Futures Tools

Literature Review

The UK Government defines futures research as: *"The systematic examination of potential threats, opportunities and likely future developments which are at the margins of current thinking and planning. Futures research may explore novel and unexpected issues, as well as persistent problems or trends"* (Defra, 2002).

Futures research can inform policy development and it is used widely in the private and third sectors to anticipate and prepare for future shocks and facilitate long-term planning (Roney, 2010). For example the governments Foresight Programme has helped the UK Government to think systematically about future options through a testing of today's decisions to future uncertainties (Foresight, 2013).

There are a number of tools that can be used to identify, analyse and communicate insights about the future (Lowe and Ward, 2009; Sardar, 2010), ranging from highly quantitative, predictive approaches based on scientific evidence (e.g. forecasting), to more qualitative approaches based on a combination of local/lay and scientific knowledge (e.g. visioning). Tools available for anticipating and planning for the future vary according to the epistemological[1] assumptions (Aaltonen, 2005). We focus around those generic Futures tools that are most commonly used, with particular relevance to ecosystem services.

Quantitative Tools

Forecasting models look at how something has performed in the past and extrapolates those trends to create future scenarios. Software development has enabled forecasting calculation to become more accurate and precise with complex statistical models employed. Yet, despite short-term accuracy of predictions, longer-term forecasts do not have the same level of accuracy (Wright and Rowe, 2011).

In attempts to gain environmental foresight, substantial effort has been devoted to forecasting the future of social-ecological systems; for example in the climate projections of the IPCC (Thrush *et al.*, 2009). However, such attempts have a poor track record due to their high uncertainty (Bengston, 2012). Although, potentially helpful in guiding decision-making, the precision of forecasts may provide decision-makers with a false sense of certainty, meaning they prepare for a narrower range of futures, only to discover at a later date that the models were incorrect (Reed *et al.*, 2013a).

Horizon Scanning

Horizon scanning covers a number of processes for identifying and understanding emerging changes to the external environment of an organization or area of interest. Horizon scanning techniques were developed by the military during WW2 for intelligence on enemies (Bengston, 2012) but now have become standard practice in business, in many government agencies and in a range of other sectors.

The use of horizon scanning in environmental contexts and organizations is relatively limited but the UK foresight programme funded through BIS has tried to address this. Sutherland and Woodroof (2009) present a taxonomy of scanning methods in different settings, whilst Sutherland *et al.* (2008, 2010) outline scanning exercises for biodiversity and global conservation issues. The National Advisory Council for Environmental Policy and Technology recommended that the U.S. Environmental Protection Agency create an ongoing, institutionalized scanning system (U.S. EPA, 2002). The U.S. Army has an Environmental Policy Institute that conducts futures scanning on environmental issues (http://www.aepi.army.mil/) and the *iKnow* project (http://wiwe.iknowfutures.eu) which considers the Future Ecosystem Services, used horizon scanning as one of its key futures tools.

[1] Our understanding of the nature of knowledge

Delphi

The Delphi technique was developed at the RAND Corporation in the 1950s to investigate the potential impact of nuclear war (Linstone and Turoff, 1975) but now has been applied to a wide range of technological, environmental and other policy challenges. Delphi has a number of operational variations but generally involves gathering feedback from a panel of assembled experts over multiple rounds (Bengston, 2012). In a typical process, panel experts respond to questions without knowledge of the other panelists. Responses are summarized for each expert in a report, with participants given the opportunity to revise their individual responses based on views of other participants. It is usual to have approximately three rounds, after which consensus or contrasting views emerge. The aim is to achieve stability of responses. The technique explores contrasting and minority views and opinions and can help understand uncertainty. The Delphi method has occasionally been applied to natural resource and environmental issues. An early application looked at "future leisure environments" (Moeller, 1975). Other environmental applications of Delphi include GM and Nanotechonlogy (Renn, 2004) and more recently for assessing sustainability of Highland Estates in Scotland (Glass *et al.*, 2013).

Scenarios

Scenarios are neither predictions nor projections, but storylines about the future in order to help organisations think about how things might change and what can be done to promote or prevent possible future outcomes (Rural Futures Report, 2005; O'Neill, 2008). Scenarios enable choices to be made when the future is uncertain (Bohensky *et al.*, 2006). The UK NEA (2011a) recognises the importance of the multi-purpose nature of scenarios, generating not only plausible futures, but also social learning. The use of scenarios has become more prevalent over time triggered by Shell's use of the technique to anticipate the 1970s oil shortage, leading to the potential of futures work being recognised and valued by many agencies (Kass *et al.*, 2011).

Within the original UK NEA (2011a), working with scenarios was considered important to visualise the future in an accessible way, allowing decision-makers to appreciate the sensitivity of UK ecosystems to a range of drivers of change and tailor responses accordingly. Scenario tools are widely used for managing future change in the context of the natural environment (Marchais-Roubelat and Roubelat, 2007). The approach has been used in a variety of ecosystem service related areas, from anticipating risks with regards to food security, to planning a climate change agenda.

A growing number of studies incorporate, or are based on, scenario methods. Examples include the Intergovernmental Panel on Climate Change (IPCC) reports (IPCC, 2007), the Millennium Ecosystem Assessment (Carpenter *et al.*, 2005) and the World Water Vision Exercise (Cosgrove and Rijsberman, 2000). Most climate change scenario analysis under IPCC used quantitative modelling (e.g. Nakicenovic *et al.*, 2000, 2005). However, recent IPCC scenario analyses include quantitative modeling combined with narrative approaches using participation, and more holistic approaches to climate scenario development (Carter *et al.*, 2007).

Stakeholder[2] participation[3] in scenario development has become an important consideration in scenario development (Reed *et al.*, 2013b). Tress and Tress (2003) found that participatory scenario development involving local residents built trust and increased acceptance of planning decisions, whilst enabling planners to produce better plans by integrating the local knowledge elicited Similarly, Reed *et al.* (2013b) showed how engaging stakeholders in the development of scenarios in UK uplands made scenarios more relevant to stakeholder needs and by integrating local and scientific knowledge(s), increased the diversity, detail and precision of scenarios developed.

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[2] We define stakeholders as those who are affected by or can affect a decision or action (after Freeman, 1984)

[3] We define participation as a process where individuals, groups and organisations choose to take an active role in making decisions that affect them (Reed, 2008)

Backcasting and Wind Tunneling

Backcasting begins with the identification of a desired end state and then works backwards to the present in order to determine how that end-state can be best achieved (Dreborf, 1996). There are a number of variants to the backcasting methodology. Robinson *et al.* (2011) view backcasting as explicitly normative and design-oriented with the aim to explore the implications of alternative paths. Future goals and objectives need to be defined, and then used to develop a future scenario. Once the future has been envisioned, the steps to get to this vision are defined, starting at the point nearest to the future and working back to the present time. Backcasting has been used to plan for time periods (up to 10 years) and has been applied to the marketing of innovations (e.g. Boons *et al.*, 2012), and as an-add on to scenario planning (Robinson *et al.*, 2011). Backcasting has been used in environmental analyses, particularly in Canada (e.g. Gleeson *et al.*, 2012). Everard *et al.* (2009) have employed backcasting in relation to ecosystems science in their work on an integrated catchment value systems model. Manning *et al.* (2009) use backcasting to provide a structured framework for achieving large-scale ecosystem restoration, along with milestones and scenario planning.

Wind-tunneling is similar to backcasting in that it involves a similar process of reflective thinking to achieve a desired outcome. The tool differs by involving a form of test as to whether the decision will be particularly effective in the future (see for example Windtunneling, 2011). Although a relatively new concept, van der Steen and van Twist (2012) argue that it is the most relevant for today's policy-makers, which leads to continual scrutiny of decisions.

Visioning

Visioning is a flexible process for identifying future aspirations of a group of people (e.g. organisation, firm, community, interest group) involving the prediction and understanding of long term challenges and imminent problems (Steele and Price, 2009). Visioning processes are often linked in with scenario planning as it helps generate and evaluate alternative future patterns. Visions are usually constructed by several actors in a group, with each adding to the idea and working out how to implement the vision in reality (Kallis *et al.*, 2007). They can be informally constructed, through conversations, or more formally through workshops (Van Der Helm, 2008). In Scott *et al.* (2013) visioning was used in field situations experientially where participants constructed visions of different rural-urban fringes over the course of three visits using reality prompts from the setting. The vision tool then acts as a compelling statement of a desired future that a group or organization wants to create based on shared deep values and purpose (Bezold, 2009).

Visioning has been utilised in a number of environmental cases, including Defra's Food 2030, which aims to addresses the food concerns (Marsden, 2010), and Wilkinson and Mangalagiu (2011) who explored a vision for climate change impact on organisations. Bookman (2000) describes a comprehensive example of visioning applied to the future of coastal areas in the U.S.

Summary

Futures tools have been applied to many subjects and situations in the last 50 years; however, they are still relatively new to environmental issues, with the exception of scenario analysis. The challenges to ecosystems services are characterised by the need for more long-term approaches which are not well suited to our short-term governance systems. However, we face a more risk-laden future, requiring 'anticipatory governance' (Guston 2007), which requires new tools for thinking about and planning for the future. Unfortunately, current tools and practices for ecosystem service planning, such as forecasting, have proven to be less effective than hoped, due to the complexity of ecosystems and the short time frames over which reliable predictions can be made. Whilst tools such as scenarios, visioning, foresight and backcasting show considerable promise, they require greater evaluation as to their effectiveness in policy and decision-making for ecosystem service planning over the long-term.