

Air Pollution and Ecosystem Change Symposium

Summary of Workshop “Understanding the impacts of air pollution on the SSSI series”

Introduction

The Air Pollution and Ecosystem Change Symposium was held on 28/29 October 2003. The objectives were to:

1. Raise awareness amongst conservation agency staff of air pollution issues and their relevance to nature conservation and site protection
2. To consider how to better understand the impacts of air pollution on the condition of statutory sites and what role the conservation agencies play.

Detailed discussions of the second objective were carried out in four working groups. Discussions in the groups were structured around a common set of questions, which considered the establishment of a network to monitor air pollution impacts on the SSSI series. Recommendations and conclusions were then agreed in a plenary discussion. A summary of the discussion from the groups and plenary session is given below.

Results

1) Is there a need to monitor air pollution impacts on SSSIs?

There was common agreement that there is a need to monitor air pollution impacts on biological SSSIs.

There are a number of drivers for this, which were outlined in more detail in the presentations. These include obligations under the Habitats Directive, informing management and regulation, providing a ground-truthing for modelling approaches and informing policy development.

2) Should the conservation agencies have a lead role to play in monitoring them?

There was common agreement that the conservation agencies should, at the very least, have a prominent role to play in monitoring air pollution impacts. Most agreed this should be a lead role, but in partnership with a number of other organisations. The actual monitoring would not necessarily be carried out by the conservation agencies. However, the resource implications were highlighted by all groups.

3) Should we initially focus our efforts on the impacts of nitrogen pollution (reduced and oxidised forms) or, if not, what others should we include?

Nitrogen should be one of the main focuses given its prominence in the current pollution climate. However, for efficiency and maximum benefit, multiple drivers of ecosystem change would need to be considered at the same time. Climate change, ozone, heavy metals and radioactivity were cited as examples. It was also agreed that sulphur remained an issue in some areas, particularly with the increasing emissions from shipping. Nitrogen deposition contributes to acidification as well as nutrient enrichment and separating the effects may be difficult, especially in areas where historical deposition will already have influenced the community composition at a site.

Network structure

4) Given that there are over 6000 SSSIs (and >600 SACs) in the UK, is it feasible to monitor the impacts of the pollutants agreed in question 3 at every site or should we focus on a subset of sites?

It is not feasible to monitor air pollution impacts on all sites so, pragmatically, the whole series needs to be considered on the basis of a subset.

About 1% of SSSIs, or less than 5%, were cited as examples of how many sites may be feasible and provide reasonable representation of the whole series. It was proposed that a combination of sites reflecting different pollution climates and habitats would be needed. Sites not sensitive, such as geological sites or some designated for birds, could be excluded.

5) What can existing air pollution monitoring (deposition and concentrations) networks or other ecological/environmental change survey/monitoring programmes provide? Is there potential to use these when assessing the impacts of air pollution on the SSSI series?

It was agreed that a synthesis of existing networks/monitoring programmes was needed, an analysis of their contribution to the objectives and to recommend how these could be used more effectively and/or used a part of a wider network of sites.

A number of the sites used in existing network/monitoring programmes are situated on, or close to, SSSIs.

6) Should we ensure that we include sites that participate in some of these other networks such as the Environmental Change Network?

Where appropriate, it was agreed that existing networks, such as the ECN network, should be included. However, not all are situated on sites vulnerable to change through air pollution. Therefore, as above, further analysis is needed to clarify what existing networks can be used and what additional network monitoring is required.

7) If we are going to focus on a subset of sites, how do we decide on the number of sites and where they should be? Should we focus on SACs or NNRs, for example?

A scoping project is needed to recommend how many sites are required and how sites would be stratified. The location of sites (which would reflect a range of pollution climates), which habitats should be covered (focus on sensitive habitats). There need to be sufficient sites to ensure the different drivers can be related.

The local knowledge, more intensive monitoring, historical data, and access, mean that it is sensible to use NNRs. There is also added value from using sites designated as Special Areas of Conservation, due to the obligations for reporting and provision of advice. However, this may be constrained by where existing concentration/deposition monitoring is situated.

In the case of lichens, and other species, the NNR or SAC network might not represent the best sites for these species.

8) How should we stratify the sites? Should we primarily select sites where critical loads are exceeded or should we sample across the whole range of pollution levels?

Site selection is extremely important. It was recommended that a statistician should be consulted. Most groups agreed that some degree of stratified random sampling was necessary. Sites should be chosen to reflect high and low deposition, with the inclusion of 'clean' sites as controls. Inclusion of sites which are impacted by local sources may be helpful. It is recognised that many sites will already have experienced decline/change as a result of historical deposition/concentrations. Inclusion of sites close to critical load exceedance will provide evidence of decline, or stability, over the monitoring period, whereas historically impacted sites may show further decline or recovery. The relative contribution of reduced and oxidised, wet and dry deposition to total nitrogen deposition varies across the country and may affect ecosystem response, though this is not well understood.

Having selected sites on the basis of a range of pollution climates and critical load exceedance, other criteria could then be applied.

9) Should we pilot the network on one or a few habitats of special concern? Which should these be?

The network could be piloted on a few habitats. It was proposed that this could perhaps focus only on very sensitive habitats or compare these with habitats thought to be more robust. Alternatively, it was suggested that a comparison could be made of habitats for which we understand relatively well the potential impacts of nitrogen (i.e. heathland) compared to those less well understood (i.e. sand dunes).

However, there was no overall consensus that piloting the network was necessary. One group considered that there would be no benefit from a pilot.

Methods for assessing pollution impacts

10) Can we use bio-monitoring, physical, chemical or biogeochemical measures, which may not be specific to the designated features, to indicate impacts on designated species/habitats?

It was agreed that there was potential to use bio-monitoring. Bio-monitors could be tested across a range of critical load exceedance and the 'effect' could then be attributed to either pollution loads or other forms of management. There are many different methods available to serve as measures of nitrogen enrichment, and these are currently under review in a project funded by the conservation agencies. Some sensitive species, such as some lichens, whilst not always the designated feature, will give an early indication of change. In this way they act as surrogate. However, some individuals were more cautious about this approach and stressed that there needed to be a robust link between the bio-monitor (or other measure) and the interest feature.

One group advised concentrating on the health and abundance of keystone species, monitoring of sensitive species, i.e. lichen, and monitoring of the interest feature itself. Assessment of shifts in Ellenberg scores for nitrogen, pH, moisture and light, and soil chemistry would all be helpful.

For some habitats ('wet' habitats) proving that atmospheric deposition *per se* is having a specific impact is critical. This will require monitoring of other sources in order to partition the

enrichment signal between atmospheric deposition and, e.g. diffuse enrichment from terrestrial sources.

11) Are suitable bio-monitoring, biogeochemical or physical methods available?

Bio-monitoring or use of bio-indicators was generally favoured although it was recognised that more research is needed. There are a number of promising methods which are currently being tested in a project funded by the conservation agencies. However, there is uncertainty in all the methods and potential for inappropriate application or misinterpretation by non-experts. There is also a lack of expertise in lower plant identification which could limit the use of some bio-indicators such as lichens.

The conservation agencies will need to consider, in the future, the possible inclusion of techniques currently under development, for example, a number of molecular and microbiological biomarkers, and should include a review process to ensure the best methods are employed.

On sites influenced by a multiple of drivers it will still be particularly difficult to understand the role of nitrogen.

12) Are such monitoring methods necessary, over and above existing critical loads approaches or other modelling approaches? Could the use of such methods provide a validation to the critical loads/modelling approaches?

There was consensus that such monitoring is necessary over and above existing critical loads approaches or other modelling approaches. However, this would not negate the need for critical loads or other models, which have other objectives and also can be applied widely.

The majority consider that validation will be difficult but is very necessary. There must be an analytical programme built into the design and the links made with wider surveys/monitoring. There will be limits to the validation and many aspects of critical loads and modelling will not be assessed.

However, one group suggested that this would not be a validation exercise but instead would be supplementary.

13) If significant pollution impacts are detected how will these be integrated into monitoring and reporting of the site features?

It is essential that the results from the network feed into monitoring and reporting of habitat condition. Data collection needs to be designed to take into account the need to report at a site level as well as network level. Formal analysis is an essential part of the exercise and these costs need to be incorporated right at the start. There needs to be a process in place to feedback to regulators and government. Countrywide statistics on what percentage of features are unfavourable as a result of nitrogen deposition effects would be an immensely powerful means of influencing policy development/revision.

The detail of how this will be undertaken needs considerable further thought and depends on the type of monitoring undertaken and whether impacts can be quantified.

14) Other issues raised.

Local Knowledge

The approach taken at the symposium has been very top-down. It was questioned whether site managers would be best placed to pick up nitrogen impacts and therefore, if sites were currently impacted, this would already be noticed. However, the majority considered that whilst site managers will pick up the principle causes of an effect, such as overgrazing, there were only a few examples where local staff have reported air pollution as a cause. The impacts are often unseen and, since it is often difficult to influence the cause at a local site-level, local staff are often less aware of the issue. The exception is where there is a strong local point source. Where management can be used to ameliorate impacts local staff are more likely to get involved. In parallel to the consideration of a network, an important requirement is to raise awareness amongst area team staff and site managements and to identify sites at risk.

Recommendations

The key recommendations from the working groups and plenary discussion are:-

1. There is a need to better understand the impacts of air pollution, in particular nitrogen, on the SSSI series. A network incorporating a subset of SSSIs should be established.
2. Any new monitoring on a subset of sites should consider a range of drivers of change, including climate change. It should elucidate the role of nitrogen (and/or other air pollutants) relative to other influences on a site or other sources of enrichment.
3. An essential prerequisite to setting up any new monitoring is to analyse the existing monitoring networks/programmes to consider whether more use can be made in relation to understanding the impacts of nitrogen on the SSSI series. In particular, it was considered that the proposed ECN biodiversity sites may deliver this objective.

Additional recommendations are:-

4. Any new network, or monitoring on sites, must add value to existing programmes, including the conservation agencies' common standards monitoring on SSSIs. It must be demonstrated how it will help to ensure the achievement of favourable condition of sites.
5. A strong justification will be required to support the need for any additional monitoring, since large resources are already put into common standards monitoring. This justification should include a concise picture of the evidence of the risks from atmospheric nitrogen pollutants and the evidence of impacts on sites. It should highlight the information gaps and set out how these can be addressed by better use of current initiatives as well as new monitoring/assessment.
6. Considerable work will need to go into the design of the network and it was recommended that an official review group of experts is set up, including representatives from the conservation agencies, government and the research community.
7. In designing the network, European and international initiatives should be explored.
8. The design will need to include data management to ensure appropriate analysis and integration, where appropriate with existing reporting commitments.

9. Further consideration is needed to consider whether, and how, a new network could be used to validate critical loads or dynamic modelling approaches.
10. The network may need to extend beyond the SSSI/European site network to the wider environment, since favourable conservation status is not only site based.
11. There is a requirement for greater engagement between habitats and pollution specialists.

Summary

There was general consensus that there should be monitoring of air pollution impacts on the SSSI series in order to better understand the impacts on the series and use this to influence policy, site management and site protection. This should be on a subset of sites covering a range of habitats and pollution climates. There are a number of existing networks, and these need to be reviewed in the light of the objectives. Any new 'network' will need to add value to existing ones and to existing monitoring on SSSIs. More research into the use of indicators is required and, importantly, the linkages with the designated features need to be explicit. The size of the network will be constrained by resources, but if it has endorsement from a range of agencies it would greatly add weight and acceptance.

Next Steps

The proceedings of the symposium are published on the JNCC website. The organisers are considering options for a journal publication. In addition, the Air Pollution Lead Co-ordination Network (APLCN) and co-organisers will produce a report and recommendations for the conservation agencies' Chief Scientists. This will include a paper setting out a justification for a network, proposals for analysis of existing networks/programmes and details on how the APLCN propose to develop, with partners, the network.