

Air Pollution Bulletin

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JNCC and the country nature conservation bodies (CNCBs) collaborate on air pollution work through the Inter-agency Air Pollution Group (IAPG). Through the group, we work together to provide evidence and advice on air pollution impacts on biodiversity and ecosystems.

The Air Pollution Bulletin provides an overview of the IAPG's key activities, with links to further information. It is principally an update for conservation agency staff, but we hope it is also of interest to other organisations, the research community and the general public. If you have any comments, or would like more details on any of the topics covered, please email Susan.Zappala@jncc.gov.uk.

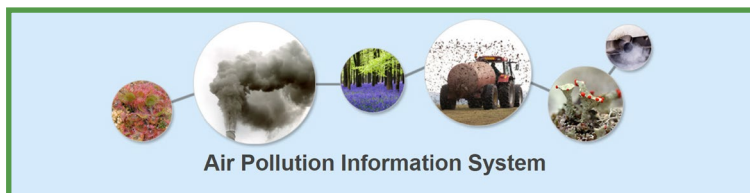
Details of these topics and other relevant updates are contained in this edition of our Bulletin. We welcome any comments you may have on the content of the bulletin.

News in Brief

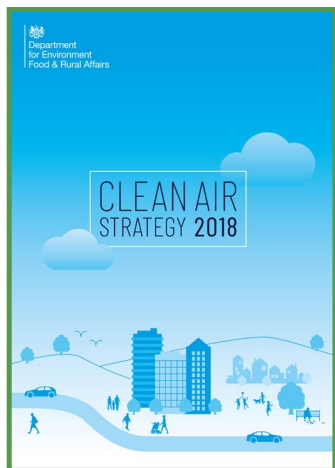
Updates to the Air Pollution Information System (APIS)

[APIS](#) remains the “go-to” website for site relevant critical loads/levels, pollution data and information on air pollution effects – with around 5000 visits per month. It is delivered through a partnership of the statutory nature conservation agencies, the environment agencies and the [Centre for Ecology & Hydrology](#) (CEH).

We have redesigned APIS so it now functions fully on portable devices, meaning you can access information from anywhere. In addition, we have funded updates to the pollution datasets and the expansion of the application of relevant critical loads to SSSI species in England.



Clean Air Strategy

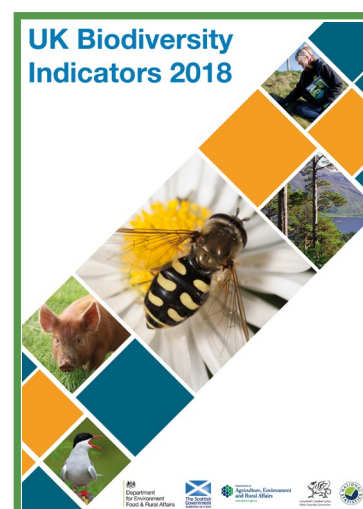


On 14 January 2019, the Government Published the [Clean Air Strategy 2019](#) after public consultation. A commitment from the 25 Year Environment Plan, the strategy outlines Government ambitions relating to reducing air pollution to protect health, nature and boost the economy. It aims to set a direction for future air quality policies and actions for the next decade and beyond.

JNCC made a response to the consultation which welcomed the measures in the strategy, identified specific areas where JNCC can support Government in taking forward the strategy and areas which need to be reinforced or where greater clarity should be given in the strategy.

UK Biodiversity Indicators

An update to the [UK Biodiversity Indicators](#) was published in July 2018, including the latest critical load exceedance statistics which are the basis of the indicator of “pressure from air pollution”.



Natural England Roads Guidance

Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations ([NEA001](#)) was published on 12 July 2018. This internal operational Guidance Note describes how Natural England advises competent authorities and others on the assessment of plans and projects (as required by the Conservation of Habitats and Species Regulations 2017 ('the Habitats Regulations')) likely to generate road traffic emissions to air which are capable of affecting European Sites. It has been published for information to help competent authorities to better understand Natural England's own approach when applying the Habitats Regulations to these matters in its role as statutory adviser.



NECD monitoring report

The 2016 revised [National Emissions Ceilings Directive](#) (NECD) sets emissions ceilings targets for five pollutants (sulphur dioxide, nitrogen oxides, fine particulates, non-methane volatile organic compounds and ammonia) to help improve the condition of ecosystems as well as human health across the EU.



Article 9 of the Directive states "*Member States shall ensure the monitoring of negative impacts of air pollution upon ecosystems based on a network of monitoring sites that is representative of their freshwater, natural and semi-natural habitats and forest ecosystem types, taking a cost-effective and risk-based approach*".

Member States were required to produce, by 1 July 2018, a report setting out how the network is designed so as to ensure compliance with Article 9. JNCC and the CCB's helped Defra to compile the UK report. The UK approach is to use data generated from seven existing monitoring schemes. This comprises schemes which cover a small number of intensively monitored sites, complemented by broad-scale schemes based on a large number of plots measuring fewer parameters. An integrated analysis across the schemes will maximize the benefits of the evidence generated across all. The impacts monitoring and analysis will be complemented by modelling to assess the extent to which critical loads and levels are exceeded across the UK. We will continue to support Defra with collation and analysis of the data for submission in 2019.

SCAIL Dairy and Cattle update

[Simple Calculation of Atmospheric Impact Limits from Agricultural Sources](#) (SCAIL-Agriculture) is a screening tool for assessing the impact from farms on SSSIs and SACs and other areas. This year, a number of improvements have been made to the tool.

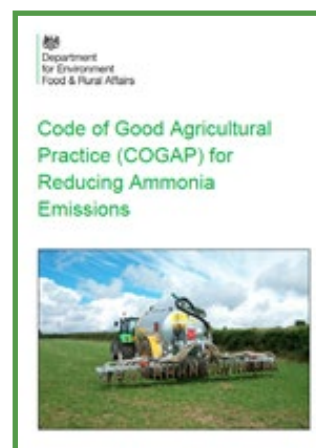


As well as pigs and poultry, you can now use SCAIL to calculate emissions and impacts from dairy and cattle farms. Emission factors are included for housing, land-spreading, manure/slurry storage, grazing and outdoor yards. Users can also define their own emissions.

In addition, the tool layout has been made more straight-forward and easier to follow.

Code of good agricultural practice for reduction ammonia emissions – England

Natural England staff have been supporting Defra to develop the '[code of good agricultural practice for reducing ammonia emissions](#)' (COGAP) recently published for England. It is a voluntary guidance code that is relevant to many farming practices and has been written specifically for English farming systems. There is also an accompanying video on [YouTube](#).



New air quality thresholds in Wales

NRW has introduced new thresholds for air pollution assessments with the aim that emissions from new agricultural sources requiring either planning permission and/or an Environmental Permit will not exceed a fixed limit.

Two relatively new pieces of legislation in Wales are helping NRW and partners develop a more integrated approach to reducing the impacts of ammonia emissions from new Intensive Livestock Units (ILUs), predominantly poultry. The [Environment \(Wales\) Act 2016](#) places a biodiversity duty on NRW and other public bodies to seek to “maintain and enhance biodiversity” in delivering its statutory functions. The [Well-Being of Future Generations \(Wales\) Act 2015](#) also places a duty on public bodies to work together to identify and deliver “Shared Outcomes”. As a result, NRW has revised its permitting thresholds for the larger ILU it regulates. It has also worked closely with local authorities to ensure a consistent approach to ILUs covered under planning as the impacts from non-regulated units can often be greater than from those which require a permit (see [Powys Pilot Study](#)). These changes were needed in response to the unprecedented increase in Poultry number in parts of Wales in recent years.



In April 2017, NRW introduced new tighter evidence-based air quality thresholds to underpin environmental permits and support planning responses. The new thresholds have been supported by technical guidance, dialogue with relevant parties, including industry, and training for NRW staff and Local Authorities. This “shared outcome approach” will hopefully prevent further damage to Wales’ most vulnerable sites. At the same time the changes will help deliver NRW’s biodiversity duty and allow sustainable expansion of this important rural industry.

[GN20](#): Assessing the impact of ammonia and nitrogen on designated sites from new and expanding intensive livestock units

[GN21](#): Planning permission and environmental assessment; Poultry units

A call to protect Wales’ internationally important wild flora and fungi from air pollution

In January 2017, Plantlife and Plant Link UK published a report “[We need to talk about Nitrogen](#)” detailing the impact of atmospheric nitrogen deposition on the UK’s wild flora and fungi. In May 2018, Plantlife launched a “sister” [document](#) outlining proposals and recommendations to reduce nitrogen impacts on Welsh biodiversity. This highlighted the rapid increase in ammonia emission in Wales since 2008 concurrent with the substantial increase in poultry across many parts of Wales. Unfortunately, much of the expansion and increase in ammonia emissions is occurring in remote rural areas containing some of Wales’ most vulnerable and internationally important lichen communities. The report identifies that NRW only regulates sources which contribute approximately 5% of ammonia emissions (Intensive Livestock Units requiring Environmental Permits) and that Welsh Government should set targets to reduce ammonia impacts from other sources across the country.

The report adds support to the changes in air quality approach adopted by NRW in April 2017. It also makes a number of proposals to tackle the issue in Wales. For example, Welsh Government are asked to establish statutory targets for reducing ammonia emissions, to protect and restore sensitive wildlife habitats. It also calls on them to regulate waste arising from intensive livestock (currently not controlled), lower the numbers of poultry from the current 40,000 that require a permit to operate and to include cattle under the permitting regime. NRW are recommended to develop an integrated strategy to reduce air and water pollution impacts from farming sources. It also calls upon NRW to produce and deliver Site Nitrogen Action Plans. To support this objective, it recommends NRW incorporates ammonia measurement and nitrogen amelioration measures into the management of all SSSI in Wales. Finally, it calls upon all public bodies in Wales to work closely together to identify and deliver “shared outcomes” to address nitrogen pollution in Wales. NRW are discussing these and considering their response as part in liaison with senior management.

Impacts of Ammonia on Lichens in Wales

Sam Bosanquet – NRW's non-vascular plant and fungus ecologist – has been gathering evidence to highlight impacts of ammonia on lichens in Wales. An assessment method based on the [Lichen App](#) was initially used to examine Wales' richest parkland lichen site: Dinefwr SSSI in Carmarthenshire.

The Twig Lichen Survey showed the heart of the SSSI to be 'Clean' but its edges to be 'At Risk' due to the presence of some nitrogen-loving lichens, whilst the areas at nearby farms were 'N polluted' and 'Very N Polluted'.

Dinefwr is situated in the highly productive Tywi Valley, where dairying is the principal form of agriculture and many trees are exposed to high concentrations of ammonia from agriculture. However, the SSSI boundary extends beyond the key area for lichens and had 'zero input' of fertiliser and manures since the early the 2000s; a 500m wide zone around the key lichen area has protected its richness. The 'At Risk' edges are receiving inputs of ammonia and nitrogen deposition from surrounding land.



Alga-encrusted *Usnea florida* © Sam Bosanquet/NRW

A contrast was provided by surveying Gregynog SSSI, where manure is spread in silage fields immediately adjacent to the SSSI, which is smaller than Dinefwr. Most trees within the SSSI show signs of ammonia pollution, with *Usnea* lichens being encrusted with algae and *Xanthoria* appearing on oak twigs and trunks.

NRW also commissioned Dr Joe Hope to carry out Twig Lichen Surveys on 12 SSSI in Powys – the "poultry capital" of Wales. This showed that 'Clean' conditions and rich lichen assemblages remain in the Elan Valley and similarly remote parts of the Cambrian Mountains, but that SSSI elsewhere in Powys are either 'At Risk' or 'N-polluted'. Much of Powys already has sufficiently high ammonia concentrations to alter lichen communities according to national modelling of ammonia, but 'Clean' assemblages persist in areas which are remote from intensive agriculture. Further Twig Lichen Survey by the Welsh Government-sponsored CENNAD lichen apprentices is gathering information from the non-SSSI landscape. The 'Clean' area around the Cambrian Mountains is also the last part of Powys that holds the N-sensitive lichen *Bryoria fuscescens*: a distinctive microlichen that plays a major role in the epiphyte community in boreal forests, but which has declined considerably in range and abundance in Wales since the late 20th century, with significantly lower survival in areas with high ammonia concentrations.



Healthy *Bryoria fuscescens* © Sam Bosanquet/NRW

The impact of ammonia on lichens may seem esoteric to many people, but in its extreme form it substantially reduces the water-interception, nutrient cycling and invertebrate hosting capacity of trees. Lichen assemblages on oak twigs in 'Clean' areas are composed of deep cushions of *Usnea* and *Evernia*, interspersed with *Parmelia*, *Hypogymnia* and other species, whereas 'Very N Polluted' twigs hold little other than thin *Physcia* or *Xanthoria* species or even just a crust of algae.

Tackling ammonia emissions in Northern Ireland

Ammonia has become a very topical issue within Northern Ireland over recent years with much concern around the assessment of applications for farm developments and the implications relating to ammonia emissions and consequent impacts.

As a consequence, in July 2016, the independent Expert Working Group on Sustainable Agricultural Land Management was asked by the then DAERA-NI minister to examine the issue of ammonia. The Group published their report in December 2017 “Making Ammonia Visible.” It made a number of key recommendations to government and farmers and called for:

- a partnership approach to address ammonia;
- improved communication and education on ammonia;
- scientific research to address significant evidence gaps;
- adoption of guiding principles for planning applications;
- the implementation of ammonia mitigation measures on farms including an end to the use of both splash-plates for slurry spreading and non-stabilised urea fertiliser;
- as well as the establishment of an Agri-Emissions Partnership.



Moss comparison - healthy and Nitrogen damaged Sphagnum from a bog in NI © Áine O'Reilly/NIEA



Lichen, Cladonia sps showing algae growth around base, another sign of N damage © Áine O'Reilly/NIEA

In response, DAERA have established a Project Board to lead the development of an Action Plan on Ammonia during 2018, in partnership with the agriculture and environment sectors. This Action Plan will aim to:

- achieve tangible and sustained reductions in ammonia emissions from Northern Ireland farms;
- reduce the impact of ammonia via nitrogen deposition on nature and habitats and, in particular, designated sites;
- respond to each of the recommendations of the Expert Working Group;
- encourage uptake of ammonia mitigation measures on-farm;
- highlight the impact of ammonia on human health, while noting the relevant uncertainties.

Integrating Tools for Air Pollution Assessment (ITAPA)

Introduction to the project

ITAPA was a project to identify user requirements for air pollution assessment tools and to recommend technical solutions. The project ran from April 2017 until June 2018. It was led by JNCC in partnership with Natural England, NIEA, NRW and SEPA.

The project followed a JNCC and Natural England study in 2016/17 which evaluated the integrated air pollution assessment tool [AERIUS](#) and concluded that AERIUS should be included in a subsequent Discovery Project (ITAPA) looking at options to address user needs for air pollution assessment tools.

Why was ITAPA needed?

Currently air pollution assessments draw on several sources of data, guidance, dispersion models and assessment tools; together these provide information on emissions estimates, dispersion modelling, background pollution mapping and comparison against environmental benchmarks. The range of tools has been developed over time, often separately for different applications even though user requirements overlap. Evolving requirements, open data, technological advances and the need for greater efficiency and transparency in decision-making meant it was timely to undertake a “discovery project” to define the range of user requirements and evaluate different options for addressing these.

The key drivers behind the project included:

- Legal challenge to air pollution assessment of strategic plans becoming more frequent;
- Gaps in current tools for assessment of multiple and individual sources;
- Challenges with accounting for “in combination” and “cumulative impacts”;
- The desire from competent authorities, advisers and applicants for a consistent, risk- and evidence-based method for assessing potential effects from air pollution;
- Whilst existing tools contribute well to assessment of individual proposals, interaction between proposals and with national policy and inventories was identified as a gap.

Who is the project of interest to?

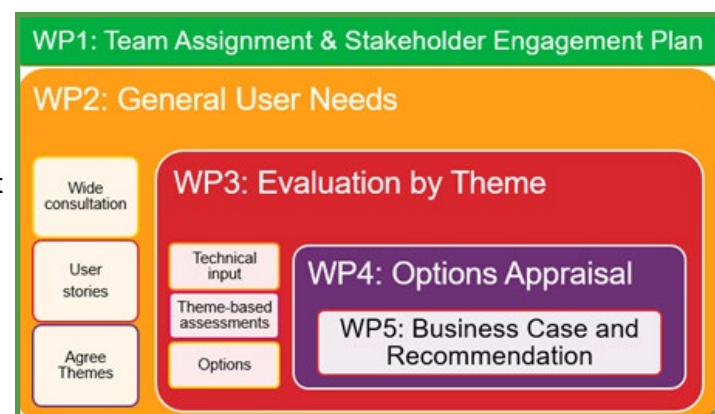
Air pollution issues cut across several policy areas relevant to Defra, the Statutory Nature Conservation Bodies and Regulators including human health issues, biodiversity, industrial emissions, agricultural sources and natural capital. Also, industry and individuals invest resources to undertake or commission air pollution assessments to support applications for planning permission or environmental permits. We have involved all these stakeholders in the project.

How did we approach it and what did we find?

Our approach was to work closely with stakeholders, from public, private and third sector organisations, who use tools for air pollution impact assessment to examine their requirements (provide “user stories”).

We identified a wide range of user needs covering four related overarching assessment types:

- Impacts of point/linear source (typically a single source, permit application);
- Impact assessment for multi-source assessment (typically a local strategic plan);
- Understanding effects of national policy measures;
- What measures should be taken to reduce impacts on sites, including scaling from local to national level.



We explored these in more detail in theme groups and identified technical solutions. The themes were:

- data and visualisation;
- modelling and assessment tools;
- reporting/outputs.

Next steps

Subsequent to the project, the Clean Air Strategy was published for consultation and included some actions which relate closely to ITAPA user needs assessment and reinforce the proposed solutions.

The ITAPA steering group are exploring funding options with a view to building an integrated tool utilising the open source software of the Dutch AERIUS tool (option 4). This would be restricted to ecosystem assessments. If we are successful in securing funds, a part of the development will be to drill down into the user requirements pertaining to the related issues of modelling, background pollution data and the decision basis.

The Nitrogen Decision Framework

Despite evidence for widespread impacts of nitrogen deposition on plant species and the quality of semi-natural habitats in the UK, detecting and attributing those impacts at a “site-level” is difficult. Site assessment using Common Standards Monitoring (CSM) underreports nitrogen impacts as it was not designed for this purpose

For some habitats, none of the targets listed in CSM guidance are indicators of N deposition effects. Even where they could be used as indicators, impacts may be obscured as the observed response is not specific to atmospheric nitrogen deposition or could be caused by another factor such as site management or hydrology. Consequently, current reports of SSSI/SAC feature condition and trend are inconsistent with broader evidence of nitrogen impacts for sensitive habitats.

This conundrum has kept IAPG members busy over the last decade through a range of studies which have been reporting through our bulletin. These have concluded that there is no quick or simple way to monitor and attribute nitrogen impacts on the condition of habitats at individual sites, largely because the responses to nitrogen may also be driven by other factors. Intensive, repeated, survey is required to be confident of cause and effect. Such an approach is taken in [Natural England's Long-Term Monitoring Network](#). This level of detail, however, is not compatible with the relatively rapid assessment methods of CSM.

The [Nitrogen Decision Framework](#) (NDF) was developed to determine whether it is likely that the condition of habitat features have been affected by nitrogen deposition, providing a mechanism for combining site based evidence with a risk-based “Exceedance Score”. The Exceedance Score is derived from best available evidence which is usually modelled data combined with critical loads at the national scale. There are uncertainties around both, so the Exceedance Score is designed to take this into account. Four outcomes are possible.

- N likely to have no impact on the feature;
- N likely to be a threat to habitat condition;
- N likely to be a cause of unfavourable habitat condition; or
- N likely to be preventing recovery of a habitat feature.

As the NDF takes account of uncertainties and the extent to which we can be confident that there is an nitrogen impact at the site, only strong site-based indicators influence the outcome. These are only available for 12 out of the 47 CSM habitat types that are considered sensitive to atmospheric nitrogen. In the absence of strong indicators, the outcome is determined solely by the Exceedance Score.

Outcomes of the NDF are conservative: a conclusion of unfavourable condition is only returned where the predicted deposition is twice the upper end of the critical load and only sites where the modelled deposition is less than half the minimum critical load value are identified as being under no threat from nitrogen deposition. This contrasts to a “traditional” critical load assessment where the outcome is restricted to either exceeded or not exceeded.

Since the publication of the NDF, Natural England and NRW have been testing its application in pilot areas.

In Scotland, SNH funded a study in 2017 “Towards the development of a Nitrogen Deposition Decision Framework for vegetation assessment in Scotland”. The study analysed vegetation data from repeat surveys covering 12 widespread Scottish habitats from forests to alpine summits and demonstrated significant changes in vegetation composition and diversity over a 40 to 50-year period. It revealed significant relationships between N and vegetation change in all habitats. The study focussed on NDF outcomes based on Exceedance Scores only, since site-based evidence scores could not be generated to allow the relationships between NDF outcomes and vegetation change to be meaningfully tested.

The authors of the study concluded that the Framework could be a valuable tool in attributing nitrogen deposition effects to the condition of habitats and vegetation change over the range of predicted deposition across Scotland. However, the data which supports the Framework is currently not sufficiently robust to accurately predict changes in the number or types of plants found in Scottish habitats. The lack of suitable nitrogen indicators and thresholds data is especially acute for the upland habitats which are more common in Scotland when compared with the rest of the UK. The report includes recommendations to address these gaps. SNH is working with partners, such as SEPA and Scottish Government in Scotland, and elsewhere in the UK to improve the evidence of nitrogen deposition impacts across a range of habitats and thereby strengthen the results coming from use of the Framework.

A mammoth task

England/Wales workshop on tackling air pollution on Fenn's & Whixall Special Area of Conservation

In July 2018, the Natural England Air Quality Network hosted a workshop to discuss the mammoth task of tackling air pollution at [Fenn's, Whixall, Bettisfield Wem and Cadney Mosses Special Area of Conservation](#) (SAC) as part of the [Marches Mosses BogLIFE project](#) and internal training at Natural England. The two-day event was called "Air Pollution: Strategic Solutions and Establishing Baselines" and aimed to provide an introduction for Natural England network members to monitoring and strategic approaches to reducing air emissions and managing protected sites to reduce the impact on habitat.

A workshop on the first day introduced the [Fenn's and Whixall Shared Nitrogen Action Plan](#) pilot being initiated by a PhD policy intern later this year. Given the cross-border nature of the Fenn's and Whixall site, the workshop attendees included Natural Resources Wales, JNCC, Environment Agency, Shropshire Wildlife Trust, Shropshire Council and DTA Ecology because of their involvement with advice on assessing emissions in this area. The workshop provided an introduction to the SAC as well as a quick review of different approaches to tackling "in-combination" assessment and background pollution on designated sites. Participants shared their experiences, approaches and data sources which raised a significant amount of healthy debate. Overall the conclusion was that air pollution issues can often be complex and have site specific elements that influence decision making and the risk assessments that underpin these decisions.

Monitoring methods to establish baselines of air and habitat quality as well as measuring progress with initiatives to reduce pressure on the habitat from air pollution were discussed. At this workshop, use of citizen science through survey of lower plants was highlighted in anticipation of trying this out on the site visit. Special attention was paid to materials from the Centre for Ecology and Hydrology [Lichen App](#), Open Air Laboratories' [Air Pollution Survey](#) and the [Lichens – Making the Invisible Visible – An Air Pollution Survey](#) materials from Royal Botanical Gardens in Edinburgh and the Field Studies Council [Guide to using a lichen based index to nitrogen air quality](#). Partners were interested in considering lichen and bryophyte monitoring and citizen science methods in their future work.

The group offered special thanks to Shropshire Wildlife Trust for hosting the workshop at their visitor centre in Shrewsbury and to Fenn's and Whixall National Nature Reserve staff for sharing their insect repellent and expert knowledge of the site. Attendees also got a peek at the history of the Fenn's and Whixall site which was a key source of peat (and storage of a wooly mammoth figure). During the site visit to the bog, the group viewed one of the existing ammonia monitoring stations and got glimpses of local bog species including sundew. The stakeholders look forward to progressing this work to learn about monitoring strategic approaches at a national level as well achieving outcomes for the natural environment at Fenn's and Whixall itself.



Pictures showing the diffusion tubes and explanation of the air quality data analysis on site © Graham Earl



Woolly mammoth figure © Graham Earl



Round-leaved Sundew, *Drosera rotundifolia*
© Natural England/Allan Drewitt