

Cynulliad Cenedlaethol Cymru
Y Pwyllgor Newid Hinsawdd,
Amgylchedd a Materion Gwledig
Ansawdd Aer
NHAMG (5) AA08
Ymateb gan Coed Cadw

National Assembly for Wales
Climate Change, Environment and
Rural Affairs Committee
Air Quality
CCERA(5) AQ08
Evidence from Woodland Trust

1. Coed Cadw/The Woodland Trust is the UK's largest woodland conservation charity, working for a UK rich in native woods and trees, for people and wildlife. In Wales we have over 26,000 supporters. We currently have 22 staff in our Wales team and 180 active volunteers. We own and manage over 100 sites in Wales covering 2,897 hectares (7,159 acres). Our conservation spend in Wales is about £1.7 million every year. Wales is one of the least wooded countries in Europe, with woodland making up just 14% of the landscape, and less than half of this is native woodland.
2. Trees are one tool available to all that can be readily used to help meet well-being outcomes in an integrated way across many policy areas. They are also a very engaging and highly valued [part of people's lives](#).
3. Air pollution is another reason why we think every public authority needs to develop and implement an [Emergency Tree Plan](#), as a crucial step to delivering well-being objectives, and to address the climate and biodiversity emergency.
4. In this response we make 3 main points, each of which is considered in more detail below :-
 - 4.1. Rural air pollution is just as much an issue as urban air pollution, and requires as much attention and investment, in particular ammonia emissions from intensively farmed livestock.
 - 4.2. Transport infrastructure continues to drive up pollution and environmental damage: the enlightened thinking behind the decision on the M4 Relief Road does not appear to be applied to other proposals.
 - 4.3. There continues to be a steady loss of the most effective and important component of green infrastructure - mature trees. This exacerbates air pollution and is to the detriment of public health and well-being.

5. **Climate and Biodiversity Emergencies**

These issues relate directly to both the climate and biodiversity emergencies. The Woodland Trust's views on the responses needed are set out in our Emergency Tree Plan¹. Our relevant asks are included in the sectors below.

6. **Responses to the questions posed by CCERA**

6.1. What regulatory gaps or issues will need to be addressed after the UK leaves the EU? How should these be addressed and what will be the main challenges?

- We support the comments made by Wales Environment Link on the future delivery against EU directives.
- As regards domestic regulatory arrangements, there is clear regulatory failure to control the combined effects of multiple emission sources from intensive livestock farming.
- Protection of mature urban trees is haphazard, with considerable inconsistency in the application of Tree Preservation Orders.

6.2. Are the Welsh Government's proposals for a Clean Air Act appropriate? How could they be improved? What can be learned from legislative approaches elsewhere?

- We support the comments made by Wales Environment Link.
- An Act will only be successful if it leads to substantial, widespread and demonstrable improvements in air quality. Effective governance, monitoring and reporting requirements need to be in place to ensure plans are delivered.

6.3. What are your views on the regulatory proposals in relation to the Local Air Quality Management regime? What are the main challenges in relation to the proposed approach?

- Decisions by local planning authorities continue to authorize new sources of pollution. We ask whether putting the onus on local authorities to drive air quality management creates a conflict of interest with their planning functions and their wish to facilitate development.
- Who will assess the quality of local authority plans and risk assessments? What reporting of performance and holding to account will there be of local authorities, and who will do this?
- We suggest this illustrates an environmental governance gap. This is already apparent in the absence of performance monitoring on the compliance of planning decisions with Government policy and PPW10.

¹ Woodland Trust (2020) Emergency Tree Plan: How to increase tree cover and address the nature and climate emergency. January 2020. <https://www.woodlandtrust.org.uk/publications/2020/01/emergency-tree-plan/>

6.4. What are the main challenges in introducing a legislative framework for air quality as set out in the consultation document?

- Ensuring that local authorities have sufficient skills and capacity to make comprehensive assessments and objective decisions on air pollution priorities, and providing independent scrutiny of this. The New Local Government Network (NLGN) received replies from seven councils from Wales to their Leadership Index survey December 2019. Only 14% of respondents (ie one of 7) agreed that they have sufficient power and resources to improve air quality in their area. Respondents from Wales identified their biggest barriers to improving air quality as: Competing priorities (43%); Lack of resources (29%); and Limited decision-making power (14%).²
 - Monitoring and ensuring the effective delivery of policy and plans.
- Providing an effective governance and enforcement system, accountable to citizens, and with clarity on the responsibilities of local authorities, NRW, Government and new environmental governance body.

7. Pollution from intensive livestock and poultry units

7.1 We welcome the recognition in the Welsh Government's consultation document. It is not clear that addressing this will be picked up as a priority in action plans.

7.2 The Trust has commissioned work on this issue and its impact on woodland, and an extract from a recent report is provided as Appendix A. Whilst our focus is on impact on woodland, this is indicative of wider impacts on other habitats and wildlife. These are discussed fully in the Wales Environment Link response, and are covered comprehensively in the report from Plantlife "*We need to talk about Nitrogen*"². The human health impacts are noted in the consultation document.

2

7.3 Ammonia is an insidious threat to ancient woodlands: the changes it brings about are virtually imperceptible day-to-day, but over years the changes could be so profound as to alter most aspects of the woodland's ecological function, including soil chemistry and nutrient cycling, the ground vegetation, and the health and growth rate of the trees. The serious and extensive nature of these

² Plantlife (2017) We Need to Talk about Nitrogen. Atmospheric nitrogen deposition and its impact on UK wild plant and fungal communities. 11 pp. <https://www.plantlife.org.uk/uk/our-work/policy/nitrogen>

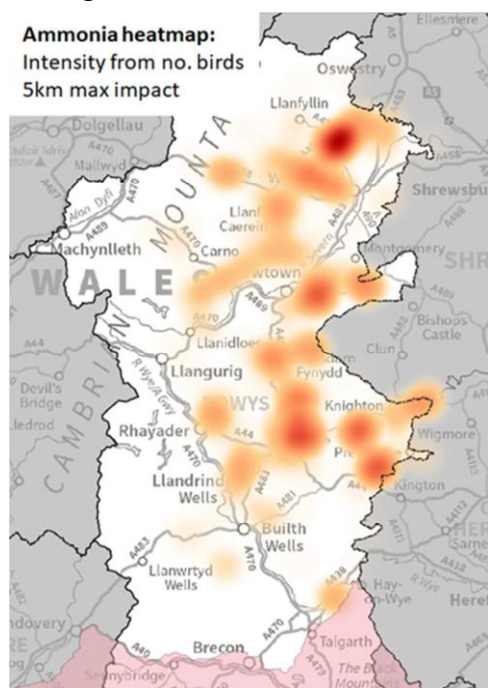
impacts is discussed in more detail in a Technical Advice Note published by the Woodland Trust.³

7.4 One of the fundamental issues is that current regulations accept that a single new development may make emissions up to the maximum allowed ammonia concentration threshold, with no account taken of existing emissions or emissions from other developments.

7.5 Campaign for Rural Wales (CPRW) volunteers monitor planning applications made to Powys

County Council. They have produced on-line maps which indicate the location and approximate size

(by number of birds) of applications for new intensive poultry units.⁴ Planning applications in Powys, as at July 2019 were for 200 units including 340 sheds, housing 9 million birds.



7.6 This indicative “heatmap” for Powys indicates where the impacts from just these new applications are particularly concentrated.⁵ This has to be overlaid on emissions from existing activities which may already exceed critical loads. The impact of a single unit may seem insignificant, but their combined impact may be severe.

7.7 This analysis indicates that 2,896 hectares of ancient woodland sites in Powys – 15% of the total for the county – are within 1km of at least one poultry unit. Almost 80% (over 15,000 hectares) of ancient woodland is within 5km of one. Our current assessment of applications⁹, which is significantly incomplete, suggests some 70 ancient woods may be substantially adversely affected, nine of which are Sites of Special Scientific Interest.

7.8 Addressing this issue requires changes to regulatory guidance and practice, improvement of monitoring, and investment in emissions control. Trees can play

³ Woodland Trust (2019). Assessing air pollution impacts on ancient woodland – ammonia. Woodland Trust Technical Advice Note 1. February 2019 6pp . <https://www.woodlandtrust.org.uk/media/1687/ammoniaimpacts-on-ancient-woodland.pdf>

⁴ <https://www.brecon-and-radnor-cprw.wales/wp-content/uploads/2019/07/IPU-ALLdataV4-Master20190707-Powys-By-Size-FINAL-1.0-20190713.pdf>

⁵ Woodland Trust (2020) Data on Ancient Woodland in Wales. Unpublished. See Appendix A

a role in the interception and capture of ammonia emissions⁶, and planting of tree belts may buffer ancient woodland sites from existing sources of pollution. Detailed discussion of emissions management and regulatory issues are in our Technical Advice Note ⁴ and NRW evidence report⁷

7.9 Our asks of the Welsh Government, NRW and local authorities are:

- Remove the presumption that a single source may emit the entire maximum allowable emissions load for that locality.
- A responsibility for planning authorities and NRW to look at the cumulative effects of new applications on local air quality, including of those below the current regulatory threshold.
- A reduction in the threshold for Environmental Impact Assessment and environmental permits for intensive pig and poultry units.
 - A requirement for environmental permitting of beef and dairy herds.
 - Requirements for more efficient management, storage and application of manure, slurry and other fertilisers.

8. Transport Infrastructure

8.1 Roads and airport development continue to drive environmental damage and increased pollution. Such infrastructure proposals currently threaten at least 15 ancient woods in Wales, and include the A55 Deeside corridor proposal, the A40 improvement and the A48-M4 link road proposals, and developments associated with Cardiff and Swansea airports. ⁸ These schemes are particularly damaging because they drive increased traffic and pollution, and because of their extensive direct and indirect impacts on wildlife.

8.2 We greatly welcome the enlightened decision on the M4 Relief Road, reflecting that the additional road building and traffic generation was unjustifiable once proper allowance is made for the permanent environmental damage, public wellbeing and social justice considerations. We hope this thinking indicates a move towards embedding sustainability and wellbeing into economic and transport policy, but it does not yet seem to be applied to other infrastructure developments. Our experience is that the Welsh Transport Appraisal Guidance process (WelTAG) ⁹, developed with the Future Generations Commissioner, has not yet become embedded practice, and shortcuts are still being taken on sustainability appraisal and community engagement.

⁶ CEH (2018) Trees can help mitigate ammonia emissions from farming. <https://www.ceh.ac.uk/press/treescan-help-mitigate-ammonia-emissions-farming>

⁷ Bosanquet, S.D.S. 2019. Lichen surveys to investigate ammonia impacts. NRW Evidence Report No. 298. Natural Resources Wales, Bangor.

⁸ Woodland Trust (2020) Development Threats to Ancient Woods and Trees in Wales: 2019 Annual Report

⁹ <https://gov.wales/welsh-transport-appraisal-guidance-weltag>

8.3 Our asks of the Welsh Government and local authorities are:

- To ensure the full and comprehensive adoption of the WelTAG process.
- To fully consider the actual need for new roads against other sustainable transport options, i.e.

public transport, changing travel behaviour, reducing traffic demand, etc.

- Avoid the need for any road to be routed where it will damage ancient trees or woodland or other high value habitat. We typically see that where avoidance is possible, it is not pursued as it would often incur additional costs to the project. It is concerning that Government and its

agencies are contributing to the biodiversity crisis and rejecting the costs necessary to conserve irreplaceable habitats.

9. Loss of Mature Urban and Street Trees

9.1 There is evidence of a steady loss of mature tree cover in Welsh towns and cities. This matters for air pollution because mature tree canopies can be very effective at removing particulate pollutants. This benefit is quantified in i-tree reports, such as have been undertaken for Wrexham, Bridgend, Tawe Valley and Cardiff.

i-tree report¹⁰	Airborne Pollution removal	Estimated value
Wrexham	60 tonnes / year	£700 000 in health damage costs avoided
Bridgend	61 tonnes / year	£179,000 in damage costs avoided
Tawe catchment	136 tonnes / year	£715,500 in damage costs avoided
Cardiff	190 tonnes / year	£940,000 (per annum in terms of NO ₂ , SO ₂ and PM _{2.5} only)

i-tree reports also assess and value the carbon sequestration and storage by urban trees and the quantities of rain water intercepted, thus saving on sewerage provision costs.

¹⁰ <https://www.forestresearch.gov.uk/research/i-tree-eco/i-tree-eco-projects-completed/>

9.2 The loss of mature tree cover is in part revealed by surveys of urban tree cover carried out by NRW in 2009 and re-surveyed in 2013. Conclusions from their 2016 report ¹¹include:-

- *Urban tree canopy in Wales was 16.3% in 2013, down from 17.0% in 2009.*
- *159 out of our 220 towns show an overall decline in canopy cover between 2009 and 2013.*
- *Some 7,000 large amenity trees were lost over 7 years, possibly due to increasing development pressure, or trees planted by the Victorians coming to the end of their lives.*

9.3 The Trust is experiencing a high volume of contact from local community groups driven to campaigning against removal of mature trees. Local communities care, and understand better than decision makers, the exceptional value of mature trees. The widespread nature of such campaigns suggests a possible local democratic deficit and a social justice imbalance. Community based volunteers have to struggle to match the influence and resources of those who propose and benefit from development.

9.4 The Swansea Tree Forum is a fantastic example of what residents can achieve when they work together to stand up for Street Trees. In 2018, Swansea residents became concerned about the number of mature trees being cut down to make way for new developments. Within a week, a petition to protect the city's trees had gained 5,000 signatures. The local council listened to its residents and explained why the trees needed to be removed. But understandably, people were still upset to see so many mature trees lost. With the Woodland Trust's support, this collaborative work led to the creation of the Swansea Tree Forum, a network of people working together to green Swansea through the planting, promotion and protection of urban trees. The forum is increasing its influence as a stakeholder in tree and urban greening issues, as well being as a useful mechanism for the council to engage its residents and seek added value to their own efforts

9.5 We do not have the resources to monitor and report on the scale of and nature of cases, but development and infrastructure projects appear to be driving tree removal above and beyond the need for the planned replacement of over-mature and potentially dangerous trees. For this reason we think it now essential that minimum tree cover targets are established for every urban area in Wales

¹¹ NRW (2016) Tree Cover in Wales Towns and Cities: Understanding canopy cover to better plan and manage our urban trees // Study Summary. <https://naturalresources.wales/media/679615/eng-urban-tree-summary->

¹² [.pdf](#)

otherwise continued decline will be driven by short term economic considerations.

9.6 Replacement planting programmes are important, especially in the face of ash dieback disease which may result in the loss of 20% of non-woodland trees. Replacement planting cannot be used to justify the premature removal of large trees. We provide a technical guide on the provision of trees on residential development sites.¹³ We particularly recommend the Wrexham Tree and Woodland Strategy¹⁴ as the best example of a comprehensive and committed approach to valuing and managing urban trees.

9.7 The consultation document acknowledges the value of vegetation and trees (p83) and PPW10 makes very clear the value and benefits of extensive green infrastructure. Though secondary to emission reduction, green infrastructure, and particularly the mature tree component, is a crucial mitigation measure and one that improves quality of urban life in general.

9.8 **Our ask of the Welsh Government:-**

- That green infrastructure and air quality plans are fully integrated, and that both are considered to be overarching health and well-being issues.
- To monitor the actual outcomes and environmental impacts of planning decisions, for example on ancient trees and woodland.
 - Renew TPO legislation and ensure local authorities have the resources to fully implement it.

9.9 **Of local authorities:-**

- Prepare emergency tree plans, including commitments to minimum tree cover targets.
- Require a minimum 30% tree cover on development land, retaining mature trees.
- Review and apply TPO regulations in keeping with best practice.

9.10 **Of Assembly Members and MPs:-**

¹³ Woodland Trust (2019) Residential developments and trees: a guide for planners and developers. January 2019. <https://www.woodlandtrust.org.uk/publications/2019/01/residential-developments-and-trees/>

¹⁴ Wrexham CBC (2016) Wrexham Tree & Woodland Strategy 2016–2026 https://www.wrexham.gov.uk/assets/pdfs/env_services/trees/tree_and_woodland_strategy.pdf

- Resist damage and loss of ancient woods and mature trees in their constituency.
- Continue to engage with local community campaigns. **Appendix A. Rural Air Pollution.**

Extract from: Data on ancient woodland condition in Wales,

Data on ancient woodland condition in Wales

A report for the Woodland Trust by Rob Marsh Extract, pages 26-29: Rural Air Pollution

Air pollution in rural areas is an increasing concern to the Woodland Trust. It is particularly relevant to this study, because longer-term monitoring of woodland condition is needed to detect many of the impacts of air pollution.

Most forms of air pollution are being tackled by regulation and technological improvements, and industrial pollution has generally declined in recent decades. But nitrogen pollution – particularly in the form of ammonia – bucks this trend and is actually increasing. Intensive farming causes concentrated emissions out in the countryside, where it is becoming a serious, and invisible, problem¹⁵.

Ammonia

Ammonia is an insidious threat to ancient woodlands: the changes it brings about are virtually imperceptible day-to-day. One could walk around the same woodland every day for years, unaware that anything untoward was happening. Yet over those years the changes could be so profound as to alter most aspects of the woodland's ecological function, including soil chemistry and nutrient cycling, the ground vegetation, and the health and growth rate of the trees. As the altered ecological processes roll on, everything is affected. Eventually this invisible

¹⁵ Defra estimates that “about 80%” of UK ammonia emissions are from agriculture, primarily from livestock, manure / slurry management and fertiliser use.

<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=15900>

pollutant can alter the dominant tree species on the site, and given a few more decades the woodland may look very different, its wildlife changed dramatically.

The impacts of ammonia are complex, but it can be likened to drenching woodland close to the point of emission with nitrogen fertiliser, which can be readily taken up by some – but not all – of the woodland vegetation. These plants thrive at the expense of less nitrogen-tolerant species, gradually the species composition is altered, and different species become dominant. As this happens, there are knock-on effects for the nutrients in the woodland soils, which exacerbate changes to the way the ecosystem functions.

Another factor is that some species are *intolerant* of high levels of nitrogen, which (at high levels) will effectively poison them. Lichens are particularly sensitive, and have a crucial role in native woodland ecosystems, supporting many of the insects, and – by extension – the birds and other animals which predate them.

If that isn't enough reason to be worried, consider woodlands' role in rainwater interception. Winter storms mainly occur when there are no leaves on the trees. Lichens are thought to increase canopy water uptake by around 50%. We may be oblivious to lichens in the tree canopy most of the time, but we could rue their disappearance if our homes are flooded further downstream.

What can we do about it?

Ammonia is an example of *diffuse* pollution, which becomes a problem when lot of small, notobviously-damaging activities are combined. For example a farm diversifies into raising poultry on a relatively modest scale. Understandably, the farmer is unaware that this could create problems for woodland ecology. But combined with *existing* ammonia levels, and increasing emissions from other farms where the owners have intensified production, ammonia quickly reaches the threshold where it has a serious impact.

There is a real challenge in ascertaining what those threshold levels should be, and even more difficulty establishing when they are reached or exceeded. The worst impacts of ammonia occur at short range from source – a few hundred metres – and emissions are likely to vary through the year, depending on farm management practices. Measuring levels with sensors or air sampling is generally

unfeasible. National maps¹⁶, showing estimated ammonia levels and thresholds in relation to habitats, are currently part of the regulatory framework, but there is concern about the effectiveness of this approach.

Sam Bosanquet's Evidence Report to NRW¹⁷ (Item # 53) is recommended for further information on this topic, particularly the "scientific background" section, which gives a more thorough and sober assessment of the topic than this brief overview. The report draws together seven other relevant studies on ammonia impacts in Wales, which are themselves relevant to future study of the issue in Wales. The Woodland Trust have also published an Advice Note on ammonia¹⁸. Both documents examine the regulatory issues and set out a good case for improving the regulatory framework, particularly in the context of ancient woodlands. NRW is concerned particularly (though not exclusively) with Designated Sites in the planning process, while the Woodland Trust's view is that better regulation (and a more stringent interpretation of levels of pollutant that may cause damage) is necessary to protect ancient woodland sites more widely.

A chicken and egg problem

Farming in Wales continues to change in response to existing market conditions, and concerns about an uncertain future. Livestock farming varies in the extent to which ammonia is produced. We can say, very generally, that the more intensively farming is practiced, the more severe ammonia pollution may be, but farmers can adopt practices and design improvements which mitigate the negative impacts.

To form a picture of Wales' agricultural sector, two documents are particularly useful, both of them National Assembly Research Briefings: from 2016 on the entire farming sector¹⁹, and from 2018 on the poultry sector²⁰. At present much of

¹⁶ See the Air Pollution Information System (Item # 55) and National Atmospheric Emissions Inventory (Item # 56).

¹⁷ Bosanquet, S.D.S. 2019. *Lichen surveys to investigate ammonia impacts*. NRW Evidence Report No. 298. Natural Resources Wales, Bangor.

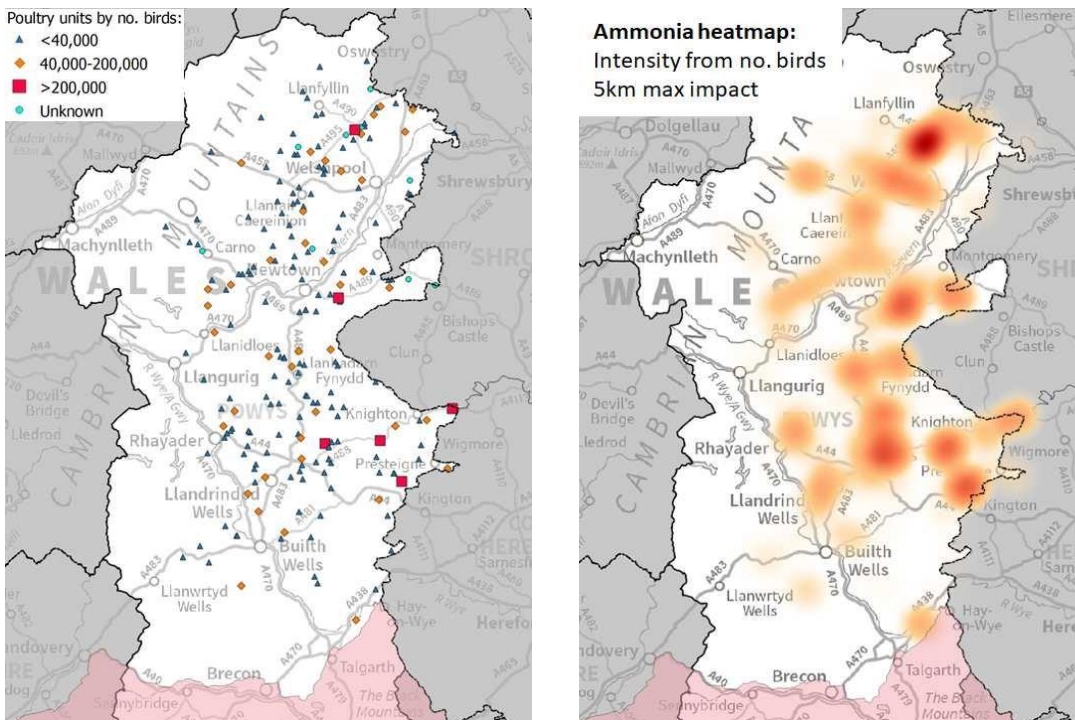
¹⁸ Hotchkiss, A. 2019. *Assessing air pollution impacts on ancient woodland – ammonia (Woodland Trust Technical Advice Note 1)*. Woodland Trust.

¹⁹ Wiseall, C. 2018. *The Farming Sector in Wales – Research Briefing*. National Assembly for Wales.

<https://www.assembly.wales/Research%20Documents/18-057%20%20Farming%20in%20Wales/Farming%20in%20Wales-Web-English.pdf>

²⁰ Laimann, J. and Henderson, E. 2018. *The Poultry Sector – Research Briefing*. National Assembly for Wales. <https://www.assembly.wales/Research%20Documents/18-053-The%20Poultry%20Sector/18-053-WebEnglish.pdf>

the concern about ammonia pollution relates to the recent proliferation of Intensive Poultry Units (IPUs).



IPU Planning Applications in Powys, and derived ammonia heatmap. Data courtesy of Brecon & Radnor Branch of CPRW.

Poultry (meat and egg production) is a fairly small sector within Welsh agriculture, currently accounting for about 6% of production by value. Margins in the sector are tight, and under a hundred producers apparently account for over 90% of production in Wales. Many of these are “vertically-integrated” companies, which also own packaging and processing facilities and sell into larger markets. Large producers sometimes form supply contracts with smaller farm businesses, whereby they help with planning applications and supply infrastructure and feed for birds; the farmer manages production day-to-day and sells at an agreed price to the larger company.

There has been a proliferation of IPUs in parts of Wales in recent years, most notably Powys

(also across the border in England) and Anglesey. This has been a concern to the Campaign for Rural Wales (CPRW), who campaign on the issue, both in relation to

impacts from the IPU themselves, and perceived problems with the planning and regulatory processes²¹.

CPRW volunteers have monitored planning applications made to Powys County Council, which indicate the location and approximate size (by number of birds) of applications for *new* IPU facilities. They have produced a series of maps (most recently in collaboration with CPRE in Shropshire²²) showing the location and indicative impacts in terms of ammonia pollution.

The maps above show the locations of the IPU applications (most of which are now likely to be operational), and an indicative “heatmap” to indicate areas most likely to be affected. This is an imperfect assessment: the assumptions about intensity are crude, the data is incomplete, and it takes no account of other sources (such as dairy farming); conversely it takes no account of mitigation measures which may have been implemented. Nevertheless it serves the purpose of highlighting the problem of diffuse pollution: the individual farms’ impact may seem insignificant, but their *combined* impact may be severe.

Our analysis indicates that 2,896 hectares of ancient woodland sites in Powys²³ – 15% of the total for the county – are within 1km of at least one poultry unit. Almost 80% (over 15,000 hectares) of ancient woodland is within 5km of one, and as we have seen, the effect is intensified where there are multiple farms in close proximity. That is just recent applications for poultry units: when we take into consideration older IPUs, and emissions from other types of farming, the impact is likely to be far greater.

Local Planning Authorities are responsible for administering planning consent applications for new (or expanding) IPUs and other infrastructure associated with intensive agriculture. Larger businesses may fall under NRW’s environmental permitting regime, and Environmental Impact Assessments may be required

²¹ https://www.brecon-and-radnor-cprw.wales/?page_id=13

²² https://www.brecon-and-radnor-cprw.wales/?page_id=1513

²³ These figures exclude the part of Powys within Brecon Beacons National Park (BBNP), which is a separate Local Planning Authority. Analysis based on CPRW data for IPUs (Item # 53), queried against NRW’s Ancient Woodland Inventory (Item # 5) for Powys excluding BBNP.

where developments exceed particular size thresholds²⁴. The issue is complex, and there is considerable concern²⁵ that the regulatory regime and guidance are inadequate to protect ancient woodlands from diffuse pollution.

We have focused almost exclusively on poultry units. A 2017 study for Defra²⁶ found that (at UK level) 47% of ammonia emissions were from cattle farming, while 15% were from poultry. Further work will be needed to improve our picture of how farming practices across the landscape are impacting on the ecology of our native woodlands.

In this study we have drawn attention to the main existing sources of information on rural air pollution, its sources and impacts. By drawing attention to CPRW's work, we point out a single example of the changing nature of agriculture, and the urgency of adapting our regulatory regime to meet it. We will need to pay more attention to this issue in years to come. The information we have now is incomplete, and we must improve on it to improve our countryside stewardship and avoid long-term damage to our woodlands.

This extract is from:

Woodland Trust (2020) Data on ancient woodland condition in Wales. A report and evidence annexe prepared for the Woodland Trust.

²⁴ NRW guidance: <https://cdn.naturalresources.wales/media/685782/gn021-poultry-units-planningpermission-and-environmental-assessment.pdf>

²⁵ See for example NRW's Evidence Report, and the Woodland Trust's Technical Advice Note (both cited above), also various press articles, some linked from the CPRW website page above (footnote 36).

²⁶ Misselbrook, T.H. and Gilhespy, S.L. 2017. *Inventory of ammonia emissions from UK agriculture*. Defra.