EAWG4 Discussion paper

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Managing change: the role of scenarios in decision making

Key messages

- A questionnaire, circulated to over 70 stakeholders, on key policy objectives and drivers of change resulted in the collation of a range of diverse, relevant and multi-scale drivers necessary for the future management of Scotland's ecosystems. Greater engagement with sectors, other than the environment and conservation, e.g. planning, energy, business communities, health etc. is required to ensure a full and complementary suite of drivers is captured.
- Scenario planning is a complex process and can take considerable time and resources. Greater effort is required to demonstrate its benefits for decision making through worked examples and case-studies and maximise the uptake of the scenarios concept in decision making.
- An exploration of the drivers impacting on the delivery of broad policy goals in the Land Use Strategy demonstrated the commonality/similarity of many drivers across policy areas. It also demonstrated that many drivers are interlinked and interact with each other, highlighting the interdependencies of different policy areas.
- Workshop participants strongly agreed that a common approach to scenario planning for decision-making would be beneficial, reducing duplication of effort and increasing scientific robustness. The establishment of a scenario working group was considered to be the best approach to take this work forward.
- Any scenario tool-box/driver framework for Scotland needs to consider drivers at different scales and to ensure it is applicable to different management issues and situations.

Background to EAWG4

The workshop reported resulted from two parallel processes. First, a previous workshop, held at the James Hutton Institute in November 2012, (Helliwell & Irvine, 2012) identified a range of current research activities across the Main Research Providers (MRPs[1]) in Scotland that rely on developing and applying scenarios as a mechanism to aid policy making through understanding the consequences of change. Projects were variously addressing challenges in the areas of food security, energy security, climate change, water quality and flooding, and land use change. One of the identified needs from this workshop was to identify a set of drivers for common use in research conducted by MRPs that was supported by policy makers and other end-users. One mechanism to achieve this would be to set up a scenario working group.

[1] The James Hutton Institute, Scotland's Rural College, Royal Botanic Garden Edinburgh, Moredun Research Institute, and the Rowett Institute for Nutrition and Health.

Second, researchers at the University of Edinburgh, Forest Research (FR) and Centre of Ecology and Hydrology (CEH) have been working on developing a common set of drivers for Scottish Government and other stakeholders as part of recent and on-going projects related to development and use of scenarios to explore and plan for future change as part of an Ecosystem Approach to decision making (CLIMSAVE, UK NEA2, EU OPERAS, OPENESS). For example, EU OPERAs project is planning to develop an ecosystem services scenario tool box.

The above two initiatives demonstrated the sense in building collaboration among the research community in Scotland over a common approach to scenario planning. Not only would this minimise duplication of effort but also maximise scientific integrity in the development and application of scenarios. In addition, collaboration between those involved in research using the Ecosystem Approach to decision making (of which scenarios are an important tool) and policy makers, agencies and end-users is essential if, for example, an EA approach to delivering Scotland's Land Use Strategy is to be developed.

In order to progress this collaboration, the EAWG planned and ran a workshop on "Managing change: the role of scenarios in decision making" with the aim of bringing together researchers, policy makers, agencies and other end users to develop a common understanding of the drivers affecting decision making in relation to achieving Land Use Strategy goals.

Introduction

The 4th workshop of the EAWG was held on the 11 March 2013, at Victoria Quay, Edinburgh. The workshop was attended by representatives from Scottish Government, a range of agencies and organisations, and representatives from the main RESAS funded research themes within the Environmental Change and Land, Food and People research programmes 2011-2016 (see Appendix 1 for the list of participants). The main objectives of the workshop were to:

- Explore, using examples, how scenarios can be used to aid decision-making for medium to long-term strategic planning (as part of the Ecosystem Approach)
- Explore and identify the i) key drivers of change, ii) pressures and iii) issues that policy makers (from different sectors) have to consider for strategic planning and to meet policy objectives (based on the broad policy goals in the Land Use Strategy[2] (LUS)).
- Explore and identify the synergies and differences in key drivers across the different policy sectors in how they affect the delivery of the broad LUS policy goals
- Foster collaboration and knowledge exchange between researchers, agencies and policy makers to ensure the scenario research within the Scottish Government's research programme is relevant, joined-up and fit-for-purpose.
- Look at the possibility of setting up a dedicated scenarios working group to take forward the above identified drivers and use them to help define a suite of scenarios at the national, regional and local scale.

The EAWG4 workshop was one of the first steps to developing a scenario planning toolbox that can be adapted to suit different policy areas, stakeholder groups and scales.

In preparation for the workshop, a briefing note was developed explaining the role of scenario planning in the context of an Ecosystem Approach (Appendix 2). This was circulated to invited

[2] We categorised policy goals from the *Scottish Government (2011) Getting the best from our land: A land use strategy for Scotland LUS*. These were: 1) sustainable food production, 2) halting biodiversity loss, 3) low carbon economy, 4) communities better connected to the land and 5) sustainable water management.

participants, together with a short questionnaire for completion and return before the workshop date. The aim of the questionnaire was to capture the diversity of policy areas, policy objectives and targets, and to identify drivers and operational scales that policy makers, agencies and other relevant private and third sector organisations in Scotland are working with. A copy of the questionnaire, which was sent to over 70 invited participants, can be found in Appendix 3.

The agenda (Appendix 1) for the day involved a morning session based around presentations and discussion over the use of scenarios for decision making with a number of case-study examples. All the presentations for the workshop can be found in Appendix 4. The afternoon sessions were designed to capture drivers that affect the LUS policy goals and to establish how these interact with each other.

In the following sections we report on:

1. The results from the questionnaire.
2. Drivers of change in a Scottish context derived from the workshop activities, breakout group notes and plenary discussions.
3. The feedback from the evaluation forms completed at the end of the meeting.
4. Next steps.

The report reflects the expressed views of those attending the workshop and may not represent the full range of views of EAWG members.

1. Exploring the diversity of policy objectives, issues and drivers: Summary of results from questionnaire

A total of 21 completed questionnaires were received from stakeholders representing a number of organisations. The questionnaires returned were dominated by representatives from the environment, farming, forestry, rural issues, and nature conservation policy sectors. Representatives from research, planning, health and food sectors also contributed to this process. Business/industry energy and marine/fishery sectors were absent from the analysis.

A summary of the main policy objectives and associated targets that were identified is provided in Table 1a and 1b. The main policy objectives and associated targets mostly related to the environment and conservation. It is likely that this reflected the organisations represented at the workshop.

Table 1a: Main policy objectives

Halt the loss of biodiversity
Raising awareness of biodiversity/conservation
Increase the proportion of designated sites in favourable or recovering condition
Achieving sustainable development
Reduce GHG emissions in Scotland
Integrated sustainable land use
Woodland expansion
Water Framework Directive –achieve good ecological and chemical status by 2015
Protect and improve the water environment & manage flood risk sustainably
Reduce the incidence of obesity and/or improve the health status of overweight and obese people in Scotland

Table 1b: Associated targets relating to policy objectives

By 2020 people are aware of the values of biodiversity and the steps they can take to conserve it
By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded
Strengthening the Land Use Strategy
An Adaptation Programme for Scotland
Reducing Scotland's greenhouse gas emissions by 80%
97% of water bodies to achieve good ecological status by 2027

Question five of the questionnaire asked respondents to identify drivers under 5 broad themes (Social, Environmental, Technological, Political and Economic). A summary of the drivers, categorised by these themes for all spatial scales (catchment to national) is presented in Table 2. The largest number of drivers was specified in the environmental category with a total of 248 specific responses identified. This again is due to the bias towards representatives from the environment sector and not necessarily an indication that there are more environmental drivers selected *per se*. The fewest responses were in the political and technological driver categories, with 114, and 119 responses identified. Additional and more detailed analyses can be found in Rachel Helliwell's presentation in Appendix 4. The drivers identified by respondents covered a range of spatial scales from international to catchment/local but the Scottish scale was most commonly cited over and above international or regional and local.

Table 2: Number of responses for the driver themes at different spatial scales

Driver Themes	***Inter-national***	***UK***	***Scotland***	***Regional***	***Catchment /local***	***Total***
Social	20	24	39	28	23	134
Technological	23	27	30	22	17	119
Environmental	42	45	59	52	50	248
Economic	32	33	38	26	22	151
Political	22	23	30	20	19	114
Total	139	152	196	148	131	

The themes used in Question 5 have been associated with "megatrends" identified by the EEA (2011)[3]. As part of the process of mapping drivers to themes the University of Edinburgh has identified 31 drivers that fit with these megatrends (e.g. increasingly severe consequences of climate change; disease burdens and the risk of new pandemics). We took the responses from the questionnaire and mapped these onto each megatrend together with the 31 drivers identified above and listed those that did not fit well in a separate row. Appendix 5 provides tables of all the responses mapped under each of the main themes and megatrends. It is clear from the responses that the term driver means different things to different people (which highlights the need to be very

[3] EEA (2011) The European Environment – state and outlook 2010: assessment of global megatrends. EEA, Copenhagen

clear on definitions) and as such some of the responses are clearly not drivers but are responses or outcomes (either desired or undesired) which may in turn also act as drivers of change. By responses we mean that they are based on society's responses in the form of what actions are taken as the result of a policy (or actions that society is currently doing that need to change if sustainable decisions are to be made). Another way to classify the drivers could be to organise them into direct[4] drivers of ecosystem change (e.g. changes of land use cover, overuse of fertilisers, climate change) and indirect drivers which alter the level or rate of a direct driver (governance, economic). From the list of drivers in Appendix 5 it can be seen that the majority of drivers listed by respondents are indirect drivers of ecosystem change. The drivers classified as outcomes included responses such as 'affordable healthy food' and 'sustainable diet'. These appear to be more related to a desirable outcome (or an undesirable outcome if policies for sustainable decision making are not implemented). Further engagement with stakeholders on scenario building and planning will have to clearly define drivers in terms of ecosystem change and subsequent changes in ecosystem services. Concepts such as direct and indirect drivers may be useful as well as distinguishing between drivers and the outcomes and responses that result from drivers or the lack thereof.

However the drivers are classified, the range of drivers and how they interact and influence ecosystem change is very complex. For example, when does a response in one policy sector become a driver in another, and vice versa? And can these, in fact, be easily defined? When do outcomes such as obesity and mental health, become a policy (response) driver towards improved green spaces in cities? How do we systematically organise and analyse the different drivers (direct and indirect) to explore different trajectories or scenarios into the future? And how do we try to ensure our decision-making in one policy sector doesn't have unforeseen consequences in other sectors? These issues need to be addressed as simply as possible if this approach is to be useful. This can be helped by being explicit and working through the practicalities of the causal chain in a storyline that leads to the scenario in question.

It is clear that there are a considerable number of drivers proposed by our respondents that did not map onto the megatrends[5] or the 31 previously collated drivers by the University of Edinburgh (see the yellow cells in each of the tables in Appendix 5). This was true for all the broad driver themes and these additional "drivers" need to be assessed, included and used in scenario planning as appropriate. For example under the political theme there were a number of drivers that could be grouped together: 'political processes and attitudes' or 'community decision-making/empowerment' and these did not map well onto the existing EEA drivers. Similarly, under the technological theme, 'agricultural technologies' and 'renewable energy technologies' were identified by respondents as key drivers in Scotland, but didn't map onto the previously collated EEA technological drivers. 'Attitudes and preferences' such as public disconnection with nature and social attitudes, also didn't map onto the existing EEA drivers in the social theme. For the environmental theme increases in pests, diseases and invasive species and increased flooding were missing as key EEA drivers. The drivers that did map onto the previously collated drivers and tended to be more specific, detailed and relevant to Scotland. Another consideration to take into account when taking forward future scenario work. In summary, the list of drivers the respondents have produced are very useful and

[4] Direct drivers are physical changes in an ecosystem that can be measured and monitored

[5] EEA, 2011. The European Environment - state and outlook 2010: assessment of global megatrends. European Environment Agency, Copenhagen.

underline the merit of the workshop. These drivers can usefully be incorporated into a suite of storylines that are tailored towards the policy environment relevant to Scotland building on the megatrends identified by the EEA study.

2. Exploring drivers of change

Drivers in different policy areas

An Ecosystem Approach to decision-making requires that decisions, (i.e. new policies, revisions, incentives, action plans) take into consideration possible future changes. It is, therefore, important to first explore future drivers of change; their trends, uncertainties, interactions and assumptions. These main drivers, in relation to a particular issue or decision, can then be used to develop a set of storylines that describe the effect of these drivers on decisions over land use and how the drivers interact and unfold in different ways. These storylines or scenarios can then be used to explore the consequences for ecosystem service delivery and the trade-offs that occur between ecosystem services. An important addition to this process is to include possible future drivers that do not neatly fit into our current thinking. These so called 'shock' or 'wildcard' drivers have been used effectively in some scenario studies and history is replete with examples of 'high impact, low probability' events that can change landscapes and ES very quickly in unpredictable ways(e.g., myxomatosis).

To explore the different drivers of change operating in different policy areas the workshop participants were split up into five groups, each representing five broad policy areas in Scotland's Land Use Strategy[6]; 1) *sustainable food production*, 2) *halting biodiversity loss*, 3) *low carbon economy*, 4) *communities better connected to the land* and 5) *sustainable water management*. With the help of a facilitator each group was asked to discuss the broad policy objective, how it relates to other policy objectives/strategies in Scotland and what the issues are pertaining to achieving the broad objective. Following the initial discussion, each group was asked to propose and discuss all the direct and indirect drivers[7] acting on ecosystem change and relevant to achieving the overall broad policy goal. After the initial brain-storming and discussion each group was then asked to select the five most relevant drivers; categorising them according to driver type (economic, social, technological, political and environmental) making notes on trends, levels of uncertainty and operational scales. The five most relevant drivers for each policy with information of trends, levels of uncertainty and scales are presented in Appendix 6.

Within each broad policy area each group identified a range of issues and problems relating to delivery of the main objective. Issues ranged from climate change, community empowerment, cross-sectorial conflicts, to pollutants and planning. Whilst each broad policy area had specific issues to address, these issues often related to other policy areas or sectors. Example of these relationships included the impact of increased demand for renewable energy (micro-hydro and biofuels) on wetland habitats and water quality.

One of the most noticeable findings is the differences in levels of uncertainty associated with different drivers, within and between policy groups. For example, the majority of drivers identified by the sustainable water management group had a low level of uncertainty (demographics, supply

[6] Scottish Government (2011) Getting the best from our land: A land use strategy for Scotland

[7] Direct drivers are those where physical changes can be identified and monitored (e.g. land cover) and indirect drivers operate by altering the level or rate of change of one or more direct drivers (e.g. demographics)

and demand of water resources, flood risk, renewable energy) whereas, the level of uncertainty associated with the drivers for sustainable food production was generally high, a possible reflection of the fact the some policy areas are more susceptible to global trends (indirect trends) e.g. global demand and trade agreements, than more localised (catchment level) trends. There is a tendency for the drivers that operate at an international level to be difficult to regulate and have a high level of uncertainty associated with them.

In addition, as one participant noted, the objectives for water management are more clearly defined than those say for halting biodiversity loss. Similarly, the impacts of floods on people's lives are much more visible with direct personal impact than biodiversity loss.

In some cases, there wasn't a group consensus on a projected trend or trajectory for a particular driver. The complexity of interactions between society, different types of ecosystems/land uses and scales could be an explanation for this lack of agreement. This highlights the importance of defining the most appropriate scale for the issue or decision-making process as well as the importance of including a diversity of stakeholders in scenario development. Perhaps not surprisingly, these are some of the principles set out in the CBD Ecosystem Approach.

Identifying common and specific drivers and their interactions

The five groups were then asked to identify the common drivers (identified with yellow sticker) between the different broad policy areas as well as any that are perceived to be similar but , for example, operating at a different scale (identified with green sticker). In addition, the groups were asked to identify and record any interactions between the different drivers.

The results tables for each of the broad policy groups can be found in Appendix 7. The most obvious result is the level of common and similar drivers identified independently by the five policy groups. This is exemplified by the number of yellow and green stickers across all tables.
The *common drivers* (yellow stickers) identified by the groups were;

i) planning and governance, ,
ii) individual will/ability to implement sustainable management, and behaviour change (reduce fuel use/domestic efficiency), and societies perception of sustainability,
iii) renewable energy (tidal, wind, hydro, wave) , and
iv) demographics, and changing demographics/spatial (urbanisation or development on urban fringe commuting).

The range of *similar drivers* identified by the five groups included:

i) policy synergies and governance,
ii) technological development, and infrastructure (e.g. ICT, roads, technology),
iii) water resource supply and demand, and flood risk management,
iv) individual will/ability to implement sustainable management, behaviour change (reduce fuel use/domestic efficiency), and societies perception of sustainability.

There were differences between how the groups categorised the *common* and *similar* drivers. For example, some groups considered individual will/ability to implement sustainable management, behaviour change (reduce fuel use/domestic efficiency) and societies perception of sustainability as common drivers, whilst others categorised them as similar drivers. In addition, some groups

identified similar drivers, which also could be also considered to be interlinked or interacting drivers. These included drivers such as changing global and national demand, food security, global markets, and demographics. Another example would be relative availability of resources (compared to other countries), food security- global markets, squeezed middle (complex), and water resource, supply and demand.

All the five groups identified drivers which were either interlinked or interacted in some way. In fact, two groups, the *sustainable food production* and *halting biodiversity loss* independently noted that most of the drivers were interlinked one way or another. They went so far as categorising the level of linkages as high, medium and low or primary, secondary and tertiary. The *low carbon economy* group highlighted a number of interacting drivers and how their interaction could have an effect on green-house gas emissions. For example, demographics would influence the land use of an area which in turn would affect the green-house gas emissions. The *communities better connected with the land* group identified a link between land reform, community empowerment, planning/governance and renewable energy. A range of driver interactions were identified by most of the groups. Due to the high degree of interaction and inter-linkages between drivers it can be seen how decisions in one sector of policy can impact on and influence change (in ecosystem service delivery) in other sectors. This highlights the importance of conducting a review of drivers, their interactions and inter-linkages, to understand and influence mechanisms by which ecosystems, and hence ecosystems services, change and could change in the future.

The relatively simple exercises in Activity 1 and Activity 2 suggest that, due to the high level of commonality and high levels of interlinked and interacting drivers a common approach to developing scenarios for future proofing decisions in Scotland could benefit a range of sectors. This is explored further in the discussion section below.

The way forward and general discussion

This section is based on a general discussion following the Next Steps presentation by Marc Metzger (Appendix 4) and feedback from the workshop evaluation form. In his presentation Marc proposed the establishment of a scenarios working group, where the work started in EAWG4 could be taken forward to establish a standard/common list of drivers for Scotland, develop a set of guidelines for scenario planning and identify robust management alternatives (scenario response tables) so that we can develop agreement on what management actions and decisions would need to be made if a particular scenario is to be achieved (or avoided).

A common approach?

There was general agreement that there was significant commonality in the drivers across the different sectors and that a common framework or approach would be useful. This was strongly supported by the comments in the evaluation form with one participant noting that it would improve consistency and credibility in decision making. Another participant would support a common approach as long as it was applicable to different issues and situations. However, there was recognition that this would be a "*complex task and that heed needed to be taken to ensure it didn't become too complicated or onerous*". As one participant commented "*very important to stay big picture and not get hung up on the detail*". Some of the difficulties dealing with this complexity related to scale issues and the definitions of drivers at different operational scales. For example, water supply and demand seems particularly relevant at catchment scale but also has implications

for food production which has a more global emphasis. One participant questioned the need to have drivers at different scales as drivers at a broad scale would encompass everything below. Also, if drivers were distilled down too much they could become too narrow and case-specific. One suggestion was to have a common approach at a higher level, with lower levels being spatially and temporally specific. Another suggested approach would be to develop a tiered approach or framework. One participant felt that more discussion was needed on how to deal with scale issues for drivers e.g. is there a need for '*nesting drivers*'.

A number of policy areas and stakeholder groups were seen as missing from the workshop that would be important to include in future workshops. The policy areas/sectors missing included health, transport, education, private business, marine, renewable energy and atmospheric sciences. More involvement from stakeholders not dealing specifically with environmental issues would be beneficial. Suggestions for other stakeholder groups to be invited to future workshops included agricultural estates, the National Farming Union, Marine Scotland, strategic and local planning authorities and people working on CAP reform. One participant suggested that more stakeholders and fewer researchers should be present at future meetings.

The majority of participants agreed that the way forward would be to develop a common approach, however, to get further engagement from policy makers and practitioners it would be important to have best practise case-studies from different sectors or worked examples. This would demonstrate the importance of scenario building in decision-making, build a better understanding of its benefits to policy and get more buy-in. A possible practical example would be to use scenario planning to assess the implications of achieving different targets, and the implications of action or intervention on reaching a target. Another participant felt that scenario planning would be most useful when applied to specific policy questions and that guidelines on how to do it would be very useful to policy makers.

Next steps

1. Set up and run a Scenario Working Group (SWG) drawing on researchers, policy makers and practitioners. How are we going to take the scenario group forward? The SWG will get together after the summer to plan activities aimed at developing a scenario toolbox for Scotland. A follow-up stakeholder meeting will be organised in due course (Spring 2014) to test initial version of the tool box.
2. What are we going to do with the data we have acquired? A) Develop and modify the EEA driver table to include drivers currently not in there. B) Analyse the responses from the questionnaire using the direct/indirect framework and consider the categorisation of driver, response and outcome and how this might vary depending on scale.
3. How do you plan to use the drivers collated for scenario work? Develop scenarios/storylines at national and case study (local) level. The latter will involve place-specific scenarios and response options leading to a range of land-use configurations resulting from co-constructed scenarios which can be modelled and evaluated complying with more of the EA principles relating to scale and stakeholder engagement. This will be carried out in collaboration with the Regional Land Use Pilot in Aberdeenshire. The former may well be modified version of NEA storylines and will be more of an Ecosystem Services Assessment.

4. There has been a specific demand for a scenarios workshop dedicated to renewable energy. This is the next activity to be organised by James Hutton Institute with the Scottish Government and other relevant stakeholders