Key environmental issues facing Scotland; final report			
LIFE ACTION 9: Develop a method to prioritise environmental problems across media			
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1 Background

The Scotland's Environment Web (SEWeb) partnership is working to improve public understanding and engagement with the environment. As part of this work, we delivered simplified assessments of the state of the environment. This report outlines the process followed, the method used, the outputs and a critique of the method.

2 Objective - why are we assessing the state of environment?

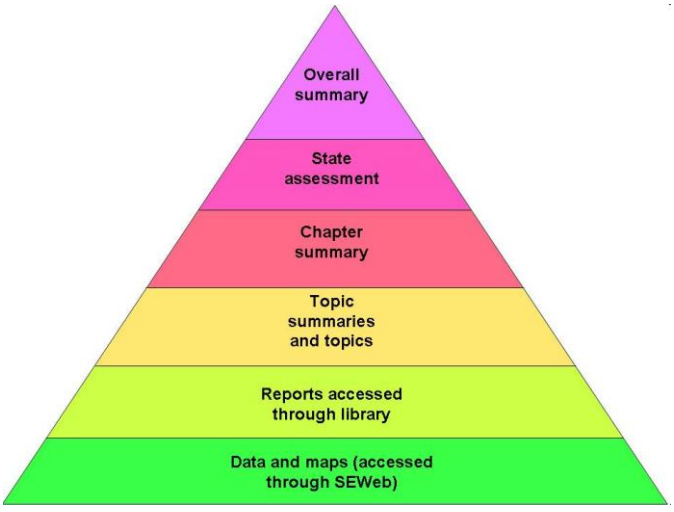
We aimed to identify the key issues facing Scotland's environment, in order to provide a clear summary of the state of the environment to inform and educate the public

2.1 How does this fit into the state of the environment report?

The state of the environment (SoE) report on SEWeb aims to provide clear information on the state of the environment. The "Get Informed" section holds the SoE text and is divided into chapters (e.g. land), which are further divided into topics (e.g. soil). Each topic and each chapter has a summary and these are brought together to provide an overall summary of the state of environment.

The ethos of the SoE report is to allow readers to drill down through varying degrees of detail to obtain the level of information they require, ranging from the broad summary, down to individual data sets. This model is illustrated in Figure 1.

Figure 1. Conceptual model of SoE report and SEWeb interaction



The assessments of state are designed to be the starting point for the public to explore the SoE report and give users (many of whom have little knowledge of the environment), a quick summary of each aspect of the environment. The accompanying narrative sets-out the context and caveats of the assessment.

A similar approach was taken in the development of the original "spectrum" diagrams for SEWeb in 2011.

Ipsos-MORI reviewed the 2011 SoE text and spectrum diagrams using independent focus groups and reported that "*Some participants were very positive about* [the spectrum diagrams]*, describing them as "easy to understand", "clever" and "concise". Some participants felt the diagrams explained "in a nutshell" how each aspect of the environment had changed over time. In contrast, other participants described the diagrams as "boring", "confusing" and "difficult to interpret"".*

Furthermore, "*Participants had a great deal of trust in the summary diagrams*".

From this work, we concluded that the summary diagrams do aid public understanding of the state of the environment, but that further work was required to simplify the visualisation of the assessments, and give more transparency on how the assessments were made.

3 Developing and selecting an assessment method

Initial option development was carried out in SEPA, then reviewed by the editorial group. The initial options were based on previous work (developed as part of Scottish Government's CAMERAS initiative, and used to review Scotland's monitoring effort).

These used a complex matrix, by which various combinations of pressure and drivers were assessed and scored, based on factors such as geographic extent, reversibility, severity and whether there was a "tipping point". Although the editorial group were happy to support using this process, they made useful comments on the likely issues with such a detailed process, and recommended simplifying the assessment method.

4 Method and process used

4.1 Process used

Assessing and prioritising the key environmental issues is by definition complex and difficult. As the SoE report covers a wide range of topics, developing a strictly objective method which allows comparison between them was difficult. Consequently, the editorial group opted to use a more subjective method, drawing on the expertise held by Scottish scientists and policy makers. These specialists carried out assessments, following strict criteria which attempted to minimise subjectivity and maximise comparability.

Assessments were carried out for the majority of the topics in the SoE report. A small number of topics were excluded (because it was deemed inappropriate to assess them, due to no shared opinion of what a "good state" would be), or because there were other sources of information for the public to consult (the Marine Atlas was felt to be a good source for marine waters, and there were concerns that providing an assessment based on a different method may be confusing).

Groups of specialists for each topic were identified by the topic authors and the editorial group, with further nominations requested from Scottish Environment Link. A spread of expertise was sought, although group membership was biased towards members of the organisations active in the SEWeb initiative.

An average of six specialists per topic was identified, drawn from across non-governmental organisations, SEWeb partners, academics and Main Research Providers. The list of participants can be seen in annex 1.

These specialists were asked to complete the assessment exercise online individually. The outputs for each topic were collated and sent to all the members of that group.

A teleconference between the specialists was then held, during which a consensus view on the drivers and pressures, state and trend of that topic was established.

The separation of the process (an individual element, followed by a meeting to achieve consensus) was deliberate; allowing specialists the space to consider their responses individually helps to avoid "group think" and confirmation bias. This approach is more effective at gathering the true range of views than developing a shared view in a group.

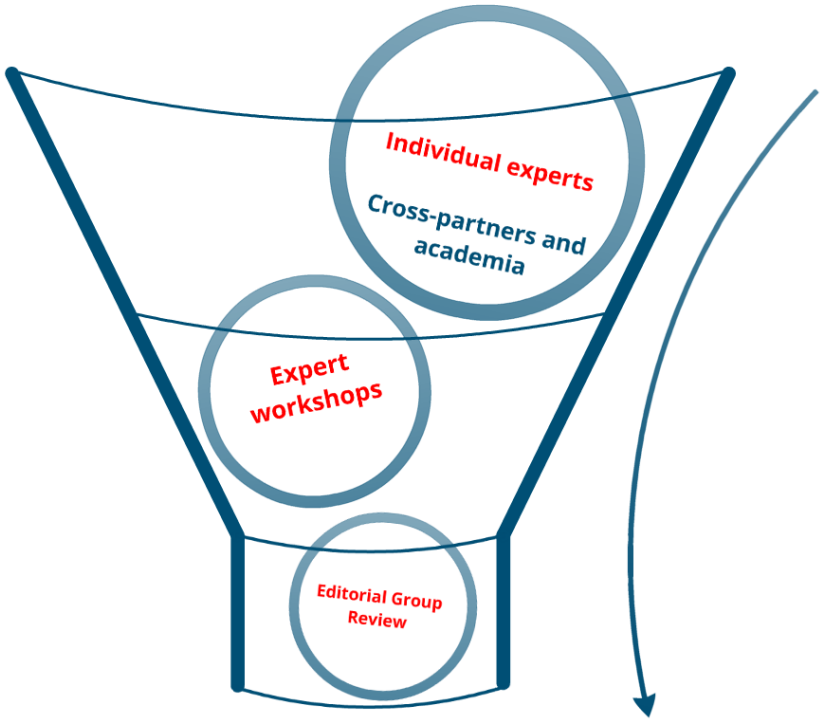
A summary of the output, a note of the discussion and of the participants was sent to all the specialists identified. A small number of the specialists only took part in one aspect of the assessment (either the individual scoring, or the group discussion), and these are flagged in the individual topic summaries.

Every expert was asked to confirm that they were willing to have their name and organisation listed as participating in the process.

Once the expert groups had signed-off the output, the topic assessments were brought together and reviewed by the Editorial Group. For two topics, the editorial group arbitrated between different points of view within the group and recommended a final position. The specialist groups for these topics accepted the arbitrated result.

The process for assessing the state of environment is illustrated in Figure 2.

Figure 2. Process for producing assessments



4.2 Assessment method

There were five components to the work:

1) An expert judgment of the current state of the environment
2) An expert judgment of the trend in state
3) A brief narrative, expanding on the above conclusions
4) The list of primary and secondary pressure(s) which resulted in the current state
5) A list of the datasets which contributed to the conclusions above

The state and trend assessments are embedded in the SoE report (for example, a number of topics in the "water" chapter), and the "indicators and data" pages have started to publish the data sets drawn on. As discussed in section 6.0, the primary and secondary pressures haven't been published separately, but are included in individual topics.

4.2.1 An expert judgment of the current state of the environment

The greatest challenge in making the assessments was coming to an agreed view of what the "desired" state of the environment was. Without clarity of the endpoint, having meaningful discussion on the current state is impossible.

Due to the wide variation in topics (from "health and wellbeing" to "river and loch wildlife") , the appropriate end point differed.

For the more traditional topics, (such as soil and water) the endpoint was that "they must be able to fulfil all their expected functions", i.e. to be in an excellent state, they must provide all the benefits expected of a pristine environment. A topic would be assessed as in a poor state when it was degraded to such an extent that it was not able to carry out its functions or provide the benefits expected.

For other topics (e.g. fossil fuels and minerals), a working definition from the Brundtland Commission was adopted, "development which meets the needs of current generations without compromising the ability of

future generations to meet their own needs". To be in excellent condition, there should be little damage to the natural capital, or to its sustainability.

Figure 3. Categories for state assessment

Alongside the state assessment we wished to indicate the uncertainties accompanying the assessment. The method used by the Intergovernmental panel on climate change was adopted, based on elicitation of expert views.

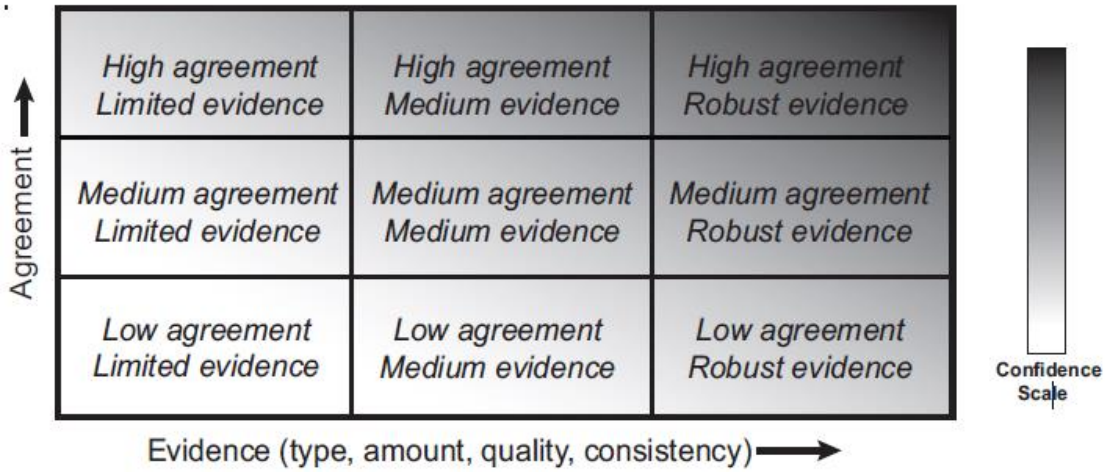


Figure. 4 A depiction of evidence and agreement statements and their relationship to confidence.

For each assessment, the specialist groups were asked to characterise the amount of evidence supporting the assessment (high, medium or low) and the level of agreement within the group. This gives a greater degree of flexibility in assessing uncertainty, and allows us to make clearer statements to the public.

4.2.2 Trend

As well as assessing the state of a topic, an assessment of how that state is likely to change in future was required. It was recognised that future trends were difficult to predict, and that the uncertainties in the assessments would be greater.

Figure 5. Categories for trend assessment

There was only one topic where specialists felt able to make an assessment of state, but not of the trend.

We asked each specialist group assess the trend over the timescale they thought appropriate. As a guide, we suggested that the predicted trend be assessed over the time period during which current human activities were likely to have a strong impact.

The uncertainty around the trend assessments was expressed in the same way as for the state assessments.

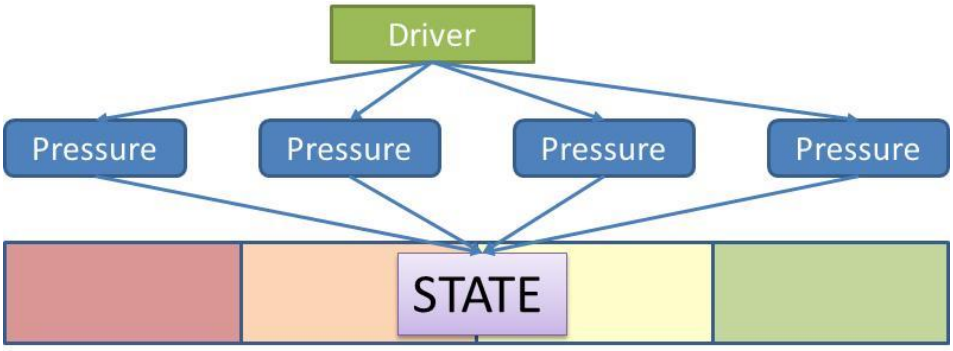
4.2.3 Narrative

In order to produce a clear output, which was comparable across topics, the lists of drivers and pressures were constrained. The space for a narrative allowed more nuanced assessments to be recorded, or caveats on the assessment to be elaborated on.

4.2.4 Assessing pressures and drivers

The conceptual model for assessing the key environmental issues is illustrated in Figure 6. Specialists were asked to assess a combination of drivers and pressures (selected by the editorial group).

Figure 6. Conceptual model for assessing the key environmental issues



Drivers are the overarching factors which result in a series of pressures on the environment which can themselves lead to a change of state of the environment.

List of drivers and the resulting pressures are shown in tables one and two.

Table 1. Drivers used in assessment

Drivers
Agriculture/horticulture/silviculture
Energy production
Aquaculture & fisheries
Urbanisation/development
Other industry
Transport

Table 2. Pressures used in assessment

Pressures
Chemicals
Input of nutrients
Input of chemical contaminants
Hydrological
Abstractions & Water regulation
Flooding
Physical
Building - e.g. sealing, flood defence, weirs, barrages etc.
Altering - e.g. compaction, erosion, fragmentation of habitat
Input of particles (inc. sediment)
Input of light & temperature
Input of odour, noise and vibration
Litter
Biological
Exploitation (e.g. fishing)
Invasive non-native species
Disease and parasitism (inc. microbiological pathogens)

Any grouping of drivers and pressures is an attempt to simplify and compartmentalise complex systems and is consequently imperfect; there is a brief discussion of this in the critique section.

For each combination of drive and pressure, specialists were asked to assess whether that combination was a primary or secondary pressure.

Primary pressures were those which, on their own, were judged to comprise a major impact on the state of the topic. Secondary pressures may have been collectively significant, but, individually, would not "cause" the current state.

For example, for rivers the specialists may conclude that the input of nutrients arising from agricultural activities is a primary cause of the current state of the environment, whereas input of chemical contaminants from other industry is a secondary cause.

4.2.5 List of datasets

The assessments were based on expert judgment, with this judgment informed by underlying data sources and evidence. Although there may was not a direct mathematical relationship, these data sets provided a hinterland against which judgments of state were made.

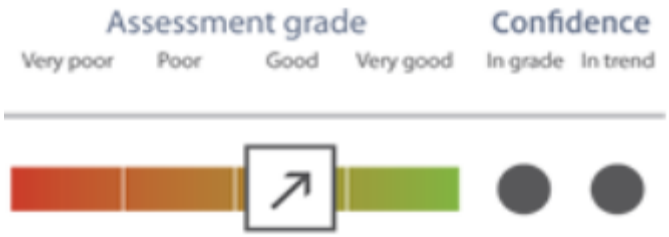
The specialists were provided with a list of data sets for the topic and asked to check it, add additional data sets of which they took account, and remove those which were irrelevant.

Some of the key data sets from this list have been identified through the "indicators and data" pages on SEWeb, although this process has not yet been completed.

5 Presentation of SoE assessment and key issues

The method for displaying the SoE assessments was based on the pictogram used by the Australian SoE report (Figure 7).

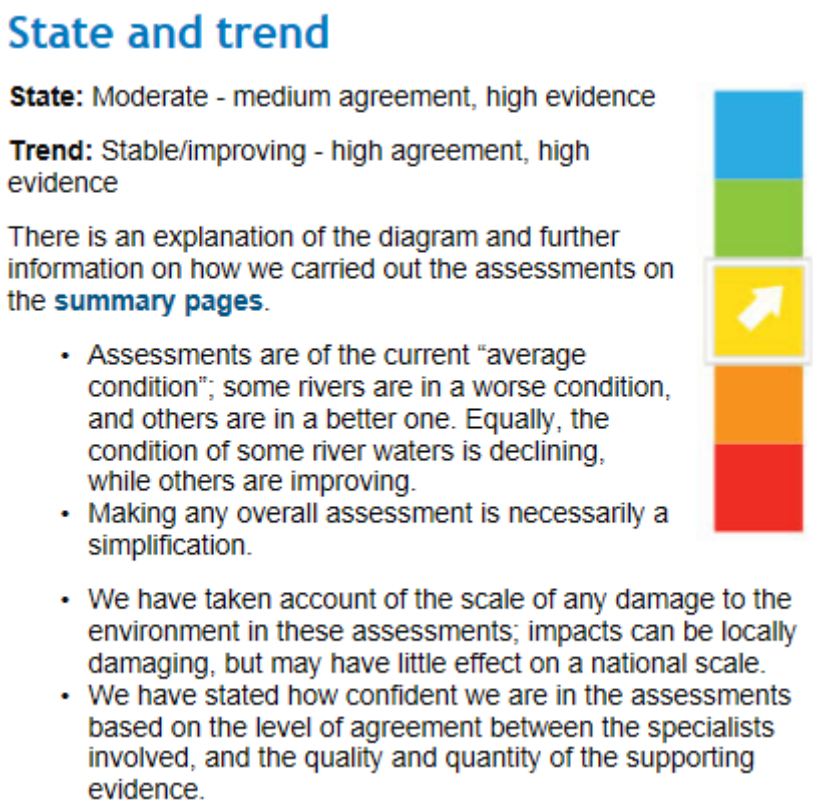
Figure 7. Australian State of the Environment report pictogram



The editorial group considered using "spectrum" diagrams, as in the 2011 report (in these, the assessments were placed on a spectrum, rather than into discrete definition of good etc.). The original intention was to indicate a level of uncertainty, and try to signify that there was a spectrum of condition from bad to excellent. However, on reflection it was felt that this actually indicated a greater degree of certainty, and suggested that the specialists were able to define the state and trend much more accurately than was the case.

An example of the finished output is shown below.

Figure. 8 Assessment for example topic



The assessments were published as part of the SoE report, which was released on the 5th of June, 2014.

6 Critique

The assessment of key environmental issues formed an integral part of the SoE report, and provide clear and concise information to the public and policy makers on the condition and trend of the environment.

There was a good level of buy-in from relevant specialist groups, and a high degree of praise for the process, *"you chaired the meeting very well"* (Health Protection Scotland), *"I found the process interesting and enjoyable"* (University of Aberdeen), *"the group discussion was challenging, but I think the final output reflects our views well*" (Scottish Environment Protection Agency).

The main weakness of any expert-led process lies in ensuring the specialist groups reflect accurately the opinions of the wider scientific/policy community. Although significant effort was made to encourage participation from across the science community, there were gaps both in knowledge and in perspective. A particular shortcoming was our lack of success in getting participants from the non-governmental sector. Despite considerable effort and encouragement, it was difficult to get sufficient time from leads in this sector, and only a small number of NGOs were represented on the final groups.

There was also a gap in the coverage of topics – twenty-one topics were assessed, with eight not assessed. We believe that an assessment method could have been developed which was appropriate for six of the eight topics, but there was insufficient time to agree a method.

An objective of the process was to develop a list of primary and secondary pressures, and use this to inform and structure the SoE report. Due to the sequencing of the work this wasn't possible, and the pressure list was not directly used to structure each section (although the output from the process was used by authors to write the topics, we did not enforce a common structure). This was a missed opportunity, and will be considered in future iterations of the SoE report.

The list of pressures and drivers provided to the specialists were biased by the backgrounds of the editorial group members; although every effort was made to ensure they were balanced, in hindsight the list still contains some biases. The assessment process did clarify what constituted a primary and secondary pressure, but different specialist groups still took sufficient different approaches to make combining the overall list of pressures difficult. A tighter definition and more rigorous stance in the meetings would make the final output more useful.

As a result, the combined lists of pressures and drivers haven't been published on SEWeb, due to the variation ion approach. They are available for use by partners, and SEPA is currently (July, 2015) using the pressure list to help shape SEPA's corporate priorities.

The outputs of the process have been shared with the editorial group of the European Environment Agency's SoE report, and they were impressed by the process we have followed, and are particularly keen to discuss how we incorporated "uncertainty" in our assessments. We will be following up this discussion for the next phase of the SoE report.

Annex 1; Specialist participants

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Sally Thomas
Scottish Government
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Royal Commission on the Ancient and Historical Monuments of Scotland
Mark Williams
Scottish Water