistical bias includes the 'Texas sharpshooter fallacy', attaching meaning to random data, and ρ-hacking, selecting data to achieve statistical significance, or using flowery language to gloss over the lack of significance ('on the very fringes of significance'). There is referee bias in scientific publications. There are badly designed incentives including money, publish or perish, impact agenda (Research Excellence Framework), competition between journals, the quest for 'impactful' papers and rejecting negative papers. The last was also a concern for Susan Owens and Andrew Pullin. A consequence is that the vast bulk of the products of science are not published, because they are 'too dull', too geographically limited, and so potentially important resources - data and evidence - are lost. Solutions lie in methodological transparency, adversarial collaboration, blind data analysis, data transparency, and publishing both negative and positive findings.

Andy Stirling alerted us to the ways in which power imposes bias in the hierarchies of knowledge and the resources afforded to research. The 'products' of science are more tangible (e.g. lead to jobs and GDP) and are therefore valued more highly than science that leads to 'process' (or intangible outputs), leading for example to the bulk of resources supporting research in associated areas of medicine and defence. Reductionism and quantification have deep and powerful roots in science and shape the hierarchies of knowledge (e.g. physics through to ecology and politics), even if reductionism doesn't serve the fundamentally systemic aspects of ecology. In turn these power relations shape the political currency of intellectual property – and lead to hierarchies of evidence. Gemma Harper suggested that the natural sciences carry more weight than economics which carries more weight than public opinion.

Acknowledgement of potential bias is the first step to managing it. Andrew Pullin described the important role that systematic reviews can play in this, for example to counter the 'selection bias' of choosing the studies that are most useful to you, the 'confirmation bias' implicit in 'policy-based evidence'. Study design is susceptible to bias. Binnie Wintle suggested that the bias in manual horizon scans depends on the diversity and extent of the networks used in sampling.

Lynn Dicks described another way in which bias is apparent, suggesting that while most of the research questions pertinent to aspects of food security were strongly clustered in the 'response' element of the DPSIR (driver-pressure-state-impacts-response) framework, most of the research is concentrated in the 'DPSI' elements.

Malcom Ausden hinted that bias may be at play in the methodologies used to monitor change on reserves, which for reasons of cost-effectiveness may focus on species for which data is relatively easy to collect (e.g. breeding and non-breeding birds and 'honorary birds' such as dragonflies, butterflies etc) before using more difficult and expensive methods, and relying on quick-and-dirty, look-see surveys to access extinction risk of rare species, and subjective visual spot-checks for habitat quality.

Communications

When science has less than the expected or desired impact it is often attributed to a 'communications fallacy' the solution to which is restate the same message, slower, more deliberately and much louder than before, like the stereotypical Englishman abroad (Susan Owens). It is more effective to change the narrative, and connect to other interests (Des Thompson), there are no scientific trump cards to beat values or a world-view (Susan Owens). Ian Boyd and Susan Owens reminded us that science is often absorbed by the policy community in ways that are not immediately obvious but become apparent over time. Success depends on resonance with the political ground (success can be immediate), or the ground may turn more fertile (seeds cast earlier germinate), or the impact may be more diffuse – a gradual absorption as science and policy co-evolve – this can be very slow. The requirement to see an immediate impact is an unhelpful barrier and the lack of direct or immediate impact can lead to a cynical view of science and evidence. This can lead scientists to underestimate the impact that they have on policy development. Be patient.

Des Thompson observed that the language of conservation language is out of tune with the public. Terms such as 'biodiversity' and 'ecosystems' mean very little to most people whereas most people understand 'nature' and think that it is important.

Fiona Fox exhorted scientists to engage with the media to inform the debate. If scientific experts don't engage on scientific issues, then who will? Confidentiality clauses can compromise openness and lead to an ill-informed public debate. Scientists should not avoid controversial issues, but build trust through better relationships with the media. A member of the audience suggested that if the country is to value nature, there needs to be a public discourse informed by ecological views and values.

Communication is also an important part of changing behaviours and Elisabeth Costa urged nudging them using the EAST framework to inform actions that are easy (harnessing the power of defaults, reducing hassle factors and using simple messages), attractive (salient and personal), social (the power of networks and social norms, reciprocity) and timely (making use of the opportunities associated with important decisions in people's lives, and working with people's tendency to discount the future and respond to immediate costs and benefits).

Knowing your audience is a vital part of communications and social marketing in conservation and Bob Smith urged scientists to use social marketing to remove barriers to change, and to publish findings to expand the knowledge base of what works.

Trust

Many contributors referred to trust operating at a range of levels as being pivotal to effective relationships between scientists, policy-makers and practitioners. Although the word was much used, only Jilly Hall began to define it through a workshop session which described it in terms of 'the willingness to believe what is being said and done', 'honesty', 'no harm', 'something to be lost', 'equality of power in a relationship' and 'hard won easily lost'.

Ian Boyd stressed the importance of developing trust as a feature of open policy making (co-production). He cited the badger cull in England as an example where policy has not worked well (there is no 'right' or 'wrong' answer) and where the issue is now characterised by a lack of trust between the policy and science communities.

The Blair government recognised that policymakers were not trusted by people, so advocated participation on the basis that involving people would make them more likely to

accept the resulting decisions. Lynn Frewer described the use of a variety of techniques used to discuss attitudes and perceptions of risk associated with GM foods. However, different techniques yielded inconsistent results so were hard to interpret. More importantly, from the standpoint of developing trust, the UK and EU positions on GM had moved on by the time the public engagement occurred, such that the participatory exercise would have limited impact on any decision and leaving a question over the real purpose of the exercise.

Power

Pernilla Malmer alluded to the famous aphorism 'knowledge is power' in observing that withheld knowledge is partly lack of communication, partly power relations. Power and power relations were implicit throughout the conference, but not discussed openly in plenary until the final day. Andy Stirling observed that, while it is considered rude to speak of power, it is key to the social process of making decisions. That is, both power *in* science and power in relationships with others. Power is complex and many faceted, but it is fundamentally about the *uneven distribution of agency*. This drives science as much as it drives any other social activity. It is the single most important social fact. It is unavoidable. It is not necessarily bad, it gets things done. Whether power is 'good' or 'bad' depends on your viewpoint. Criticism is valid when power is neglected or denied, as is often so in science, with this conference being a case in point.

Jilly Hall described land management in terms of a complex set of power relations, with the environment (nature) emerging from this socio-political context. Who 'owns' land is more complex that who holds the deeds. There are complex social interactions at play in which many people feel that they may own land, depending, for example, on the effort put into it (by the farmer, forester, game keeper, beater, volunteer tree planter etc), formal, informal or even illegal occupancy which may be permanent, temporary or transient and so on. Ownership is conveyed by social norms, for example one trespasser feels vulnerable but 10 or 100 together feel safe.

Relationships

Nearly all speakers referred to the pivotal role of building good relationships, although, as noted above, not often in the context of power and trust. Jilly Hall noted that conservation can only work with and through people, so social sciences and behaviour change are vital. In a workshop on the causal links between social and environmental outcomes, participants drew out common themes on active listening, finding common ground, understanding and respecting alternative viewpoints and building trust either directly or through trusted third parties to act as advocates.

Ian Boyd described the position of Chief Scientific Advisers as being well-placed to see the different viewpoints in the customer/supplier relationship, with the 'supplier' (scientists) offering conservation science 'products' through structural relationships. CSAs need to understand the social dynamics within and between policymakers and scientists, build trust and relationships. A degree of self-awareness is required and they need to be organisationally literate, sociable, bright and intellectual. It is important to create structures that enable these interactions to arise.

Some other examples that typify the importance of relationships in evidence, policy and practice include inclusivity, involving end-users and care not to omit minority views in horizon scanning (Chuck Kennicutt), a collaborative open sharing culture required to maximise transparency and minimise bias in evidence as the basis of systematic review (Andrew Pullin) and building alliances, continuity, trust and patience as key to using Conventions to influence many countries at once rather than inter-department power relations within a single country, and hence help environment departments to save nature (Nicola Crockford).

The flip-side to this is what happens when relationships break down. Serah Munguti observed that advocacy campaigns are the last resort after everything else has failed and when there is a crisis. Juliette Young arrived at much the same conclusion in observing that conflicts involve people with opposed views which may be expressed in all sorts of different ways but are underpinned by an inability or unwillingness to work with differing worldviews. Be flexible.

Nicola Crockford observed that there are many approaches to conserving species and habitats. All of them are important and all of them need to work together. Avoid infighting about the most important approach. Find common cause and work in concert not competition.

Institutional factors

Several contributors noted the importance of institutional arrangements in creating the basis for relationships and cultures, often alluding to trust and power. In describing the establishment of the Centre of Excellence for Biosecurity Risk Analysis at the University of Melbourne, Mark Burgman was candid about the initial culture clash and lack of trust between the university, the new centre and the Government (who commissioned CEBRA). Factors included different scientific culture within the University and its own departments, differing tolerance of risk, different approaches to contractual obligations, dress codes, modes of communication, forms of address etc. Making the Government research relationship work depends on trust, transparency, reciprocity, shared values, common goals, institutional continuity and culture change.

Lynn Frewer noted that there is often a mismatch between public engagement and the ways in which organisations work. Much of the impact of participation is in the informal ('in-between') spaces, but these are often few and far between in organisational structure and policy processes. Much depends on the individuals involved, building relationships and trust.

The Unspoken Word - key themes

World-views

Contributors recognised the importance of world-views in how evidence is perceived, and whether it is accepted or dismissed. World-views were also seen to be important in shaping the power relations that fuel social interactions and evidence, policy and practice. But there was little discussion beyond that to unpick the world-views that might be at play whether in shaping attitudes and approaches to conservation, or influencing the selection and hierarchies of evidence. In addition, world-views influence the meanings that we attach to assumptions and ambiguous or poorly defined terms (such as 'nature', 'naturalness', 'quality'). A consequence of this is that we can all leave a discussion or conference thinking that we were all talking about the same things whereas in fact we all take very different meanings (often the meaning that we want to take) from those interactions. This can have a considerable impact on what we think should be done and how that is expressed in the development, implementation and effectiveness of evidence, policy and practice.

A naïve view would suggest that there is a simple linear progression from 'matters of fact' informed by evidence to 'matters of concern' (Latour, 2004) and hence policy and practice. An alternative view is that this landscape is much more complex with a key role for narratives in translating matters of fact into matters of concern (Latour, *op cit*.). These narratives are largely unspoken and describe how we understand the world and our place in

it. In turn these shape the 'evidence' that we select to inform our understanding of issues – and hence some of the biases discussed.

Exploring narratives is important for two reasons. First, to understand how conservationists view evidence, policy and practice and what the consequences of that might be. Second, to understand how evidence might be received and taken forward by policy makers. We need to understand the narratives that conservationists use, those used by policy makers and where evidence lies in relation to them. Narratives are an important part of the power relations that drive social interactions and relationships (e.g. Cronon, 1992), as discussed by Andy Stirling.

Of critical importance in conservation is whether people are seen as a part of nature or apart from nature. The influences the understanding of terms such as such as nature, ecosystem health, native, naturalness, integrity, biodiversity, productivity, sustainability, sustainable development, resilience, diversity, stability, balance, environmental quality, wild, rewilding, multiple benefits, protected area, priority (including with respect to habitats and species), land sparing, land sharing. In short, all of the language, concepts and ideas of conservation, which perhaps testifies to the idea that 'nature' and 'conservation' are social constructs.

To give one example, in a world-view where people are apart from nature, 'integrity' would be "the "highest order" construct of environmental quality—an ecosystem with integrity is necessarily healthy, sustainable, [governed by 'natural processes'] and relatively biodiverse, when compared to a system with less integrity" (Hull et al, 2002a, p.3). But in a world-view where people are a part of nature, integrity might be associated with multiple benefits, balance, resilience, and sustainability and productivity associated with a wide range of ecosystem services (Hull *et al., op.cit*.). One is more categorical, possibly intransigent; the other is more fluid in a relationship that is continuously and actively negotiated.

In turn, this has implications for the institutional arrangements and approaches to conservation, including what we measure and performance management frameworks. The idea that nature is unambiguous and categorical sits comfortably with more rigid measurement frameworks informed by authoritative science used to 'deliver' conservation objectives (see e.g. Stone *et al*., 2001). In contrast a more fluid negotiated consensus between people and nature based on a broad range of knowledge and possible truths could be more in-tune with more situational, participative and co-produced approaches.

This is not to suggest that the world-views on nature and their consequences can be readily polarised. Indeed the world-views outlined above are not necessarily mutually exclusive: some people may gravitate more to one than the other, while others may hold both simultaneously. Similarly, while debates between utilitarian and intrinsic values greatly exercise many conservationists, many people hold both together without conflict (e.g. Hunter et al., 2014), although it appears that while utilitarian values are often associated with general and replicable issues, intrinsic values are often more situational and associated with personal experience and knowledge (Robert Fish, pers comm., from the public dialogues on the UK National Ecosystem Assessment). The above burlesques serve only to illustrate that world-views can and do shape evidence, institutional arrangements and approaches to conservation.

Stories and power relations go hand-in-hand in the unspoken factors that shape evidence, policy and practice.

"Given that stories will be told, is there something to be learned from thinking consciously about storytelling, rather than subconsciously telling a story?" (Janda and Topouzi, 2015, p.518).

Science and its 'independence'

Throughout the conference, contributors used 'science' sometimes synonymously with 'evidence', sometimes recognising that it is distinct from other sources of evidence and knowledge. Science itself is complex and difficult to define; it too is socially constructed. Understandings of science depend, among other things, on preferred philosophies of science, on method, on theory and models, on hierarchies of knowledge (e.g. Chalmers, 1999). The extent to which science seeks to reveal a single universal objective reality, or whether observations and objectivity are both theory-dependent, is also relevant (e.g. Chalmers, *op.cit*).

Although not discussed directly, different views were presented concerning the extent to which science should serve the general and replicable case and thereby 'speak truth to power' while other forms of knowledge, such as social sciences, tend to the more situational and seek to expose multiple truths.

More challenging was the idea that science is 'independent' and that scientists are better placed than others to play the role of 'honest brokers'. This is based on the idea of a simple linear progression from data and information to evidence, policy and practice discussed above. The view also elides the fact that science and scientists are involved in a social activity, are socially situated or embedded, subject to power relations and offer differing, sometimes conflicting, views of their 'reality'. There are many different types of scientists (academic, industry, government, NGOs etc) with different interests and viewpoints involved in a discourse (e.g. Stone et al., 2001; Bauer, 2009). Further, like all people, scientists play many roles, including, in some cases, being conservationists and these wider social relations also shape the worldviews and power relations that shape their views and scientific activity.

A consequence of this is to blur the simple linear notion of science as being the subject of a transactional relationship between the science (supplier) and the policy-maker (user) communities (see e.g. Stone *et al.* 2001).

In practice, the credibility of the scientific views(s) cannot be taken for granted, but must be evaluated along with other evidence and factors for a given situation and context (Sarkki et al., 2015). This extends to probing the framing of questions that form the basis of systematic reviews, including who is the user community and in whose interests are they posing the question. Who undertakes this, and how, given that systematic reviews *are* the subject of a contractual relationship between a user and supplier needs to be explored further.

These observations extend the discussion on unconscious methodological bias voiced in the conference (previous section) to the wider social biases that affect scientists as members of social groups. Bias is not possible to manage if it is denied.

Science and the administration of policy

In the same way that 'all politics is local' (Tip O'Neil, former Speaker of the US House), so all nature is local. By this we mean that while general forces and factors may be at work ultimately nature depends on the local context and situation and emerges from environmental factors interacting with geological, historical, social, cultural, technological, ethical, political and economic factors. And nature changes as these factors change – it is constantly in motion. Further, wherever nature exists, it's in someone's back yard, even if it is 'nationally' or 'internationally' important. Responding to contextual and situational factors is a huge challenge for the administrative arrangements that support conservation activity. Administrators tend to simplify, standardise and centralise (e.g. Stears, 2012), because that makes activities more readily comparable, auditable and accountable, reduces duplication and what might otherwise appear to be inexplicably different approaches in different places.

In political rhetoric this is sometimes referred to as the 'postcode lottery'. But sometimes things differ in different places because places are…different.

If, in striving for the general and replicable, science supplies evidence that combines with administrative factors that simplify and standardise, what are the implications for the situational and contextual characteristics of nature and the diversity that is likely to result? Put simply, does diversity in nature basically depend on people doing different things in different places? This challenge is similar to the status of individuals, each of us with our own situation and context, in the social care system. How much does the approach that emerges reflect reality, stories or power relations?

The extent to which administrative and institutional arrangements are able to respond flexibly and quickly to reflect the character of real-world problems is a critical success factor in translating evidence into effective policy and practice (e.g. Sparrow, 2011). But there is a great deal of inertia in institutions, often as a result of their structures and processes and associated habits and ways of working (Sparrow, *op.cit*). Internal arrangements designed for one set of problems may be ill-suited to others. An important distinction is whether organisations (including government) exist to 'deliver' or to 'enable', with the latter essential in creating the conditions for the participative approaches and building trustful relations that were advocated by many of the contributors.

The political-economy

The issues of power and trust that underlie both the spoken and unspoken word of the conference reflect the idea that nature emerges from power relations acting across society over time. Nature is an emergent feature of political economies, of socio-ecological systems. Both science and non-scientific knowledge are required to evidence policy and practice for nature. One way to evaluate these relationships is through environmental justice, examining the distribution of costs and benefits (distributive justice), the decision-making process (procedural justice) and issues of recognition (which views are heard and which are ignored). The less these principles are followed, the more likely the conditions for conflict.

Conclusions

A great deal of immense value was said at the conference. Whatever world-views are at play there are two inescapable facts (not a word that we use lightly) about nature: most of it, certainly in the UK, emerges from socio-ecological systems that are constantly in flux and people have been a dominant factor for at least the last several hundred or thousands of years; and, *all* conservation activity, without exception, involves working with and through people (even non-intervention management requires a decision or choice by people not to intervene in certain areas).

Conservation has to be interdisciplinary with people centre-stage. Ecology is an umbrella term for the application of as many disciplines are as required to understand the character of a problem and to inform solutions. While this was clearly acknowledged in the conference, and we all know that we should work with other disciplines, doing it in practice is far less common – another illustration of the clash between the normative and the reality. Is this really because it is hard to find and work with individuals from other disciplines, or is it a manifestation of a more fundamental problem? All too often many conservationists view anything other than prime concern for a species as an admission of 'failure' or 'sell-out', even, or especially, in a conflict situation. Perhaps it is a lack of willingness to accept a range of worldviews that limits multidisciplinary approaches. Collaborations that result from like-minded people working together are likely to seriously limit the potential for creativity, innovative analysis and insights that could enrich the options available to policy makers.

Rich as they were, our discussions were mainly within science, with some contributions from social sciences and practice, but what about the wider societal debate? The conference made an important start, but there is still much to do. Examining and exploring what was left unsaid provides important clues on the next steps required to progress and to develop the discourse more widely.

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