Cyfoeth Naturiol Cymru / Natural Resources Wales

Written evidence to Environment and Sustainability committee – General principles of the Environment (Wales) Bill.

June 2015

SUMMARY

The creation of Natural Resources Wales (NRW) was the first step towards the integrated management of Wales' natural resources. We are developing Natural Resource Management (NRM) as the core approach to the delivery of all our responsibilities. Nevertheless, not all our functional legislation facilitates this way of working. We welcome the introduction of the Environment Bill as it represents the key second step on the journey towards integrated and sustainable management of natural resources. This Bill, along with the Wellbeing of Future Generations Act and the Planning Bill, places sustainable development at the heart of strategic decision making across Wales not just in NRW but across the wider public, private and third sector. **Everyone** will need to grasp the new ways of working set out in the Environment Bill if we are to find innovative solutions to the biggest challenges facing the natural resources of Wales.

The need for the legislation:

1. Our air, land, water, wildlife, plants and soil – our 'natural resources' – provide us with our basic needs, including food, energy, health and enjoyment. When cared for in the right way, they can help us to reduce flooding, improve air quality and supply material for construction. They also provide a home for some rare and beautiful wildlife and iconic landscapes, which improve our wellbeing and boost the economy via tourism.
2. But these natural resources are coming under increasing pressure – from climate change, from a growing population and from the need for energy production, amongst others.
3. Decades of work to understand, protect and improve our environment have taken us a long way.
4. Yet despite this, the continuing decline in biodiversity and the threats to the ability of our natural resources to continue to deliver benefits to society, poses a significant risk to the well-being of Wales. The evidence we present in our report *Snapshot of the State of Wales' Natural Resources* (Annex 1), underlines the **need for a step-change in the approach to natural resource management by all parts of the public, private and third sector in Wales.**
5. Much of the environmental legislation governing the work of NRW is functional and does not facilitate more integrated and flexible approaches to the management of our natural resources.
6. Part One of the Environment Bill builds on the best Welsh and international evidence base. We believe the provisions will facilitate a **flexible and adaptive** approach to secure the integrated and sustainable management of natural resources in Wales.

7. The definition of sustainable management of natural resources in Section 3 and the principles set out in Section 4 of the Bill are clearly aligned to the Ecosystem Approach principles defined by the UN in the Convention on Biological Diversity. We support the definition and principles.
8. Section 5 of the Bill refines our general purpose to align it to the definition of sustainable natural resource management and the principles. We are happy with the proposed changes, as the new purpose aligns much more closely with our long term vision for our organisation. Nevertheless, we recognise that the **new purpose will not change our underpinning functional legislation** but provides a more helpful framework to develop NRM ways of working.

Implementation

9. The management of our natural resources is a **shared responsibility** not just the concern of NRW.
10. At the moment public bodies and other organisations are focussing on their specific responsibilities or duties under the WFG Act and perceive that the proposals in the Environment Bill relate solely to NRW. Unless this gap in understanding is addressed, it is likely to create major challenges for implementation.
11. Under the WFG Act, the formation of Public Service Boards (PSBs) and inclusion of NRW as a core member provides an important opportunity to join up and integrate approaches to implementation.
12. However PSBs will not necessarily represent the interests of land managers (agriculture and forest/woodland), the business sector or environmental NGOs. Other arrangements may need to be developed to ensure these groups can participate effectively.
13. Area Statements could provide us with an opportunity to streamline the number of other plans that we and others produce.
14. Co-production and collaboration is central to how we propose to develop the State of Natural Resources Report and Area Statements. Annex 2 and 3 set out our propositions of how we want to work with others to produce them.
15. We are concerned that Section 15 of the Bill is too open ended and raises the expectation that NRW will provide information and lead on the implementation of area statements on behalf of other public bodies. Clarification is needed to set limits around the assistance that NRW could be asked to provide.

Financial Implications of the Bill

16. The provisions in the Environment Bill are central to our purpose of delivering an integrated approach to the sustainable management of natural resources in Wales. As the NRW business case demonstrates, efficiency savings will be realised in the longer term for us and our partners.
17. However, in the **short to medium term, implementation of the requirements in the Bill will require us to dedicate significant staff time to get through the initial increase in work.**
18. This investment is essential if we are to realise savings and efficiencies in the longer term. As we develop a better understanding of the likely costs we will discuss funding with Welsh Government.
19. Thereafter, NRM will be embedded across the organisation and will be at the heart of everything we do.

The Environment (Wales) Bill is a once-in-a-generation opportunity. Taking a joined up approach to managing our natural resources will help us to tackle old problems in new ways. To find better solutions to the challenges we face – and create a more successful, healthy and resilient Wales, now and in the future.

1. Introduction

1.1 Many of the proposals in the Bill are central to the role and remit of NRW. Our response is divided into eight sections in line with the Parts of the Bill. We have used the Committee's term of reference to structure our response. We have addressed questions two and three in our sections on 'Proposals' and 'Implementation'. Question four is addressed for each part, in paras 2.4, 3.2, 5.4, 6.2, 7.2 and 8.5 below. We do not think it is our role to address question five. We have provided more detail on the proposals on sustainable natural resource management, waste and flood risk management. The covering note cross references the different sections of this submission with the terms of reference and consultation questions defined by the Environment and Sustainability Committee.

2. Part one – Sustainable management of natural resources

2.1 The need for the legislation

2.1.1 Our air, land, water, wildlife, plants and soil – our 'natural resources' - provide us with our basic needs, including food, energy, health and enjoyment. When cared for in the right way, they can help us to reduce flooding, improve air quality and supply materials for construction. They also provide a home for some rare and beautiful wildlife and iconic landscapes we can enjoy and which boost the economy via tourism.

2.1.2 The scale of the challenges facing our natural resources in Wales is demonstrated in our report, *Snapshot of the State of Wales' Natural Resources* (Annex 1) which sets out the latest evidence from our monitoring of natural resources across Wales. Decades of work to understand, protect and improve our environment have taken us a long way. But these natural resources are coming under increasing pressure – from climate change, from a growing population and from the need for energy production.

2.1.3 In 2010, Wales, alongside other administrations in the UK and Europe, failed to meet international biodiversity targets agreed under the UN Convention on Biological Diversity[1] and triggered a number of government led reviews in Wales[2], Westminster[3] and Brussels[4][5]. The policy and scientific consensus that emerged underlined the need for a more **integrated** approach to the management of natural resources, focussing much more explicitly on the **benefits** to society of **resilient ecosystems** and the need for flexible, **adaptive management.**

2.1.4 Much of the environmental legislation governing the work of NRW is functional and does not facilitate the integrated, flexible and adaptive approaches to the management of our natural resources identified as so important in the policy and scientific evidence. The proposals in the Environment Bill, along with the WFG Act, Planning Bill, and UK Marine and Coastal Access Act (2009) provide the legislative framework to drive adaptive management of our natural resources in Wales allowing us to look at the whole picture.

2.2 Proposals for Sustainable Management of Natural Resources

2.2.1 If we are to secure new solutions to old problems we must encourage innovation and creative problem solving by working with others. The Environment Bill along with the WFG Act and Planning Bill facilitates such an approach. We anticipate the need for additional

[1] 2010 Biodiversity Target: https://www.cbd.int/2010-target/about.shtml
[2] http://www.assembly.wales/Laid%20Documents/CR-LD8384%20-%20Sustainability%20Committee%20Inquiry%20into%20biodiversity%20in%20Wales-31012011-208859/cr-ld8384-e-English.pdf
[3] http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx
[4] EC 2020 Biodiversity Strategy: http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm
[5] EC Green infrastructure Strategy: http://ec.europa.eu/environment/nature/ecosystems/index_en.htm

legislation in the future as we gather more evidence and learn from the early implementation of Area Statements.

2.2.2 The definition of sustainable management of natural resources in S3(1) and S3(2) and the principles set out in Section 4 of the Bill are clearly aligned to the principles defined by the UN Convention on Biological Diversity. We support these proposals.

2.2.3 S5(2) of the Bill refines our general purpose to align it to the definition of sustainable natural resource management and the principles. We are happy with the proposed changes, as the purpose aligns much more closely with our long term vision for the organisation:

> *Proud to be leading the way to a better future for Wales by managing the environment and natural resources sustainably.*

Nevertheless, it is important to recognise that the proposed change will not alter our underpinning functional legislation. The revised purpose serves an important role in clearly defining a framework in which we can develop NRM ways of working across the organisation and with other parts of the public, private and third sector in Wales.

2.2.4 We welcome the proposals in Section 6 of the Bill for a revised biodiversity duty for Public Bodies. Strengthening the current biodiversity duty is critically important because it will ensure that the wider public sector integrate the principles of sustainable management of natural resources and the resilience of ecosystems within their decision making processes. The improved accountability resulting from the introduction of tri-annual reporting on compliance with the duty will also address a gap identified in the 2010 Defra review of the biodiversity duty.

2.2.5 On the specific requirements in the Bill for the sustainable management of natural resources, we welcome the proposals in Section 8, 9 and 10 of the Bill which set out a flexible legislative framework to facilitate **adaptive management** of our natural resources:

1. The **State of Natural Resources Report (SoNaRR) will be developed by NRW** and will set out the current evidence base and the potential risks to the ability of natural resources to deliver long-term benefits for the wellbeing of Wales. Developed collaboratively, SoNaRR will help set the scene, will look ahead, and will prompt and be a catalyst for change. Our proposal for developing the first statutory SoNaRR is contained in Annex 2.

2. The **National Natural Resources Policy (NNRP) will be developed by Welsh Government** and will need to set the vision and "plan" for managing the issues and opportunities associated with Wales' natural resources. We believe this document plays a critical role. It needs to be clear on:
    a. priorities and outcomes **without** prescribing the activity or means of delivery;
    b. tackling conflicts at the national level through the integration of policy;
    c. alignment of funding mechanisms.

    In practice, we believe that the NNRP will be critical to driving integration and efficiency, addressing the conflicts and strategic challenges around the use and management of natural resources at national and local levels. If this does not happen there is a risk that Area Statements will get bogged down, trying to resolve issues locally when they really need to be addressed nationally.

3. The **Area Statements developed by NRW** will facilitate local action and delivery of the national priorities using the NRM approach. Developed **collaboratively**, Area

Statements will be evidence based – drawing upon evidence at the catchment and landscape scale as well as more local information. It will drive action to the appropriate level of decision making. We will use them as vehicle to engage people, communities and stakeholders in decision making. It will also need to put in place systems to **monitor** activity and report on outcomes. In the last 18 months we have set up three NRM trials to test and develop practical approaches to the implementation of NRM across Wales, to inform future development of Area Statements. Our proposal for taking these forward is contained in Annex 3.

4. The **second SoNaRR** will then capture the evidence obtained from both local delivery (Area Statements) and the overall national picture.

2.2.6 The Area Statements will also help us understand any barriers to adopting a more integrated approach to the management of natural resources. For example, working with a particular group of people in a place may highlight that a specific piece of legislation is driving a way of working that has a negative impact on the environment. Using this evidence, NRW will review if our guidance or interpretation of the law is the cause of the problem. In this situation we would work with stakeholders to revise our guidance, in line with our commitment to adaptive management. If the under-pinning legislation is the source of the problem, then the provisions in S22(1c) and S23(3) of the Bill will allow us to put a case to Welsh Ministers to temporarily suspend the specific piece of legislation. If we secure Ministerial agreement, we expect to continually monitor and review progress and will report to Ministers with recommendations which either support a future case for legislative change or not. These provisions therefore allow for adaptive management and governance.

2.2.7 Co-production is one of the central principles of sustainable management of natural resources as reflected in Section 4c of the Bill. We are committed to working collaboratively with a wide range of stakeholders in order to better identify environmental problems and solutions. This is not always simple or straight forward and we welcome the provisions in Sections 12, 13 and 14 of the Bill to place a clear duty on the wider public sector to work with us to prepare SoNaRR and Area Statements. Although we recognise that we must support other parts of the public sector with the provision of information and evidence, we are concerned that Section 15 is too open ended, and raises the expectation that NRW will provide information and lead delivery of Area Statements for other public bodies.

2.2.8 We welcome Sections 16-21 that set out revised powers for entering into management agreements for the achievement of any of our functions. Our current powers are limited to nature conservation, landscape and recreation interests. We consider this change will complement the set of tools needed to manage natural resources adaptively. Some examples of how these may be applied include:

- Permitting flooding of land in order to complement or even reduce the need for hard flood defences.
- Management agreement with landowners to block up drains to restore peat bogs. Furthermore funding could be derived from water companies if a saving in water treatment costs for sediment removal was identified.
- Management agreement with a private woodland owner to manage their woodlands and sell timber, or to include sales of timber in NRW e-sales auctions i.e. act as a broker for private woodlands and timber purchasers.

These could potentially be considered forms of “payments for ecosystem services”.

2.3 Implementation

2.3.1 We are concerned that public bodies and businesses may not yet fully appreciate the importance of looking at the Environment Bill alongside the WFG Act, Planning Bill, and Marine and Coastal Access Act, and do not understand the linkages and flows of information between the "products" produced under each piece of legislation. At the moment organisations are focussing on their specific responsibilities or duties under the WFG Act and perceive that the proposals in the Environment Bill relate solely to NRW. Unless this gap in understanding is addressed now, it is likely to create major challenges for implementation. Of equal importance is the risk of duplication, missing major opportunities for streamlined and efficient sharing of information and evidence.

2.3.2 Under the WFG Act, the formation of PSBs and inclusion of NRW as a core member, provides an important opportunity to join up and integrate approaches to enable the implementation of provisions in the Environment Bill. We recognise the value of using the PSBs to foster a common understanding of the opportunities and benefits in a particular place. There will be opportunities to share evidence from both SoNaRR and the Area Statements to inform the preparation of needs assessments and well-being plans. However, it is important to recognise that PSBs will not necessarily represent the interests of land managers (agriculture and forest/woodland), the business sector or environmental NGOs. These are potentially significant gaps. It may therefore be necessary to develop other governance mechanisms linked to PSBs to facilitate decision making or in some cases, create separate processes.

2.3.3 Our approach to Area Statement will need to be flexible. It will vary according to the priorities identified in the National Natural Resources Policy, the type of resource at stake, the location and the stakeholders involved (see Annex 3). We will draw on the learning from catchment approaches to managing our water environment. Catchment approaches are evolving to consider landscape scale solutions as they address such difficult issues as diffuse pollution. We recognise that our underpinning environmental evidence will normally be at a catchment or a landscape scale. But we may need to translate this to different spatial scales to make it more meaningful and compelling for the people, communities and decision makers we need to work with in the spirit of the principles of sustainable natural resource management.

2.3.4 We recognise that the Area Statements could provide us with an opportunity to streamline the number of other plans that we and others produce. It means that issues which have traditionally been covered in a separate functional plan could be included in the Area Statement and no longer be produced separately. This will be a change for our staff as well as affected partners and stakeholders. Nevertheless, it is important to recognise that a number of plans that we produce are required under EU Directives with clearly defined requirements. Subsuming these within the Area Statements will require a longer time frame. The scope for including other plans within an Area Statement will also be very sensitive to the geographical scale and the timetable for their production. This will require careful negotiation with Welsh Government as well as other partners and stakeholders.

2.3.5 We believe the requirement in the Bill S10(6) for NRW to consider whether "another plan, strategy or similar document should be incorporated into the Area Statement" is appropriate, and should extend to plans and strategies beyond the jurisdiction of NRW. The drive to ensure integration can be aided further through the use of the S13 power to issue guidance to other public bodies, and the S14(2) power for NRW to request assistance. It may be simpler and stronger to have a duty on public bodies to consider for themselves where and how they could implement measures through their existing plans and programmes.

2.4 Financial implications of Part 1 – Sustainable Management of Natural Resources for NRW

2.4.1 Through the development of the Regulatory Impact Assessment (RIA) by Welsh Government in the summer and autumn of 2014, NRW staff have provided advice and evidence to inform the approach, assumptions and costs underpinning the Natural Resource Management aspects. We provided the best information available to us at the time. The RIA sets out four options for implementation of the Area Statements. We acknowledge that these were developed as illustrative examples and should not be seen as NRW's preferred approach. As we have refreshed our own NRM transformational programme, we have developed a better understanding of the scale of the changes we need to implement such as IT, staff training, new systems and process to develop Area Statements. These will undoubtedly incur additional costs which we are currently estimating.

2.4.2 As the NRW business case demonstrates, efficiency saving will be realised in the longer term for us and our partners. Nevertheless, in the short to medium term the Environment Bill will require us to invest staff time and money to realise savings and efficiencies in the longer term. Thereafter, NRM will be embedded across the organisation and will be at the heart of everything we do. As we develop a better understanding of the likely costs we will discuss funding with Welsh Government.

3. Part Two: Climate change

3.1 The need for the legislation

3.1.1 We believe the Part 2 provisions provide an appropriate framework for the development of climate change targets and carbon budgets for Wales. In early 2014 we recommended the consideration of statutory Welsh climate change targets. In the Ministerial briefing we stated that "Statutory emission reduction targets in Wales would raise their profile, but more importantly would be a clear signal across government departments and beyond of the imperative of ensuring they are met".

3.1.2 Statutory emission reduction targets foster long term and robust strategies, policies and investments by the public sector, business and industry to ensure their compliance with the targets. It provides a greater degree of certainty for business, acting as a clear signal of future intent that should provide confidence for expansion of the green economy.

3.1.3 Other devolved administrations that have climate change mitigation targets also have provisions for adaptation as well. The UK Act includes statutory requirement for a 5-yearly reviewed National Adaptation Plan for England and the Scottish Act makes requirement for Scottish Ministers to produce an adaptation programme, report on progress and update.

3.1.4 We recognise that Part 1 of the Environment Bill includes principles of 'manage adaptively' 'take account of the short, medium and long-term consequences', 'take account of the resilience of ecosystems' including 'the adaptability of ecosystems'. We also note that the NNRP must consider climate change mitigation and adaptation. It follows that the Area Statements will need to specifically address climate change. The WFG Act by implication also requires public bodies to consider long-term and preventative measures in the exercise of their duties under that Act. Together we acknowledge this constitutes a programme for adaptation.

3.1.5 However in the absence of a specific National Adaptation Programme, Welsh Ministers may wish to consider whether by integrating programmes for adaptation into these functions, all sectors are covered. Careful monitoring will need to take place to assess

whether there may be gaps. If any gaps emerge appropriate mechanisms should be put in place to address those gaps.

3.2 Financial implications of Part 2 for NRW – Climate Change

3.2.1 We will inevitably be drawn into activities in relation to Part 2 of the Bill in several ways, for example, providing information and advice in the setting, monitoring and achievement of targets. This would be consistent with our current roles and functions.

3.2.2 In our remit letter for 2015-16 Welsh Government has provided us with £825,000 specifically to examine how we might become a "carbon positive" organisation. In undertaking this work, we expect to gain a better understanding of the financial implications for NRW.

4. Part Three: Charges for Carrier Bags

4.1 We are supportive of the additional powers for Welsh Minsters to charge for other carrier bags. We believe this change will further support the incentive for reuse, thus safeguarding valuable resources. Reducing the number of bio-degradable carrier bags in use across Wales will, over time, reduce the number littering our rivers, beaches and marine environments and inadvertently entering the food chain. This measure provides a useful mechanism to establish and raise awareness of the behaviour change necessary to deliver Welsh Government ambition for zero waste.

4.2 We would support a policy preference for environmental good causes to benefit from the proceeds of the carrier bag charges. We recognise a possible role for NRW to work with environmental charities to help inform how such monies could be put to best use to maximise the benefits for the environment and people of Wales.

4.3 There are no cost implications on NRW of this Part.

5 Part Four: Collection and Disposal of Waste

5.1 The need for the legislation

5.1.1 We believe the proposals will assist delivery of Towards Zero Waste policy objectives and increase the quantity and quality of recyclates, supporting the establishment of a circular economy in Wales.

5.1.2 The focus of many of the policy and legislative drivers to date has been on municipal waste. This has been very successful, with Local Authorities collectively achieving 54% recycling rate last year. However, household waste accounts for just 16% of the overall waste produced in Wales. The vast majority of waste is generated by the industrial, commercial, construction and demolition sectors. The proposals will apply to all waste streams and hence has implications for all sectors.

5.1.3 The existing separate collection regulations are limited in effectiveness as they only place a requirement on waste collection operators, including private companies, social enterprises and local authorities, to provide their customers with separate collections for paper, metal, plastic and glass. There is no direct responsibility for the producer to participate.

5.1.4 Any change to waste legislation must take care to avoid any perverse environmental or economic outcomes. Such issues could result, in part, from the lack of suitable treatment /reprocessing facilities within Wales and further afield. Whilst we strongly support the principles of waste recovery and the obvious benefits to the economy and environment of Wales from the appropriate recycling of wastes as a resource, this can only be in the context of wastes being managed appropriately, with necessary environmental safeguards.

5.2 Proposals for separate collection and disposal of waste

5.2.1 We believe the proposals in Section 66 to require non-domestic premises to put their waste out for collection, will provide a clearer and more enforceable framework.

5.2.2 We support the proposals for materials, such as food waste, to be collected separately. This will divert these materials from disposal at landfill or incineration, enabling a useful resource to be captured and recovered/recycled. Any proposed changes would require detailed modelling and the benefits of international experience where available, to ensure that all potential outcomes - positive and negative - are identified to avoid perverse consequences.

5.2.3 The inclusion of wider powers to ban some recyclable waste from incineration set out in Section 68 is sensible and working in conjunction with proposed landfill bans, would provide a useful additional driver to ensure resources are not wasted. This will also provide flexibility for the Welsh Government to modify the legislative regime in support of future policy objectives. The consequence of any future proposed changes would need to be fully considered (as in this case) before introduction.

5.2.4 In addition, when considering Local Authority Recovery Targets, Landfill Allowances Scheme and landfill tax, it is not yet clear that further regulatory interventions are necessary. We would like to see further voluntary measures to increase participation in recycling (for businesses) and by the waste industry considered alongside proposals for regulation and enforcement. These measures aim to change behaviour and so there is also a need for education to effect behaviour change, by Welsh Government, waste service providers (private sector and Local Authorities), and other appropriate bodies including NRW.

5.3 Implementation

5.3.1 We will continue to work with Welsh Government to provide technical information and to advise on the practical implications of the proposed changes. It is likely that the provisions will require NRW to produce advice, guidance and training for our staff as well as for our customers. Some permits and compliance assessment tools will need to be varied to take account of the additional requirements. These new duties will also require additional inspection of waste producers.

5.3.2 To ensure that the implementation of these requirements are effective it is important that Welsh Government provide adequate funding to the regulator to enable an appropriate compliance and enforcement regime.

5.3.3 Whilst we support the proposal in Section 67 to ban food waste from disposal at sewer, we do not believe NRW is the most appropriate body to regulate. We would have limited interaction with the businesses affected by this requirement; sewerage undertakers or Local Authority food hygiene inspectors may be better placed to regulate this.

5.3.4 Some small businesses may have limited space for separate recycling bins for all the waste streams. Also, if only small quantities of some waste categories are produced, small businesses may have difficulty obtaining a waste contractor at an economic rate. Early

feedback from companies surveyed as part of the 2012 waste arisings survey has indicated that companies are already recycling and segregating where it is economic to do so, whereas small businesses find this more challenging. There may be opportunities to innovate. For example, drawing on initiatives from Europe where street-level recycling schemes operate for small businesses. Collection system providers could also adapt their service with encouragement from Welsh Government, prompting the markets to respond and adapt to these changes so that this material is appropriately managed and recycled and recovered in a timely fashion, avoiding unnecessary stockpiling of material.

5.3.5 We are happy to work with Welsh Government and the Waste and Resources Action Programme to consider how we can aid waste producers, particularly small businesses, and to ensure that waste management service providers understand the new requirements and adapt their waste management practises.

5.3.6 Within our offices and facilities we want to help the move towards a circular economy in Wales, though our own actions in relation to our own use of resources. We already actively manage our waste aiming to minimise waste at source and ensuring any waste we do produce is stored securely, segregated and transferred for recycling. We are happy to share the experience we have had with others.

5.4 Financial Implications of Part 4 Collection and disposal of waste for NRW

5.4.1 We have worked with Welsh Government in their development of the indicative regulatory impact assessment to consider the implications of the waste provisions on NRW. We are happy that the indicative costs presented provide a reasonable reflection of the costs we may incur implementing these new regulatory duties. The provisions included in the Bill will allow Welsh Government to develop regulations. Additional information related to the implementation of these regulations will also be available. We understand that the regulations will be subject to a further RIA. This process will refine the cost estimates and provide us with greater certainty on the likely costs we will incur.

6 Part Five: Fisheries for shellfish

6.1 Need for the legislation

6.1.1 We believe the changes proposed in the Bill will help to enhance the management and protection of marine protected areas and the wider marine environment.

6.1.2 Currently the Sea Fisheries (Shellfish) Act 1967 grants the Minister the powers to issue a certificate to the grantee of a Several or Regulating Order to cease activities within the prescribed area in which their rights are exercisable, only if they are not properly cultivating the ground. The new proposals will strengthen and widen the Minister's ability to intervene in the operation of a Several or Regulating Order if it is perceived the grantee's activities or external circumstances such as impacts from non-native species are causing environmental harm by the issuing of a Site Protection Notice.

6.2 Financial implications of Part five for NRW – fisheries for shellfish

6.2.1 There are minimal cost implications on NRW of this Part. NRW may be required to provide evidence to help determine whether environmental harm would occur.

7 Part Six: Marine Licensing

7.1 Need for the legislation - Marine Licensing

7.1.1 We agree that having a wider suite of charging powers will allow NRW to achieve greater cost recovery in undertaking its delegated functions under the Marine Licensing regime. This will enable NRW to continue to offer services such as more thorough pre-application advice, which will benefit both the applicant and NRW's licence determination process. In summary, it will allow NRW to provide a marine licensing regime that has fairer charges and is fit for purpose. We are part of a Welsh Government Working Group developing the approach to implementation working with marine stakeholders across Wales.

7.2 Financial implications of Part six for NRW – Marine Licensing

7.2.1 The powers will enable cost recovery therefore having a positive financial impact on NRW.

8 Part Seven: Miscellaneous

8.1 Need for the legislation - Flood risk management committee

8.1.1 We believe that it is appropriate to disband the current FRMW committee and replace it with a new committee that advises at a Wales wide basis on the whole of the flood risk management agenda. NRW is one of 28 statutory flood and coastal risk management authorities and our current committee's remit is limited to the activities of NRW on managing river and coastal flood risk. The management of local sources of flooding such as surface water and coastal erosion is led by Local Authorities in partnership with water and sewerage companies. A wide range of infrastructure operators and resilience partners play key roles. Therefore it is sensible to have a committee, led by and responsible to Welsh Ministers, with the remit to look at the complete picture, to ensure investment is targeted and action delivered in the most efficient and effective way.

8.1.2 We believe it is very important for the new committee to be a key conduit for advising on the strategic direction for flood risk management. This includes advising on the shaping and implementation of WG's national Flood and Coastal Erosion Risk Management Strategy, discussing the resolution of barriers to effective flood risk management and sharing of good practice approaches.

8.2 Need for the legislation - S83. Repeal of requirements to publish in local newspapers etc.

8.2.1 We welcome the repeal of what is now an outdated form of communication. It will enable NRW to offer a more bespoke and effective approach to how it consults local communities on proposals relating to its management of Internal Drainage Districts (IDDs), such as boundary revisions, the raising and allocation of drainage rates etc.

8.3 Need for the legislation - S84. Power to make provision for appeals against special levies

8.3.1 We welcome the addition of this appeal mechanism to the Welsh Ministers regarding the special levies charged to Local Authorities by NRW.

8.3.2 Following the transfer of functions of the Welsh Internal Drainage Boards, NRW now sets these levies, along with land owner rates, to recover costs incurred from the exercise of

functions relating to land drainage within our IDDs. Therefore we recognise the need to create an alternative mechanism for Local Authorities for arbitration on NRW's IDD levy setting.

8.4 Need for the legislation - S85. Power of entry: compliance with order for cleansing ditches etc.

8.4.1 We welcome the intention to clarify that agents authorised by the Welsh Government have the right of entry to land to enable investigation of alleged non-compliance with an ALT Order in cases where access is refused by a party to that Order. There was previously no mechanism to allow for entry to land to enable investigation

8.5 Financial Implications of Part 7. Miscellaneous – Flood Risk Management for NRW

8.5.1 The typical annual costs for the running of NRW's current committee are circa £21,000. As the new committee's remit and function will be to advise the Welsh Government, with its Chair responsible to Welsh Ministers and secretariat provided by WG, it will be appropriate for NRW's flood Grant-In-Aid to reduce by that amount.

8.5.2 NRW estimates it costs £40,000 in staff time preparing papers and attending its current committee meetings. A significant proportion of that work involves monitoring and reporting project and financial progress on its annual flood risk management capital and revenue programme. The Bill's proposals for the scrutiny of that work to come under the remit of NRW's Board means this work will continue at current levels, but reporting to a different body. NRW is expected to play a key role in the Welsh Government's new committee, due to our all-Wales remit to collate and supply data on flood risk management implementation on a strategic and operational basis. As such, we see the Bill's proposed changes to NRW's roles as cost neutral in terms of NRW's future governance requirements and input to the new committee.

9 Part 8: General

9.1 We have no comments or observations on this section.

10 Schedules

10.1 We acknowledge the inclusion of Schedule 2 Para 8 – which makes an amendment to WFG Act so that it refers to the potential role of Area Statements as an importance evidence base to support the well-being needs assessment.

10.2 There is a key opportunity here for the Environment Bill to help provide further clarity around the links to the land-use planning, and marine planning systems in line with our comments in para. 2.3.1 above. For example, we would suggest a similar amendment to the S3. Planning (Wales) Act to ensure that s60 (5) of the Planning and Compulsory Purchase Act (2004) (PCPA) includes reference to the NNRP.

10.3 A similar clause could be inserted at Section 6, in PCPA - 60I (6) referring to Area Statements.

10.4 Consideration should be given to inserting a paragraph in Schedule 6 (3) of the Marine and Coastal Access Act (2009) "Marine plans to be compatible with certain other plans" to draw reference to the National Natural Resources Policy.

Natural Resources Wales

Navigation Document – NRW's response to the Environment and Sustainability Committee call for evidence on the Environment Bill

12th June 2015

Main Document – Written Evidence. This documents provides our summary and supporting evidence on each part of the bill. The table below helps readers to navigate alongside the terms of reference of the Committee.

Annex 1 – Snapshot of the State of Wales' Natural Resources. This is we the current evidence on the state of our natural resources in Wales and provides a snapshot of the main challenges that will need to address if we are to achieve the goal of managing our natural resources sustainably. The report is based on the evidence that we currently have available to us in NRW

Annex 2 – Our proposition for developing the State of Natural Resources Report. This sets out Natural Resources Wales' (NRW) proposition for the development of the State of Natural Resource Report (SoNaRR) and the principles and approach we will adopt to deliver it.

Annex 3 – Our proposition for Area Statements. This document sets out Natural Resources Wales' (NRW) vision for the development and implementation of Area Statements, and the principles and approach we will adopt.

ToR : To consider the general principles of the Environment (Wales) Bill including:	**Relevant section, paragraph or page number(s)**
1. The need for legislation in the following areas –	
Planning and managing Wales' natural resources at a national and local level;	Section 2.1; Paras 2.1.1 – 2.1.4; Page 3 Annex 1
Providing Natural Resources Wales with a general purpose linked to statutory 'principles of sustainable management of natural resources' defined within the Bill;	Paras 2.2.2 – 2.2.3; Page 4
The powers available to Natural Resources Wales (NRW) to undertake land management agreements and experimental schemes;	Para 2.2.8; Page 5
Providing a requirement for public authorities to maintain and enhance biodiversity;	Para 2.2.4; Page 4
Creating a statutory framework for action on climate change including targets for reducing emissions of greenhouse gasses;	Section 3.1; Paras 3.1.1 – 3.1.3; Page 7
Reforming the law on charges for carrier bags;	Section 4; Paras 4.1-4.2; Page 8
Providing powers to Welsh Ministers in relation to waste recycling (including the separate collection of waste); food waste treatment and energy recovery in business.	Section 5; Paras 5.1.1 – 5.1.4; Paras 5.2.1 – 5.2.4; Pages 8-9
Making provision about several and regulated orders for fisheries for shellfish;	Section 6; Paras 6.1.1 – 6.1.2; Page 10
Fees for marine licences;	Section 7; Para 7.1.1; Page 11
Establishing a Flood and Coastal Erosion Committee; and	Section 8.1; Paras 8.1.1 – 8.1.2

Changes to the law on land drainage and bylaws made by NRW	Section 8; Paras 8.2.1 - 8.4.1; Pages 11-12
2. Any potential barriers to the implementation of these provisions and whether the Bill takes account of them;	**Part 1** Section 2.3; Paras 2.3.1 – 2.3.5; Page 6 Section 10; Paras 10.1 – 10.4; Pages 12-13 **Part 2** Section 3; Paras 3.1.3 – 3.1.5 **Part 3** Section 5: Paras 5.1.3-5.1.4; 5.2.3-5.2.4; 5.3.1 – 5.3.6; Pages 8-10
3. Whether there are any unintended consequences arising from the Bill;	Section 2; Para 2.2.6 refers, Page 5.
4. The financial implications of the Bill (as set out in Part 2 of the Explanatory Memorandum (the Regulatory Impact Assessment, which estimates the costs and benefits of implementation of the Bill);	**Part 1** Section 2.4; Paras 2.4.1 – 2.4.2; Page 7 **Part 2** Section 3.2; Paras 3.2.1-3.2.2; Page 8 Section 5.4; Para 5.4.1; Page 10 Section 6.2; Para 6.2.1; Page 11 Section 7.2; Para 7.2.1; Page 11 Section 8.5; Paras 8.5.1 – 8.5.2; Page 12

5. The appropriateness of the powers in the Bill for Welsh Ministers to make subordinate legislation (as set out in Chapter 5 of Part 1 of the Explanatory Memorandum, which contains a table summarising the powers for Welsh Ministers to make subordinate legislation.	We do not consider it appropriate for NRW to comment on this matter.
Consultation Questions Part 1: Natural Resources Management • Do you agree with the Welsh Government's proposals on definitions for 'natural resources' and 'sustainable management of natural resource'? Are there things missing that you think should be included? • What are your views on the proposals for a National Natural Resource Policy? Is the Bill clear enough about what this will include? • Do you agree with the proposals for area statements? What should these cover and is the process for their development clear enough in the Bill? • What are your views on the proposal to strengthen the biodiversity duty on public authorities operating in Wales? • Are you content with the proposals for NRW to have wider powers to enter into land management agreements and have broader experimental powers?	Covered in our response to Part 1 Section 2; Paras 2.1.1 – 2.3.5 See also Annex 3 – "NRW Proposition for developing Area Statements".

Part 2: Climate Change • Do you agree with the proposals for the 2050 target? • For your views as to whether the interim targets should be on the face of the Bill? • Do you believe that the introduction of carbon budgets is a more effective approach than the 3% annual emissions reduction target that is currently in place in Wales? • What are your views on what emissions should be included in targets? All Welsh emissions or those within devolved competence? • Do you agree with the Bill's proposals as to what should happen if the Welsh Ministers fail to meet emissions targets or carbon budgets? • What should the role of an advisory body on climate change be?	This is covered in our response to Part 2 Section 3; Paras 3.1.1 – 3.1.5; Page 7
Part 3: Carrier Bags • Do you agree with the proposal that Welsh Ministers should have powers to raise a charge on all types of carrier bags not only single use bags? • Do you agree with the proposal that Welsh Ministers should have powers to raise different charges on different types of bags on? • Do you agree that the profits from the sale of carrier bags should be directed to all charitable causes rather than just environmental ones?	This is covered in our response to Part 3 Section 4; Paras 4.1 – 4.2; Page 8

Part 4: Collection and Disposal of Waste • For your views on whether the Welsh Ministers need further powers to require that certain types of waste are collected, treated and transported separately? • Do you agree that non-domestic premises should be required to put their waste out for collection in line with any separation requirements set out by the Welsh Government? • Whether you agree that the Welsh Government needs wider powers to ban some recyclable waste from incineration? • What will the impacts of these waste proposals be for you or your organisation? • Are there other waste proposals that you think should be included in the Bill?	This is covered in our response to Part 4 Section 5; Paras 5.1.1 – 5.4.1; Pages 8-10
Parts 5 & 6: Marine Licensing and Fisheries for Shellfish • Do you agree with the proposals to introduce charges for further aspects of the marine license process? What will the impacts of these changes be for you? • Do you agree with the proposals to give Welsh Ministers powers to include provisions in Several and Regulating Orders to secure protection of the marine environment? • For your views on the proposals to give Welsh Ministers powers to issue site protection notices where harm may have been caused by the operation of a fisheries Order to a European marine site? • Are there any other marine and fisheries provisions you would like to see included in the Bill?	This is covered in our response to Part 5 and Part 6 Sections 6&7; Paras 6.1.1 – 7.2.1; Pages 10-11

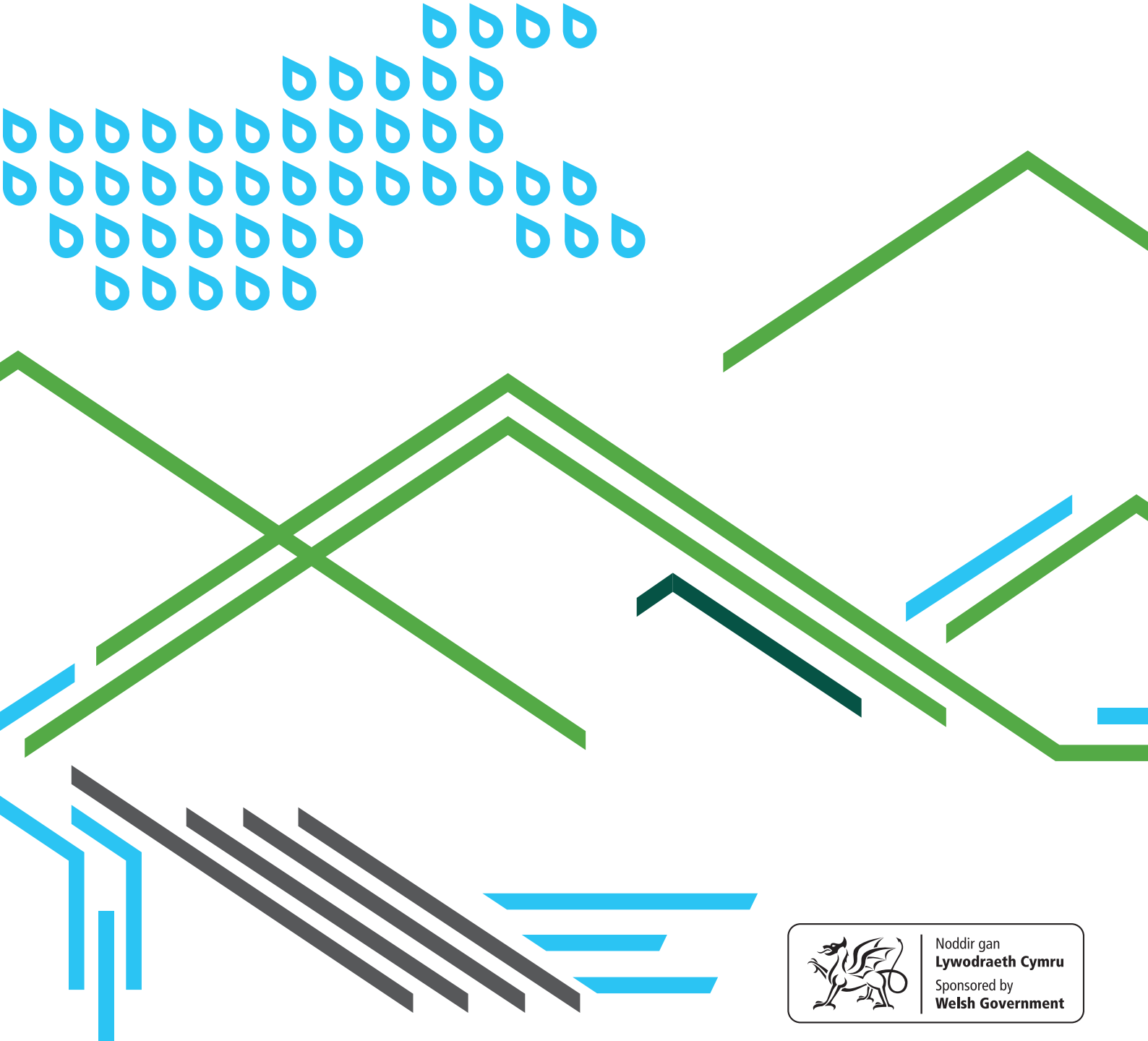
Part 7: Flood and Coastal Erosion and Land Drainage • Do you agree with the proposals to replace the Flood Risk Management Wales committee with a Flood and Coastal Erosion Committee for Wales? • Whether you agree with the proposal for powers to be given Welsh Government agents to enter land to investigate alleged non-compliance with an Agricultural Land Tribunal order in relation to drainage?	This is covered in our response to Part 7 Section 8; Paras 8.1.1 – 8.5.2; Pages 11-12
Overarching Question For your views on the relationship between this Bill and the Well-being of Future Generations Act 2015 and the Planning (Wales) Bill? Are the links and connections between them clear?	This is covered in two parts: Section 2.3; Paras 2.3.1 – 2.3.2; Page 6 Section 10; Paras 10.1 – 10.4; Page 12

Finance Questions What are your views on the costs and benefits of implementing the Bill? (You may want to consider the overall cost and benefits or just those of individual sections) **You may also want to consider:** • How accurate are the costs and benefits identified in the Regulatory Impact Assessment? • Whether there are any costs or benefits you think may have been missed? • What is the cumulative impact of the costs or benefits of the Bill's proposals for you/your organisation? • Do you think 10 years (2016-17 to 2025-26) is an appropriate time period over which to analyse the costs and benefits? • The cumulative cost and/or benefit to organisations who will be affected by the Well-being of Future Generations (Wales) Act 2015, the Planning Bill and the Environment Bill? • Are there any other options that would achieve the intended effect of the Bill in a more cost effective way?	This is considered as part of our response to question 4 above.

Cyfoeth Naturiol Cymru
Natural Resources Wales

A Snapshot of the State of Wales' Natural Resources

// Current evidence on the state of our natural resources in Wales.



Noddir gan Lywodraeth Cymru
Sponsored by Welsh Government

A Snapshot of the State of Wales' Natural Resources

In this report we set out current evidence on the state of our natural resources in Wales.

It has been prepared to inform the passage of the Environment Bill through the National Assembly, providing a snapshot of the main challenges that we will need to address if we are to achieve the goals of managing our natural resources sustainably reversing the decline in our biodiversity by maintain and enhance healthy and resilient ecosystems.

The report is based on published information and evidence that we have readily available to us in NRW. We have not yet started the more collaborative approach required to pool our knowledge in Wales and present a more comprehensive picture of the state of our natural resources. This report is designed to start the discussion and process of how we can improve the evidence base to inform the preparation of the State of Natural Resources Report (SoNaRR) that we will publish in autumn 2016 and subsequent reports thereafter, making best use of evidence held by all parties.

For some of our natural resources we already have a comprehensive collection of environmental data and evidence that allows us to understand much about their condition. Most of this data has been captured to meet our statutory duties to act and report under the EU Directives and other legislation that has been introduced since the 1970s, and which for the most part, is aimed at tackling specific environmental issues. For example, we have a relatively good understanding of the condition of our freshwaters from the monitoring we are required to do for the EU Water Framework Directive and the water quality directives that preceded this.

For other natural resources our data is more variable, both in quality and extent. For instance, we do not have widespread monitoring programmes for soils, air quality, or many of our animal and plant species, and consequently our understanding of the state of these natural resources and the structure and functioning of their supporting ecosystems is often less well developed.

The shift we are making now to sustainable management of our natural resources will require us to look at things in a new way and to fill many of the gaps we have in our knowledge and understanding. We will need to take a more integrated approach – one that looks at the whole picture rather than focusing on individual parts of the environment. We will also need to better understand and present the interconnections between natural resources and the wellbeing of people communities and businesses in Wales.

We are making some progress in this respect already. Our understanding of the complex interactions between air, land and water and how these impact on ecosystems has developed significantly in recent decades. The approach we use to manage our river systems and adjoining coastal waters is a good example of this. We manage the broad range of air, land and water-based pressures that affect our rivers at the catchment scale, recognising that a pressure impacting on one part of a catchment, whether it be a pollutant

affecting water quality or a barrier restricting fish migration, will usually affect the functioning of the river system as a whole. By taking this integrated approach to managing pressures at source we have been able to make improvements to air, land and water quality more efficiently.

Despite this progress there is still a significant gap between the established monitoring, data and environmental indicators that we currently use and the integrated knowledge-base that we will need to inform sustainable management of our natural resources. New knowledge will be needed, for instance, to improve our understanding of ecosystem functioning and environmental limits; to develop our ability to model and forecast future pressures; to understand how ecosystem condition translates into social and economic benefits; and to support the development of effective indicators to provide a comprehensive and informative picture of the state of our natural resources.

It will take time and new ways of working to gather this knowledge. We will need to work much more closely with our partners to identify new and innovative ways of capturing and exchanging data. We also need to ensure that the data we use is of appropriate quality and that we have the permissions to publish it.

We're starting out on this journey now. The evidence in the following chapters demonstrates where we are currently in understanding the state of our natural resources, highlighting some of the bigger challenges we face in managing our natural resources sustainably.

Air story

Essential for life, the quality of the air has a direct impact on people, increasing or decreasing life expectancy. In 2011, the Environmental Audit Committee noted the costs of poor air quality to UK society of around £16 billion, reducing life expectancy on average by six months[1]. Certain pollutants in the air also impact on plants and animals, and their biodiversity. Some are also of global concern (such as greenhouse gases) and some raise public concerns (such a radiological materials).

To address the harm to human health and the environment from such pollutants, there have been numerous legislative controls put in place including national annual emission limits, ambient air quality limits and sector specific measures and controls. These have resulted in significant reductions in some pollutants over the last three decades. There remain challenges around particulates, ozone and nitrogen oxides, and continued pressures on sensitive habitats from acid gases and nitrogen deposition, as well as greenhouse gases and climate change

In 2012, air pollution from European industrial facilities cost at least €59 billion. A small number of industrial facilities are responsible for the majority of the damage costs — half of the total damage cost across Europe occurs as a result of emissions from just 147 (or 1 %) of the 14,325 facilities assessed between 2008 to 2012[2].

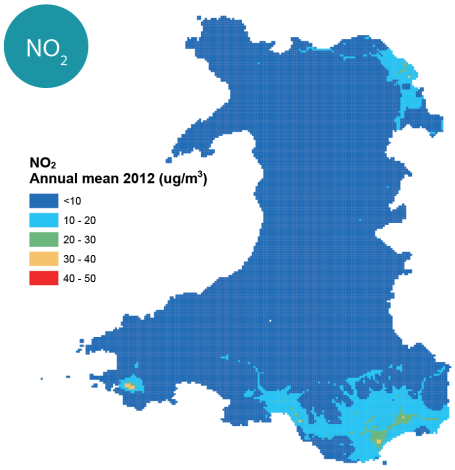
Air Evidence

The evidence that follows is a summary of the state of Wales' air as we currently understand it. Measures we use to describe the pressures affecting the air and benefits or risks identified are included at a high level. There are gaps in our knowledge and there will be other ways of showing how the economy, the environment and the people of Wales are reliant on each other to ensure a resilient Wales for the well-being of future generations. This will be explored further as we develop the State of Natural Resources Report, the first of which is to be published in the Autumn of 2016.

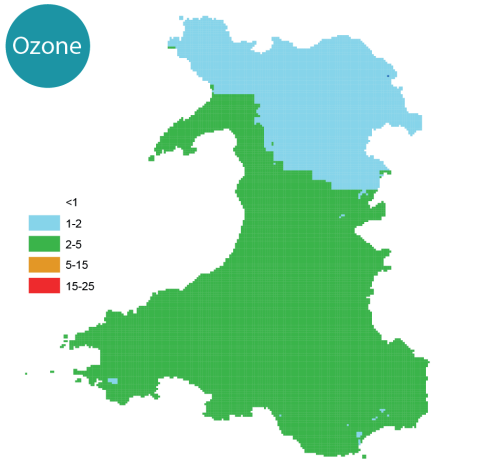
State and pressures

The quality of Welsh air can be visualised using modelled maps of background concentrations. Ricardo-AEA calculate concentrations from the National Atmospheric Emissions Inventory (NAEI) data using dispersion modelling. Results from National monitoring networks across Wales are used to calibrate the model output and the maps are verified against local authority monitoring data.

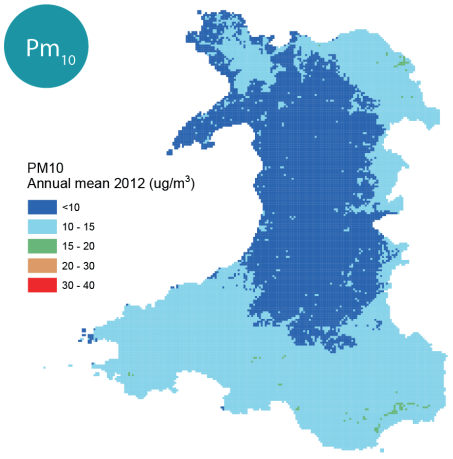
Modelled maps of background concentrations



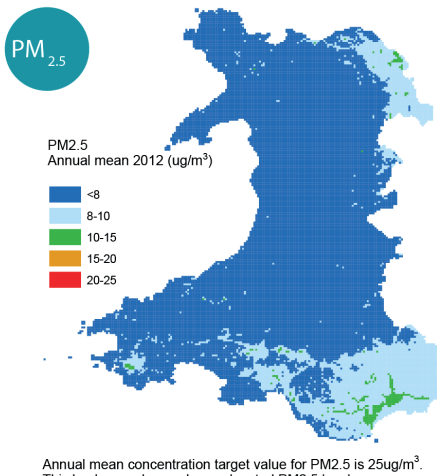
Annual mean concentration limit value for NO_2 is 40ug/m^3.
This background map shows elevated NO_2 levels are assiciated with urban areas and principal road links



Annual mean concentration target value for ozone is 120ug/m^3 as an 8 hour mean, not to be exceeded more than 25 times per year averaged over 3 years.
This background map shows the number of days over the target value in 2012



Annual mean concentration limit value for PM10 is 40ug/m^3.
This background map shows elevated PM10 levels are associated with urban areas and major roads



Annual mean concentration target value for PM2.5 is 25ug/m^3.
This background map shows elevated PM2.5 levels are assiciated with urban areas and major roads

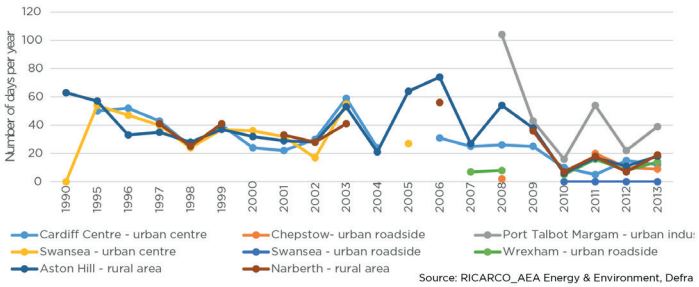
Source: Ricardo-AEA

The UK's Air Quality Strategy sets out Air Quality Standard Objectives as minimum or zero risk levels. They are set in relation to scientific and medical evidence on the effects of the particular pollutant on health, or, in the appropriate context, on the wider environment.

Moderate or high air pollution days[3]

Air quality across Wales varies from day to day.

Trends in number of days when air pollution is moderate or higher in rural zones and urban agglomerations



Levels of individual pollutants are measured at National Automated Monitoring Network sites across Wales. Concentrations of the pollutants are analysed to determine the number of days at each site on which the pollution is moderate or higher, i.e. when concentrations for at least one of the pollutants exceeds the National Air Quality Standards.

The number of days where air pollution was moderate or higher at the Cardiff Urban monitoring site reduced between 1995 and 2013. Of all sites in Wales, the Port Talbot urban / industrial monitoring site had the most days where air pollution was moderate or higher in 2013.

As in the rest of the UK, particulates and ozone caused the vast majority of the moderate or higher pollution days in 2013, either separately or in combination with each other. These pollutants are influenced by weather, which contributes to the variability over time. Air quality monitoring in Wales is undertaken both by Local Authorities, and through National Networks managed by the Welsh Government

Summary of latest Exceedances[4]

Where the substance is a priority pollutant, a summary of compliance with Air quality Strategy (AQS) Objectives or European Union (EU) limit values are included later in this chapter. In addition, no monitoring sites in Wales exceeded AQS Objectives or corresponding EU limit values for carbon monoxide, benzene or lead during 2013. No monitoring sites in Wales exceeded the EU target values for arsenic, cadmium or benzo(a)pyrene in 2013. One site (Pontardawe Tawe Terrace), which is in an industrial area, exceeded the EU target value for nickel in 2013.

The seven priority air quality pollutants

Emissions of all seven priority air quality pollutants have declined since 1990. Of these, the rate of decline is similar for particulates, nitrogen oxides, non-methane volatile organic compounds, sulphur dioxide and carbon monoxide. Lead shows a much higher rate of reduction from 1990 to 2000 due to the phasing out of leaded petrol. Ammonia emissions have declined at a slower rate than other pollutants.

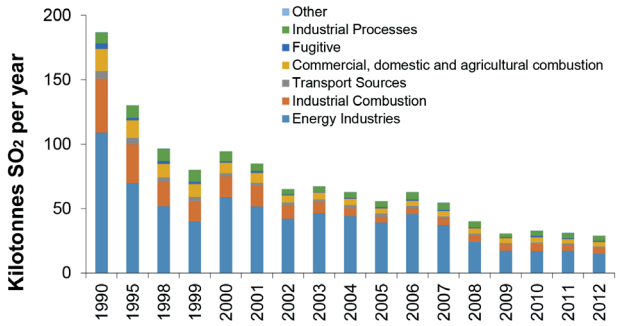
Natural Resources Wales regulates emissions to air for major industrial and waste sites where an environmental permit is required to operate. Other regulators manage emissions from sources like transport and lower hazard businesses. Ambient air quality is managed by the Local Authority who have a duty to declare air quality management areas when the appropriate standards are not met.

Sulphur Dioxide (SO_2)

No monitoring sites in Wales exceeded any Air Quality Strategy (AQS) Objectives or corresponding European Union (EU) limit values for sulphur dioxide during 2013[4].

Sulphur dioxide is emitted when fuels containing sulphur are burned. As with nitrogen oxides, SO_2 contributes to acidification of soils and waters, with potentially significant impacts including adverse effects on aquatic ecosystems in rivers and lakes, and damage to forests. In high concentrations, SO_2 can affect our airway function and inflame the respiratory tract. SO_2 also contributes to the formation of particulate matter in the atmosphere[5].

Total sulphur dioxide emissions by source in Wales



Emissions of SO_2 have declined by **84%** since 1990

Emissions of SO_2 from sources in Wales were estimated to be 29kt in 2012, 7% of the UK total[6]. Emissions have declined by 84% since 1990, mainly due to a reduction in power generation due to the installation of a FGD (flue-gas desulphurization) plant at a coal-fired power station and the introduction of a CCGT (Combined Cycle Gas Turbine) plant. The latter is more efficient than conventional coal and oil stations and has negligible SO2 emissions.

The damage costs to health and the environment as a result of SO_2 emissions from Industrial facilities in the UK has been estimated at €7,814 per tonne[2].

Reducing SO_2 emissions aids recovery of sausage beard lichen

Case Study

The spectacular Sausage Beard Lichen (Usnea articulata) was lost from mid Wales by the early 20th century and was then only found at fewer than 15 sites in Pembrokeshire and Gower. Over the last 10 years we have discovered more than 90 new populations, in Pembrokeshire, Carmarthenshire, Ceredigion, Breconshire and Glamorgan. They extend as far east as the Onllwyn and Merthyr Tydfil areas, where historic pollution would have meant that very few lichens could grow at all, and have also been noted on the coalfield between Llanelli and Cross Hands. Most of these new records have been made by observant NRW staff going about their daily business, rather than targeted surveys. It is thought that slightly reduced SO_2 pollution in Pembrokeshire allowed the remaining colonies to bulk-up and begin sending aerial fragments eastwards to colonise other parts of South Wales. The now cleaner air in these other areas has allowed the lichen to survive and then spread onwards.

Nitrogen oxides (NOx)

Five Welsh monitoring sites (Neath Cimla Road, Caerphilly Hafodyrynys, Newport M4 Jct 25, Rhondda Pontypridd Gelliwastad Road and Swansea Hafod) exceeded the annual mean objective of 40 µg/m^3 for nitrogen dioxide (NO_2). Of these, one (Caerphilly Hafodyrynys) also exceeded the AQS Objective for hourly mean NO_2 concentration on more than the permitted 18 occasions in 2013[4].

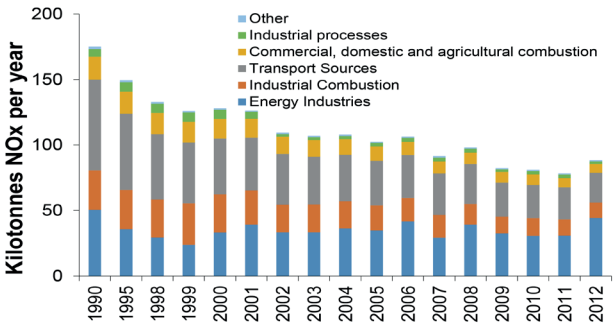
Atmospheric deposition of nitrogen is an ongoing pressure impacting on several habitats[7, 8,] including woodlands and coastal habitats, and other forms of air pollution have been cited as a pressure in urban situations[9].

Nitrogen oxides are emitted from fuel combustion, such as from power plants and other industrial facilities. NOx contribute to acidification and eutrophication of waters and soils, leading to loss of biodiversity, often at locations far removed from the original emissions. High levels of NOx and can lead to the formation of particulate matter and ground-level ozone. Of the chemical species that comprise NOx, it is nitrogen dioxide (NO_2) that causes

adverse effects on health; high concentrations can cause airway inflammation and reduced lung function[5].

In 2012, emissions of NOx from sources in Wales were estimated to be 88kt, 8% of the UK total[6]. Emissions have declined by 50% since 1990, with 20% of emissions in 2012 from road transport and 42% from power generation. The main reason for the decline in emissions is the road transport sector, due to a number of reasons including the requirement for new petrol cars to be fitted with three-way catalysts since 1989, adoption of "EURO standards" for new cars and improvements in catalyst repair rates. Energy sector emissions have varied throughout this time. Recent trends have followed the consumption levels of coal, which increased in 2006, 2008 and 2012.

Total nitrogen oxide emissions by source in Wales



The damage costs to health and the environment as a result of NOx emissions from Industrial facilities in the UK has been estimated at €5,181 per tonne[2].

Ammonia (NH_3)

Ammonia, as for NO_X, contributes to both eutrophication and acidification. Most NH_3 emissions — around 93 % in Europe — come from the agricultural sector. A relatively small amount is also released from industrial processes, transportation and waste management.

The effects of ammonia on habitats can be acute close to the source of emission. The implications on sensitive habitats is of significant concern.

Ammonia is a precursor to secondary particulate matter. Control of rural ammonia emissions will have a major benefit on human health by

In Wales, the percentage of sensitive habitats exceeding critical loads for acid deposition decreased from 89.9% in 1995-1997 to 80.4% in 2006-2008[8].

SO_2 and NO_x impact on habitats and species

"Critical loads define the pollutant level below which harmful effects on certain elements of the environment are not expected to occur according to present knowledge. Critical loads are used as an effects-based tool for assessing the sensitivity of terrestrial and freshwater habitats to the harmful effects of sulphur and nitrogen deposition. By comparing the critical loads with atmospheric deposition (e.g. from rainfall or airborne particles), and determining the excess deposition above the critical load (i.e. the "exceedance"), the potential impacts of current and future deposition scenarios are examined."[7]

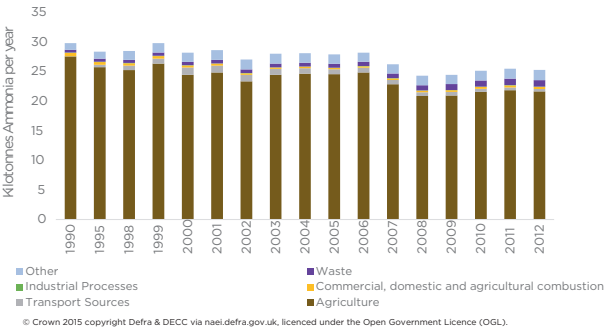
In Wales, the percentage of sensitive habitats (designated Natura 2000 sites) exceeding critical loads for acid deposition decreased from 89.9% in 1995-1997 to 80.4% in 2006-2008[8].

The percentage of sensitive habitats where eutrophying pollutants exceeded critical loads decreased from 98% in 1995-1997 to 94% in 2006-2008. This is still higher than in 1999-2001 when 91% of sensitive habitats had eutrophying pollutants exceeding critical loads[8].

reducing episodes of poor air quality caused by fine particulate pollution (PM 2.5) [5].

Emissions of ammonia in Wales were estimated to be 25kt in 2012[6]. These emissions have declined by 15% since 1990 and account for 9% of the UK total. Agriculture is the main source with manure management representing 62% of total ammonia emissions in 2012, and 52% coming from cattle manure management. Ammonia emissions have increased in recent years, with a 4.8% increase between 2008 and 2011 driven primarily by increasing emissions from fertiliser application, composting and biogas production via anaerobic digestion.

Total ammonia emissions by source in Wales

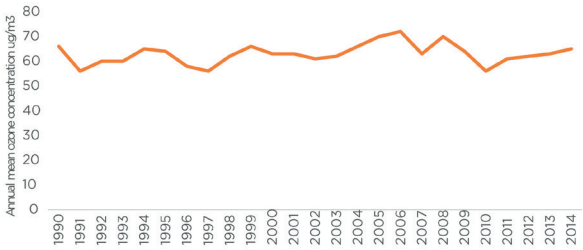


The damage costs to health and the environment as a result of ammonia emissions from industrial facilities in the UK has been estimated at €15,159 per tonne[2].

Ozone

Eight sites in Wales exceeded the AQS Objective for ozone (100 µg/m^3 as a maximum daily 8-hour mean) on more than the permitted 10 occasions in 2013. These were: Aston Hill, Cwmbran, Marchlyn Mawr, Swansea Cwm Level Park, Swansea Hafod DOAS, Swansea St Thomas DOAS and Vale of Glamorgan Fonmon[4].

Annual mean ozone concentration at Aston Hill



Exposure to high concentrations of ozone may cause irritation to eyes and nose. Very high levels can damage airways. Ozone reduces lung function and increases incidence of respiratory symptoms, respiratory hospital admissions and mortality. Ground level ozone can also cause damage to many plant species leading to loss of yield and quality of crops, damage to forests and impacts on biodiversity[5].

Ozone concentrations are highest at rural locations. Although there are no clear trends, concentrations vary considerably from year to year because of variation in meteorological factors[4].

Particulate Matter (PM)

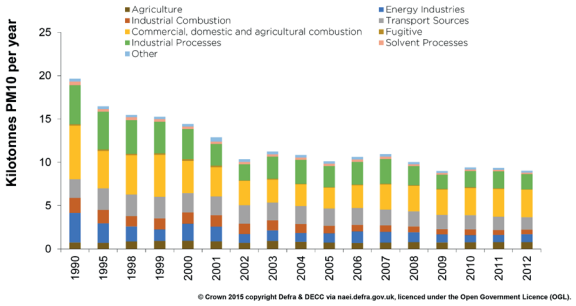
Particulate matter is one of the most important pollutants in terms of potential to harm human health. It enters sensitive regions of the respiratory system and can cause or aggravate cardiovascular and lung diseases and

cancers. PM is emitted from many sources and is a complex mixture of both primary and secondary PM; primary PM is the fraction that is emitted directly into the atmosphere. Secondary PM forms in the atmosphere following the release of precursor gases (mainly SO_2, NO_X, NH_3 and some non-methane volatile organic compounds)[5].

Annual mean PM10[a] concentrations have generally decreased in recent years, at both urban background and urban traffic sites[4].

Emissions of fine particulates have decreased across all sectors since 1990, although there are still 'hotspots' of poor ambient air quality. The proportion of man-made sources compared with outside Wales or non-man made sources varies significantly through the year. Where a local authority has declared an air quality management area an increased focus on understanding the causes exists with steps taken to make improvements. One such AQMA for particulate is in Port Talbot where the regulators work jointly with local businesses and Welsh Government to address the issue of poor air quality. This has seen reductions in emissions from sites regulated by Natural Resources Wales and Neath Port Talbot CBC along with increased data analysis to understand the other sources of pollution in the area.

Total particulate emissions by source in Wales



Emissions of PM10 were estimated to be 9kt in 2012 and have declined by 54% since 1990[6]. Welsh emissions account for 8% of the UK total. 35% of emissions came from commercial, domestic and agricultural combustion in 2012. Emissions from power generation accounted for 14% of total emissions in 1990 but reduced to 7% of the total in 2012. The reduction is mainly due to gas replacing coal fired energy generation. Other factors include a reduction in emissions from the residential sector due to the restriction of the use of coal for domestic combustion through the Clean Air Act.

Emissions of PM10 were estimated to be 9kt in 2012 and have declined by **54%** since 1990[6].

The damage costs to health and the environment as a result of PM10 emissions from industrial facilities in the UK has been estimated at €15,995 per tonne. The equivalent for PM2.5[b] in the UK has been estimated at €24,632 per tonne[2].

Carbon Monoxide (CO)

Carbon monoxide reduces the capacity of the blood to carry oxygen to the body's tissues and blocks important biochemical reactions in cells. People with existing diseases which affect delivery of oxygen to the heart or brain, such as angina, are at particular risk[5].

Total carbon monoxide emissions by source in Wales

[a] Particulate Matter <10um diameter
[b] Particulate Matter <2.5um diameter

Ambient levels of carbon monoxide in Wales are not at a level to cause such problems.

Emissions of CO from sources in Wales were estimated to be 205kt in 2012 and have declined by 69% since 1990[6]. Wales' emissions account for 10% of the UK total. In 2012, 16% of emissions were from road transport compared with 48% of total emissions in 1990. The reasons for this 69% decline include the requirement for new petrol cars to be fitted with three-way catalysts since 1989 and, in more recent years, the switch from petrol cars to diesel cars. Industrial process emissions from the iron and steel sector are now the most significant contributor to total emissions, accounting for 39% in 2012. Since 2008, there has been a reduction in the emissions from passenger cars, mainly driven by improvement in catalyst repair rates.

Non Methane Volatile Organic Compounds (NMVOCs)

Non-methane volatile organic compounds, important ground-level ozone precursors, are emitted from a large number of sources including industry, paint application, road transport, dry-cleaning and other solvent uses. Certain NMVOC species, such as benzene (C_6H_6) and 1,3-butadiene, are directly hazardous to human health.

Emissions of NMVOCs were estimated to be 47kt in 2012, representing 6% of the UK total in 2012[6]. Emissions have declined by 67% since 1990. This reduction is mainly due to the 96% reduction in road transport emissions since 1990, as a result of new petrol cars being required to be fitted with three-way catalysts since 1989 and, in more recent years, the switch from petrol cars to diesel cars.

Lead (Pb)

The heavy metal lead is emitted mainly as a result of combustion processes and industrial activities, where it exists in the raw materials. As well as polluting the air, heavy metals can be deposited on terrestrial or water surfaces and subsequently build up in soils and sediments. Heavy metals can also bio-accumulate in food chains. They are typically toxic to both terrestrial and aquatic ecosystems.

Exposure to high levels of lead in air may result in toxic biochemical effects which have adverse effects on the kidneys, gastrointestinal tract, the joints and reproductive system, and acute or chronic damage to the nervous system. Lead also affects intellectual development in young children[5].

Emissions of lead from sources in Wales were estimated to be 9.7 tonnes in 2012[6], 16% of the UK total. Emissions have declined by 93% since 1990. The reduction is mainly due to the phase-out of leaded petrol. The Industrial Processes sector accounted for 73% of 2012 emissions with the iron and steel sector accounting for 68% alone.

Air Quality Management Areas (AQMAs)

Local Authorities are required to ensure that local air quality meets national standards. If not, they must take action to improve air quality. Since December 1997, local authorities have been carrying out a review and assessment of air quality in their area. This involves measuring air pollution and trying to predict how it will change in the next few years. The aim of the review is to make sure that the national air quality objectives will be achieved throughout the UK by the relevant deadlines. These objectives have been put in place to protect people's health and the environment. If a local authority finds any places where the objectives are not likely to be achieved, it must declare an AQMA there. This area could be just one or two streets, or it could be much bigger. The local authority will then put together a plan to improve the air quality - a Local Air Quality Action Plan. AQMAs have been declared in Wales for PM10 and NO_2.

In 2012, more than 26,364 people lived in AQMAs in Wales[9].

Radioactivity/Radiation

Radioactivity enters the environment from natural sources and man-made processes. Routine discharges of small quantities of radioactive waste to air from man-made sources are made from a range of nuclear and non-nuclear facilities in the UK. In Wales there are three nuclear sites and a number of non-nuclear facilities, predominantly in the medical sector that use radioactive materials and dispose of radioactive wastes. Discharges of radioactive substances into the environment from man-made processes in the UK is strictly regulated by the environmental agencies, including NRW for activities in Wales. The exposure to people and the environment from man-made sources is extremely small.

Radiation from natural sources in the UK includes cosmic radiation from the sun and the decay of naturally occurring radionuclides in soil and rocks, which depending on the rock type and location, may generate radon gas which can enter people's homes if they live in an area with certain geological conditions. Radioactivity, whether naturally occurring or man-made, can be taken up by plants and animals with the result that it can enter the food chain.

In the UK, there is an extensive programme of food, dose rate and environmental monitoring conducted in the terrestrial and marine environment by the Food Standards, Health and Environmental agencies. Results are published annually in the Radioactivity in the Environment (RIFE)[10] report. The monitoring programmes conducted by these agencies are independent of, and also used as a check on, the monitoring programmes undertaken by site operators who discharge radioactive waste, which are regulated by the environment agencies.

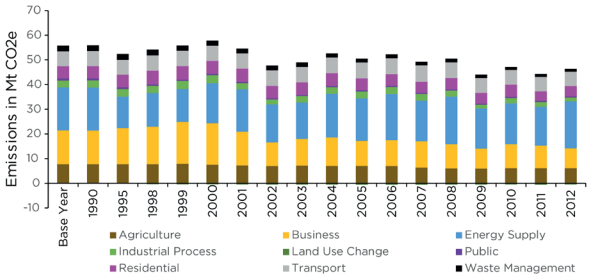
The 2013 report records that "Continuation of the monitoring programmes conducted by the agencies helps to demonstrate that radioactivity in food is well within safe levels and that exposure to members of the public from authorised discharges and direct radiation around the 39 nuclear sites in the UK has remained within legal limits". The report confirms that around 12,000 analyses and dose rate measurements were completed as part of the independent monitoring programmes in 2013.

Measurements of naturally occurring radioactivity such as radon gas in homes are undertaken by Public Health England. Measurements are compared with the UK Action Level set at 200 Becquerels/cubic metre (Bq/m^3). As of July 2012, radon measurements had been completed in around 17,700 Welsh homes and some 1,900 homes were identified with a radon concentration at or above the Action Level. For the majority of cases remediation was successful in reducing the radon level to below the Action Level[9].

Greenhouse Gases

Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NOx), hydro-fluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) are referred to as greenhouse gases.

Greenhouse gas emissions by sector from Wales



Greenhouse Gas emissions from Wales reduced by 18% between the Base Year[c] and 2012.

Total Greenhouse Gas emissions from Wales reduced by 18% between the Base Year[c] and 2012. Carbon dioxide emissions fell by 14% in this time period. These emission reductions are a result of a decline in manufacturing emissions (e.g. in iron and steel, bulk chemical production) in the business and industrial process sectors, efficiencies in energy generation and business sector heating, the use of natural gas to replace some coal and other fuels as well as abatement in some chemical industries. Transport emissions have only reduced slightly (-5%) since the Base Year due to increasing population and increasing demand for transportation off-set by improvements in energy efficiency of vehicles[11].

42% of emissions in 2012 from sources in Wales were from energy supply, 17% from business, 13% from transport, 13% from agriculture and 9% from residential sources.

The agriculture sector is the most significant source sector for methane and nitrous oxide, accounting for 64% and 89% of total Welsh emissions of these two gases, respectively.

Methane emissions from the waste management sector reduced by over 50% between 1990 and 2012 due to the increased capture and combustion of methane from landfill sites.

For full sector breakdown see National Atmospheric Emissions Inventory Report.[11]

Emissions from the energy industries, manufacturing industries and industrial processes sectors are largely subject to the EU Emissions Trading Scheme (EU ETS). Since the scheme's introduction in 2005 there have been very high levels of compliance in Wales. We may not see reductions of greenhouse gas emissions in Wales as a result of the scheme because it is pan European and does not individually restrict member states or countries within member states.

[c] 1990 for CO2, CH4, N20. 1995 for HFCs, PFCs, SF6

In Wales the coverage of the EU ETS is higher than the rest of the UK, reflecting the high share of heavy industry in Wales (e.g. emissions from power stations, refineries and integrated iron and steel works) and as a result, the non-traded share of the total GHG emissions in Wales in 2012 is only 46%.

In 2012, 15 sites in Wales contributed 97% of total Welsh emissions in the EU ETS. The table below puts the emissions of these sites into context with other Greenhouse gas emissions from sources within Wales.

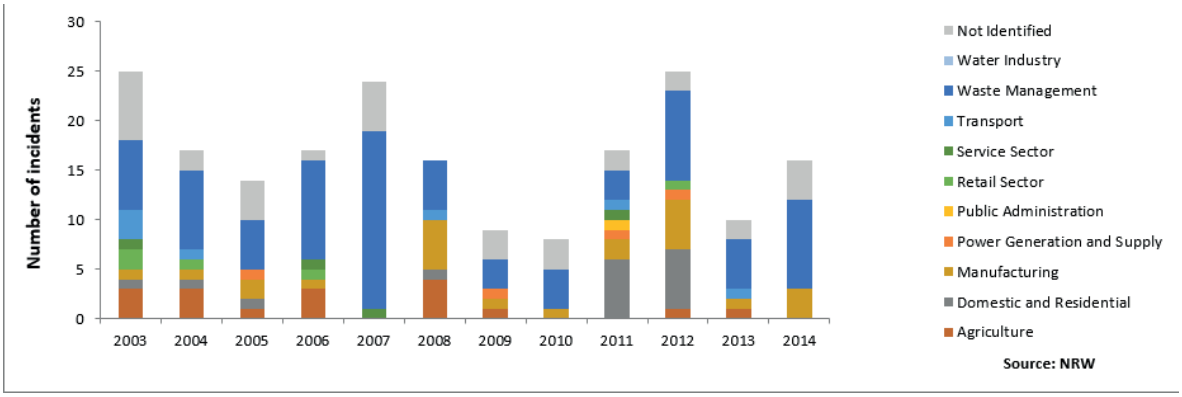
Top carbon dioxide equivalent emitters in Wales 2010 to 2012[12]

Site	CO_2e tonnes 2010	CO_2e tonnes 2011	CO_2e tonnes 2012
Total top 15 emitters in 2012 EU ETS in Wales	22,697,127	21,503,374	22,745,326
Agriculture	6,124,000	6,129,000	6,142,000
Transport	5,950,000	5,844,000	5,770,000
Residential	4,951,000	3,848,000	4,233,000
Waste management	1,234,000	1,196,000	1,137,000
Other Operators in EU ETS	1,385,776	1,108,009	784,885
Public sector	449,000	411,000	440,000

Pollution Incidents

Between 2007 and 2010 there was a steady decrease in the number of serious pollution incidents affecting air quality in Wales. The number has varied in recent years with 16 in 2014. Unregulated waste sites consistently cause most of the serious (category 1 and 2) pollution incidents that affect air quality.

Category 1 & 2 pollution Incidents by source affecting air quality in Wales



Examples of Benefits and Risks to Benefits

Air pollution and greenhouse gases are not always visible, but their impact can be long lasting.

Poor air quality is a significant public health issue. The Committee on the Medical Effects of Air Pollutants (COMEAP) has estimated that the burden of particulate air pollution in the UK in 2008 was estimated to be equivalent to nearly 29,000 deaths at typical ages and an associated loss of population life of 340,000 life years lost[13]. It has been estimated that removing all fine particulate air pollution would have a bigger impact on life expectancy in England and Wales than eliminating passive smoking or road traffic accidents[14]. The economic cost from the impacts of air pollution in the UK is estimated at £9-19 billion every year; this is comparable to the economic cost of obesity (over £10 billion)[15].

Land Use, Land Use Change and Forestry (LULUCF) activities can result in net emissions or removals of greenhouse gases, and changes in carbon stocks within forest land, cropland, grassland, wetlands and settlements. Current projections for net emissions and removals of greenhouse gases to 2050[11], arising from LULUCF activities, show that the UK LULUCF is projected to be a net sink for all climate change scenarios. Changes to the way these land types are managed risks them becoming net emitters.

Air: Links with land and water

Pollutants in the air can affect what goes on in our land and water resources (rivers, lakes, seas).

Greenhouse gases are emitted through many human activities including agriculture, development and industry. Waste management practices through landfill and farming of cattle and sheep increases methane emissions. Steel and energy production can lead to increases in greenhouse gases as well as other harmful emissions such as particulate matter (PM10 and PM2.5). Emissions to the air can result in global warming leading to changes in weather patterns and also rainfall that is more acidified which leads to further problems on land and in water.

Forests and soils, including peats, are important for carbon sequestration, removing and storing carbon dioxide from the air to reduce the amount of greenhouse gases in the atmosphere.

Emissions to air of sulphur and nitrogen containing pollutants from heavy industry, power generation and transport have caused acidification of freshwaters across Wales. Where the geology has a low buffering capacity (i.e. soils with low levels of base cations such as calcium), deposition of acid gases enters watercourses and causes large drops in pH, killing aquatic life such as invertebrates and fish. A recent NRW Water Framework Directive assessment estimated that 21% of Welsh river and 36% of Welsh lake water bodies were at risk of acidification.

Regulatory controls have resulted in marked reductions in sulphur dioxide emissions. Long term monitoring in the UK Uplands Waters Monitoring Network is tracking these trends in the context of ongoing reductions to acid deposition and climate change.

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Land story

Our land is one of our most precious natural resources. Our land is our geology, soils, plants, wildlife – which in turn provide us with many of our basic needs including food, energy, health and enjoyment. When cared for in the right way, our land provides for us in many ways: it is the place where we grow food; soils and woodland lock up and store carbon and floodwater; farmland and woodland produce food and timber; it allows us to harness resources for creating energy; it provides materials for construction; it provides habitats for a huge variety of plants and wildlife; and it creates beautiful and iconic landscapes – places we can enjoy and which boost the economy via tourism.

Our working landscapes produce high quality food and timber as well as supplying Wales and large parts of England with drinking water. With a total land surface of nearly 2.1 million hectares and a population of 3.1 million people[a], we have an important role to ensure that Wales' natural resources are resilient and used in such a way as to ensure future generations can enjoy the economic, social and environmental benefits that they bring. Resilience (the ability to withstand environmental and societal challenges) is crucial to longevity.

Getting out and about

Access to the countryside and urban 'greenspace' (parks and open spaces) is important for people as well as providing natural habitats and a home for a range of species. Greenspace and trees can provide benefits to people by helping to improve air quality and create shade and, if planted in the right way, can contribute to reducing the risk of flooding. The percentage of people with easy access to greenspace is relatively high across most of Wales but it does not meet the national target[1].

Using the land

The existence of a rich and diverse landscape is largely dependent on the varied use of the land, which is itself dependant on the nature and properties of soils, elevation and steepness.

The use of land for agriculture, particularly through the dairy and red meat sectors, not only provides food but is multifunctional, contributing to other services valued by society. It contributes directly to the Welsh economy (Gross Value Added was £374.3 million in 2014[2]) and provides ecological, cultural and visual services. Culturally, agriculture is important for the Welsh language – a large proportion of agricultural workers use written and spoken Welsh regularly[3]. However, agriculture can also bring challenges through greenhouse gas emissions, diffuse water pollution, biodiversity loss and potential increased flood risk[4]. Agriculture and changes in agricultural practice, coupled with atmospheric deposition, climate change and infrastructure development remain the main threats to Welsh habitats.

Forestry is also multifunctional, contributing over £450 million (Gross Added Value) to the Welsh economy each year[5]. It is particularly important not just for the range of timber products but also for a wider range of services including biodiversity, carbon sequestration, removal of pollutants from the air, recreation and heritage. Soils, particularly peat, also store a significant amount of carbon. However, our peat habitats have been adversely affected by climate change, land management and atmospheric pollution[4].

Case Study

Carbon Sequestration

Carbon sequestration is where carbon dioxide is removed from the atmosphere by natural or artificial processes and stored as a liquid or solid. Current sequestration in Wales by trees is about 1,419,000 tonnes annually (approx. 3.8% of total carbon dioxide emissions)[5] and the Woodland Carbon Code in Wales is helping to improve this. Wales' status as a net sink for carbon is a result of a low incidence of land use change and a relatively young forest resource[7]. Peatlands provide a significant carbon store despite covering only 4% of Wales' total land area. If they were returned to near-natural condition, their estimated climate change mitigation potential is 300,000 tonnes of carbon dioxide per year which is the equivalent of 5% of all Welsh transport related emissions.

[a]2013 mid-year population estimate

Land Evidence

The evidence that follows is a summary of the state of Wales' land environment as we currently understand it. Measures we use to describe the pressures affecting the land environment and benefits or risks identified are included at a high level. There are gaps in our knowledge and there will be other ways of showing how the economy, the environment and the people of Wales are reliant on each other to ensure a resilient Wales for the well-being of future generations. This will be explored further as we develop the State of Natural Resources Report, the first of which is to be published in Autumn 2016.

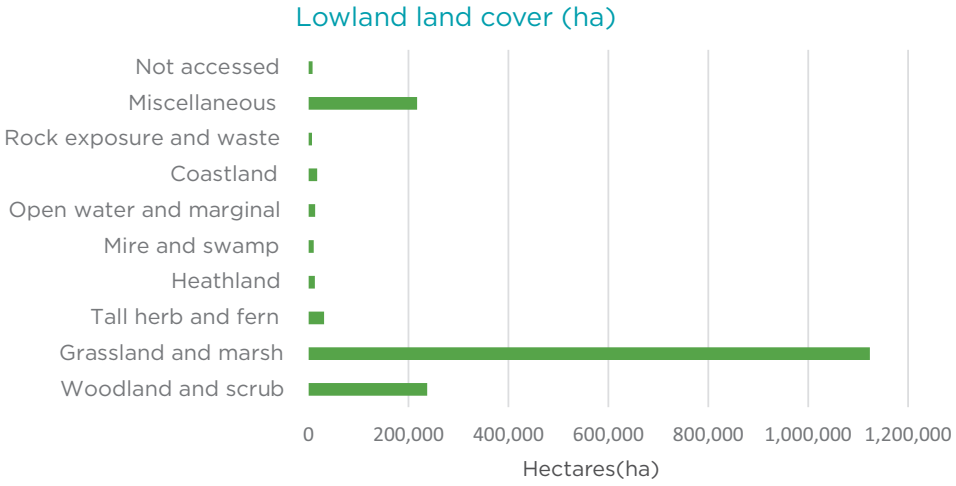
State

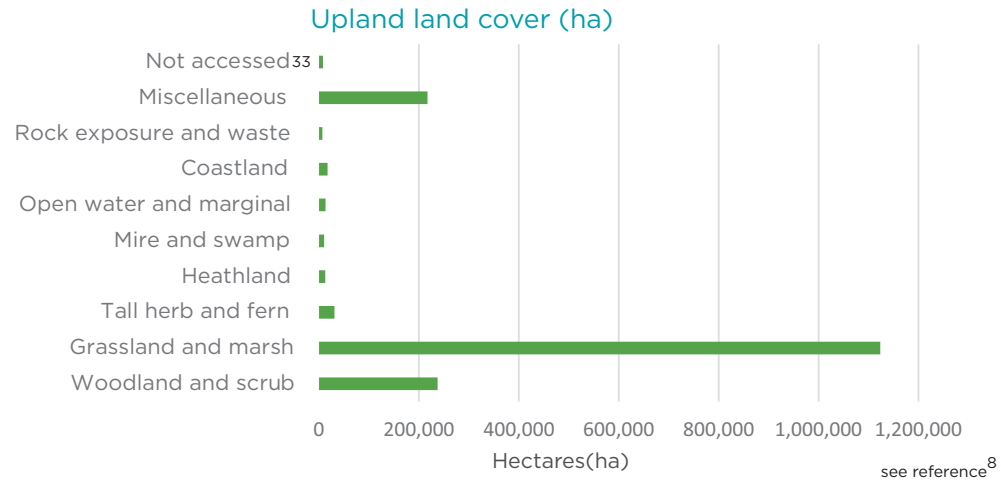
Land Use and Landscape

Wales is renowned for its attractive landscapes, with three National Parks and five Areas of Outstanding Natural Beauty covering 24% of the country's land surface[4]. Fifty seven percent of the Welsh landscape is considered to be of outstanding or high landscape quality[7] which reflects our rich and diverse habitat cover. Semi-natural habitats cover 623,100ha (30%) of our land area[8].

An average of 11.2% of Wales is urban (compared to 11.6% UK average; 'urban' includes buildings, roads, gardens, parks, waste sites and any other structure or space installed for human activities[9]) and 15% of Wales is woodland[10]. Total

57% of the Welsh landscape is outstanding or high landscape quality





see reference[8]

land on farm holdings accounts for approximately 87% of the total land area of Wales[11] which will include some 'urban' aspects such as roads and buildings as well as some woodland. The character of the Welsh landscape has changed throughout the mid 20th Century as a result of development[4].

Soils

Soils are the foundation of ecosystems, habitats, and land use – most notably agriculture and forestry, and provide many ecosystem services. Use of land has had a major influence on soil properties and their development through forest clearance, agriculture and industrial contamination. Soil type, as well as climatic conditions, causes considerable variation in woodland tree composition[4].

Our estimate of the extent of deep peat soils (≥0.5m) is now 90,995ha[12]. Peatland soils also provide Wales' largest terrestrial ecosystem store of carbon, estimated at around 157 million tonnes[6]. Shallower organo-mineral soils cover an estimated 359,200ha[13]. There is currently no statutory soil monitoring programme in the UK[4].

Agriculture

The climate and geography of Wales mean that Welsh agriculture is largely about grazing livestock for meat and milk production (sheep and cattle). Growing arable or horticultural crops and raising poultry or pigs are smaller sectors. Red meat production (sheep, cattle, pigs) contributes the largest share (43% of total output) towards Welsh Agricultural Output[14]. Thirty one percent of farms are upland sheep or cattle and 4% are dairy[15]. There are currently around 9.7 million sheep in Wales, and around 1.1 million cattle[11]. Wales has about a quarter of the total number of sheep in the UK.

Seventy six percent of the agricultural land area in Wales has been designated as Less Favoured Areas[15] which are defined as land where agricultural productivity is limited by natural conditions such as steep slopes, poor soils and high rainfall. The Welsh Agricultural Statistics 2012-2013[15] showed there was 63,366 ha of woodland (20% of all woodland in Wales) on agricultural holdings in 2013, primarily located in Less Favoured Areas (LFAs).

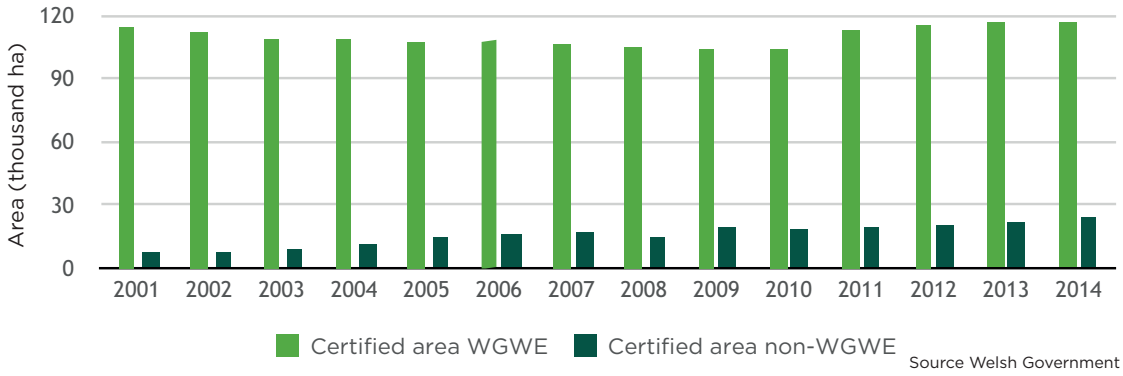
Forestry

There are 306,000ha of woodland in Wales which amounts to 15% land cover of which 151,000ha is conifer woodland and 156,000ha is broadleaved woodland[4,10]. The production from Welsh woodlands is heavily weighted to products from conifer woodlands which is produced for use mainly in construction, fencing and packaging products[5].

Woodland in Wales amounts to **15%** land cover

Woodlands can be certified which means they have been audited as being sustainably managed to either Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC) standards. The area of certified Welsh Woodlands reached 141,000ha in 2014[5]. All Welsh Government Woodland Estate (WGWE) is certified.

Area of certified woodland in Wales (thousand ha)



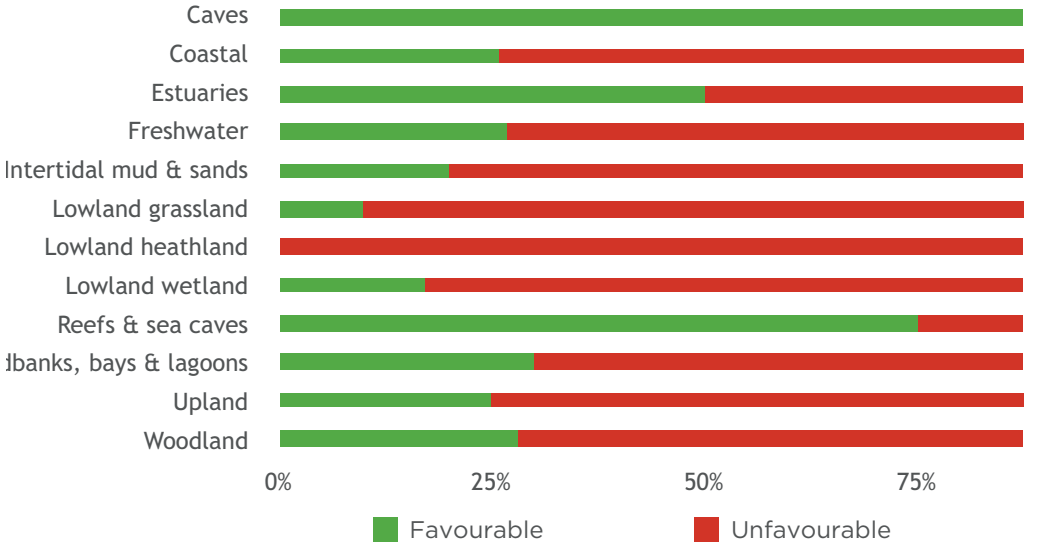
Source Welsh Government

Habitats and Species

Protected Habitats

Protected sites are key in the protection of semi-natural habitats and species and can act as excellent examples of Natural Resource Management (NRM). Some key habitats of conservation importance are scarce, small in extent and highly vulnerable. The majority of Special Areas of Conservation (SAC) and Special Protection Area (SPA) habitats in Wales are in unfavourable condition (75%) with the exception of caves (100% in favourable condition). These figures are based on the most recent reported condition assessments[16] and does not include some features (as they have never been assessed). More than 50% of Biodiversity Action Plan (BAP) habitats are in decline in Wales[17]

Percentage of SAC and SPA habitats in favourable and unfavourable condition



Source Natural Resources wales

Wales has extensive, biodiverse and economically significant semi-natural grasslands (our most extensive semi-natural habitat), as well as a large amount of heathland and peatland habitats (extremely significant in providing long-term storage of carbon). Sand Dunes, Saltmarsh and Sea Cliffs are

the most extensive coastal habitats in Wales and are important for nature conservation as well as a range of regulating services, including coastal erosion protection (sand dunes are worth £53-199 million as natural sea defences in Wales)[4]. However, they are under pressure from development and land-use change and erosion, and their condition is considered to be poor[4].

Native Woodlands

The Ancient Woodland Inventory (AWI) identifies woodlands that have had continuous woodland cover for some centuries. Studies show that these woodlands are typically more biodiverse and of a higher nature conservation value than those developed recently or those where woodland cover on the site has been intermittent. These woodlands may also be culturally important. The new updated inventory (AWI 2011) indicates that there are around 95,000ha of ancient woodland in Wales[18].

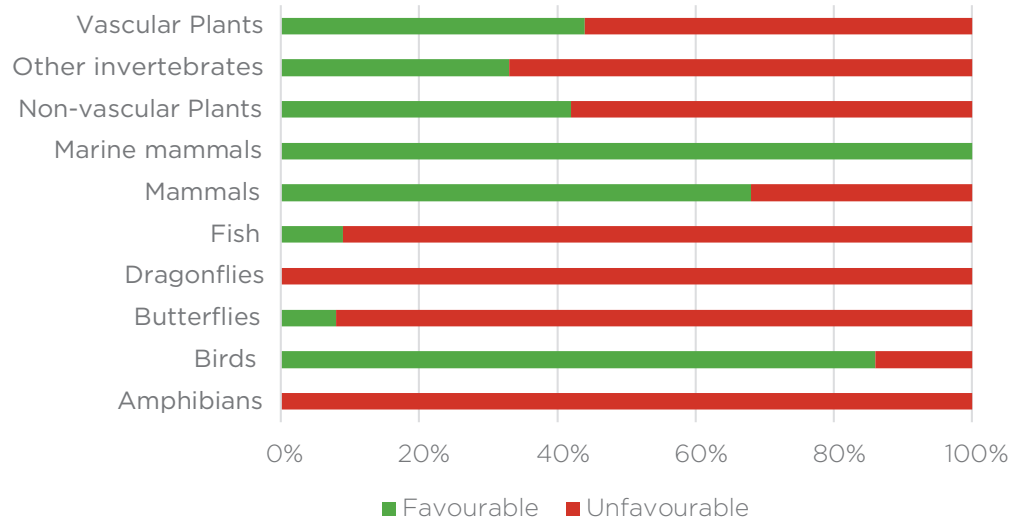
Through the Forest Resource Planning (FRP) process, NRW have identified the contributions that the FRP habitats contribute to biodiversity and the environmental benefits in which The United Kingdom Forestry Standard (UKFS) and Guidelines outline the context for forestry in the UK for sustainable management[19].

There are around **95,000**ha of ancient woodland in Wales

Native woodland is more diverse than non-native woodland and the condition of native woodland is expected to remain stable or improve in the long term[5]. The volume of deadwood (a proxy for biodiversity as it is a habitat for a range of organisms) in native woodland across the UK (3.9m^3 per hectare from 2000 to 2010) is below the UK Woodland Assurance Standard (20m^3 per hectare)[5, 20].

Protected Species

Percentage of SAC and SPA species in favourable and unfavourable condition



Source Natural Resources wales

The condition of SAC and SPA species in Wales remains mostly unfavourable (55%), with the exception of birds and mammals of which 86% and 68% are in favourable condition, respectively[17]. Butterflies are an example of species in unfavourable condition. Thirty two species of butterflies (50%) have decreased over the past 10 years with 20 of these showing statistically significant declines[21]. It is thought that fragmentation, loss of and change in habitat has caused these declines. Bats, as another example, showed an increase of 18% between 1999 and 2012[22]. However, more sustained increases would be needed to indicate recovery from previous severe declines.

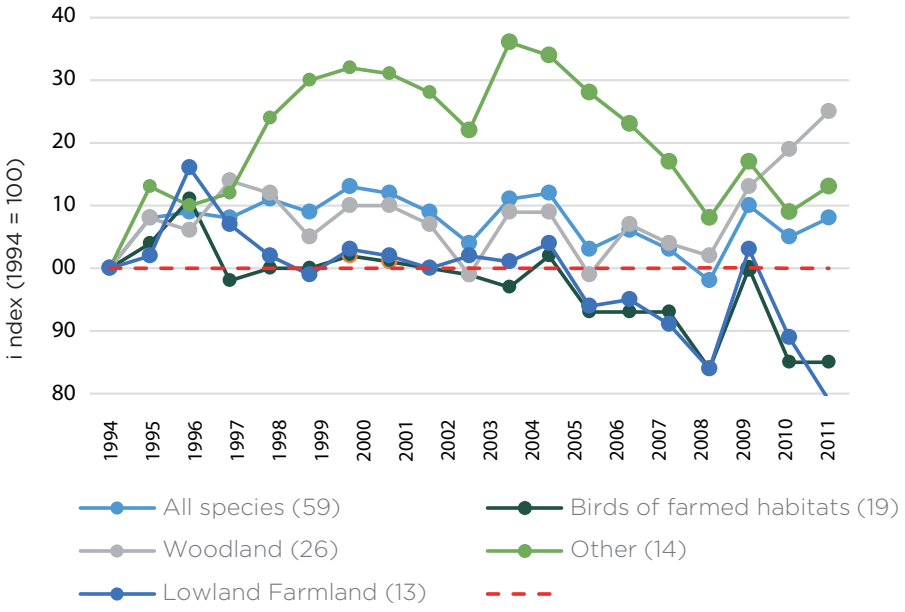
50%
of butterflies have decreased over the past 10 years

From 2002 to 2008, less than half of the priority BAP species were considered to be stable or increasing[17]. Wales (along with the UK as a whole) failed to meet 2010 biodiversity targets[4].

Birds

Wild bird populations are a good indicator of environmental state. The 'all species' index is higher in 2012 than it was in 1994 with farmland birds showing a downward trend and woodland birds increasing, particularly after 2009[23]. Our intention is to work with partners to supplement this indicator of bird populations with similar information for other groups of species such as bats and butterflies.

Short-term changes in abundance of wild birds



Source: BTO/JNCC/RSPB Breeding Bird Survey (BBS) and "The State of Birds in Wales 2012"[23]. An updated version of the graph using more recent data is expected to be available in August 2015.

Cities, Towns and Greenspace

Private residential gardens provide

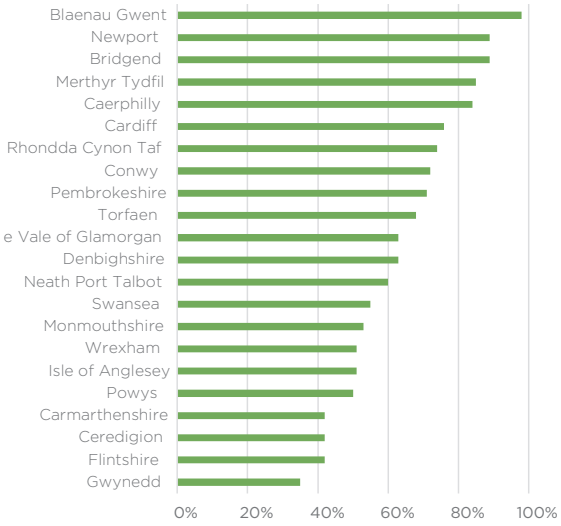
21%

urban tree cover

In 2009, there were 14,164ha of trees and woodland in Wales' urban areas, equivalent to 16.8% canopy cover. Private residential gardens make up 34% of Wales' towns and cities, providing 21% of all urban tree cover[24].

Natural green and blue spaces includes parks, hedges, trees, woodland, rivers, ponds and beaches[25]. The percentage of people with access to natural greenspace is relatively high in most areas of Wales but is still below the standard that no person should live more than 300m from their nearest area of natural green space[26]. Around 55% of footpaths and other rights of way are easy to use by the public in Wales with some counties having better access than others (ranging from 35% in Gwynedd to 98% in Blaenau Gwent)[27].

Percentage of footpaths and other rights of way which are easy to use by members of the public 2010-11



Source Welsh Government

Approximately 11% of properties in Wales are at risk of flooding from rivers and sea (148,150 residential and 60,350 non-residential[28]). Around 73,000 of these properties benefit from flood defences. Surface water flooding affects 163,000 properties (120,000 residential, 43,000 non-residential).

Industry and Waste

During 2013, Natural Resources Wales permitted sites managed a total of 7.9 million tonnes of waste[29].

The total amount of local authority municipal waste produced decreased from a high of 1.93 million tonnes to 1.56 million tonnes between 2004/05 and 2013/14[30]. The percentage of local authority municipal waste that was prepared for reuse, recycled or composted in Wales has continued to increase from 5% in 1998/99 to 54.3% in 2013-14[30]. Welsh industrial and commercial sectors generated an estimated 3.7 million tonnes of waste in 2012 – 58% was prepared for reuse, recycled & composted and 26% was sent to landfill[31]. Eighty seven percent of construction and demolition waste generated in Wales was prepared for reuse, recycled and recovered and 12% was sent to landfill in 2012[32]. Waste sent to landfill in Wales continues to decrease with 2.1 million tonnes land filled in 2013, a 52% reduction over 12 years[29].

Pressures

Soils

Soils are dynamic and are influenced by many factors. Soil quality has deteriorated, soil erosion has increased and soil formation has been affected due to various human impacts including increased crop and livestock production, expanded urban areas, Wales' legacy of industrial land contamination from metal mines and other industry as well as atmospheric deposition and inappropriate management in some cases[4]. Their function is therefore compromised.

Soils in developed areas provide the same range of services as in other environments but their quality can be — degraded and destroyed by construction of buildings and infrastructure[4].

Soil erosion and acidification are prominent pressures. Fertile topsoil develops at a rate of less than 1 cm/century[33]. An estimated 2.2 million tonnes of topsoil is eroded on an annual basis in the UK. Some agricultural practices (e.g. harvesting in wet conditions, leaving fields bare after harvest) result in large volumes of productive topsoil being compacted and degraded as well as eroded and deposited in adjacent water courses. There are also many impacts on the water environment as a result of eroded soils entering waterways.

Around 10-15% of grassland fields are affected by severe soil compaction and poor soil condition. Poor soil condition is not restricted to 'improved' grasslands as more 'semi-improved grassland soils are in poor condition. This indicates poor soil structural condition may hinder plant species diversity in some cases and enhance it in others[34].

Agriculture

Despite providing benefits in terms of food production and management of semi-natural habitats, there are a number of pressures on natural resources from agricultural practices. Many arise from social and economic factors that impact the agricultural community e.g. market prices.

We have information for cattle and sheep numbers which could be used as an indicator of pressures. Many Welsh farms have significant numbers of both cattle and sheep[15] which can, in some cases, impact on biodiversity, water quality and flood risk through grazing, trampling, nutrient management and greenhouse gas emissions. The number of dairy holdings continues to decline (2,018 in 2010 to 1,788 in 2013)[15] but the number of dairy cows and volume of production is increasing (the size of the dairy herd increased by 6 % between June 2013 and June 2014)[11].

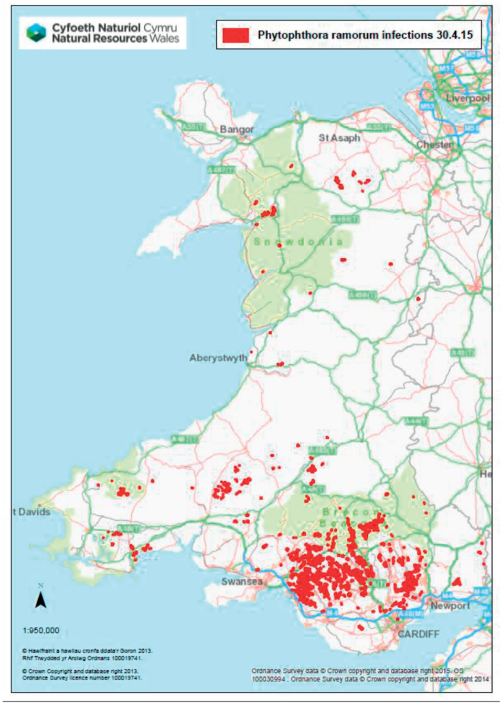
Forestry

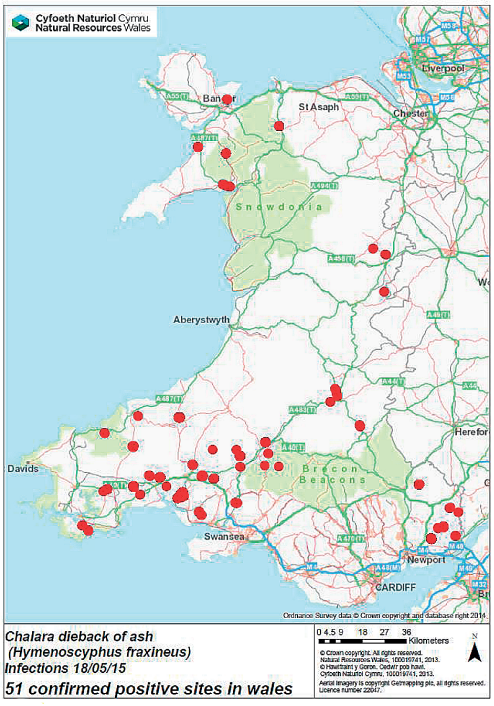
6.7 million
million trees are infected with larch disease in Wales

Woodlands are a fundamental part of the environment in Wales and there are a number of pressures on them. Pests and diseases are some of the major pressures which have had a significant impact on Welsh woodlands in recent years.

Larch disease, *Phytophthora ramorum*, is concentrated in South Wales with increases in the number of reported cases in 2013 and 2014 (Woodlands for Wales Indicators, 2013-14). Around 7% of woodlands in Wales are made up of larch (20,900 ha[35]) – most of which has been earmarked for felling due to disease. There are around 6.7 million trees infected with the disease in Wales and over 3 million larch have been felled by Natural Resources Wales so far. NRW is planning to plant 3 million new trees annually with some of these replacing the felled trees[36].

Ash die back, *Hymenoscyphus fraxineus* (previously known as *Chalara fraxinea*), has been recorded across Wales, mostly in newly planted sites (49 newly planted sites, two wider natural sites). This disease is a serious threat as it can cause widespread damage with huge losses. There were around 16.5 million ash trees in Wales in 2014 – up to 95% of these trees could be lost as a result of the disease[37]. The impacts of these diseases are direct through the value of timber and indirect due to impacts on access, recreation and biodiversity.





see refs 38, 39

Habitats and Species

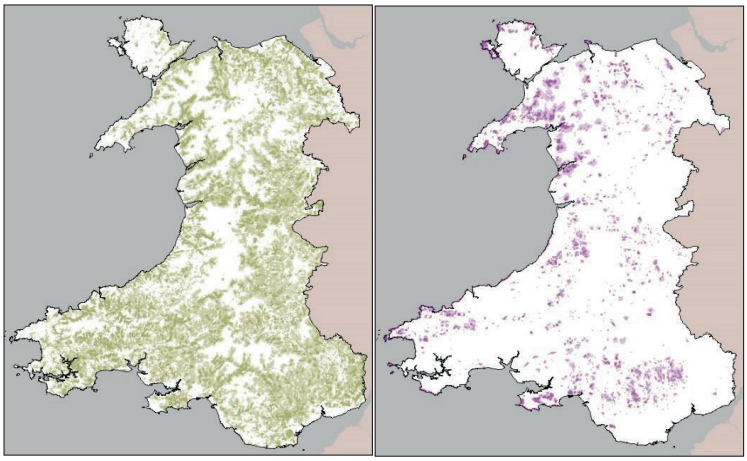
Biodiversity

Many important Welsh terrestrial natural resources have been lost or are in serious decline. Deterioration in habitat condition remains a significant concern. The alteration of the composition of lowland semi-natural grasslands was one of the most rapid and widespread vegetation changes to have taken place in Wales during the 20th Century[4].

Habitat loss, fragmentation and reduced connectivity are major causes of biodiversity loss as it limits the ability of species to move within landscapes (e.g. to forage, disperse, migrate or adapt to climate change[40]). This causes knock-on effects to ecosystem functions and service delivery (Latham et al., 2013). Many species require a range of habitats that are close to each other with specific, rather than general, habitat management.

Examples of large-scale habitat loss in Wales include:

- 30% loss of semi-natural ancient woodland in Wales, post war[41];
- 97% loss of lowland semi-natural grassland over the last century, and;
- 51% loss of lowland heathland and 95% loss of wet heathland on the Llŷn Peninsula between 1920/22 and 1987/88[8].



Habitat networks from computer models showing relative connectivity[40,42]. Contrasting habitats (L-R): Semi-natural woodland networks in Wales; Lowland heathland networks in Wales.

Smaller scale, and often unrecorded, losses continue. Species may persist in fragmented habitats for some time (years, decades, or even centuries in forests) before eventually disappearing. This delay is known as extinction debt[43], and means that the full impacts of our historic habitat loss may yet to be realised. The effects of the climate-induced 2013-14 winter storms on our coastal habitats and species is an example of this[44].

The Habitat Survey of Wales[8] gives a snapshot of habitat fragmentation in the late 20th century and provides a baseline against which to consider future change. As the level of fragmentation increases, connectivity also decreases.

Native Woodlands

The ancient woodlands in Wales are under a pressure in the same way that other woodland are, especially from climate change and pests and diseases.

Cities, Towns and Greenspace

Increasing tree loss in towns is due to: an ageing population of trees (increased number of trees that are dying and dangerous); disease; demands for new building development; work to the utility infrastructure; a poor understanding of integrating new trees into the built environment (green infrastructure); and putting into practice the 'right tree, right place' approach[24]. A total of 55 out of Wales' 220 urban areas showed an overall decline in canopy between 2006 and 2009, 20 of which lost between 2 and 6 hectares[5]. During the same 3 years, Wales' towns lost 11,000 large (>12m diameter crowns), non-woodland trees[5].

Urban creep (or urban development) causes sealing of soils which reduces the capacity for rain infiltration and leads to an increase in the amount of surface run-off. Our sewerage systems were only designed to deal with a certain amount of water and therefore increasing the amount of water entering drainage systems can affect their function[45].

Flooding events in Wales from November 2011 to March 2014 were estimated by NRW to cost over £71 million[28]. £8.1 million of this was due to damage to flood defence structures as a result of the December/January storms of 2013/2014. The estimated costs avoided due to investment in flood defence, however, is £3 billion[28]. Flooding is not only a pressure on communities and man-made structures but also causes impacts on the environment as was seen in the 2013-14 winter storms[44].

The proportion of households at risk that are able to receive flood warnings and that have registered for warnings increased between 2005/2006 and 2011/2012[46]. Less than half the people probably or definitely at risk of flooding are aware of this risk[46]. The number of people making preparations in advance of flooding has shown an overall increase since 2006-07[46].

People aware of the risk of flooding and those who have made preparations

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Aware property probably or definitely at risk (%)	44	47	57		42	43
Have made preparation in advance of possible flooding (%)	5	49	57		69	53

Source Welsh Government

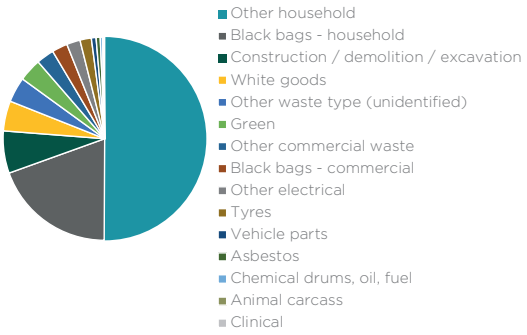
Approximately 60% of the population of Wales (1.9 million) live on or near the coast, of which 75% is designated for environmental importance[28]. Almost 28% of the coast has some form of artificial protection but 23.1% of the Welsh coast is still eroding[47]. Both erosion and coastal protection have the potential to affect designated sites, although natural change is usually positive. Over the next 100 years, 2,126 properties are at risk from erosion. However, if shoreline management plan (SMP) policies, which integrate the protection of habitats and people, are implemented this will significantly reduce to 145[28].

Industry and Waste

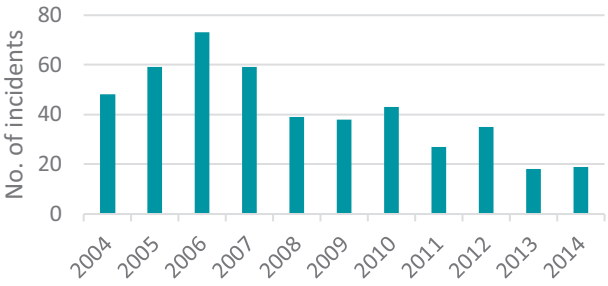
Metal and coal mine sites are significant sources of land contamination, water and sometimes air pollution. There are over 1,300 non-ferrous metal mine sites in Wales. 6.2% of all waterbodies are at risk of not achieving

Good status under the Water Framework Directive (2014 classification) due to impacts from abandoned mines and contaminated land[48]. NRW are working to restore degraded land and soil that has been contaminated, and to tackle the sources of diffuse contamination including remediation of the top 50 sites through the Metal Mines Strategy for Wales. Between April 2006 and 2013 we helped bring 97 out of 111 sites affected by various sources of contamination back into beneficial use (remediated)[49]. "New" development on brownfield sites is an integral part of remediation of land affected by contamination.

What was fly-tipped in Wales 2013-14



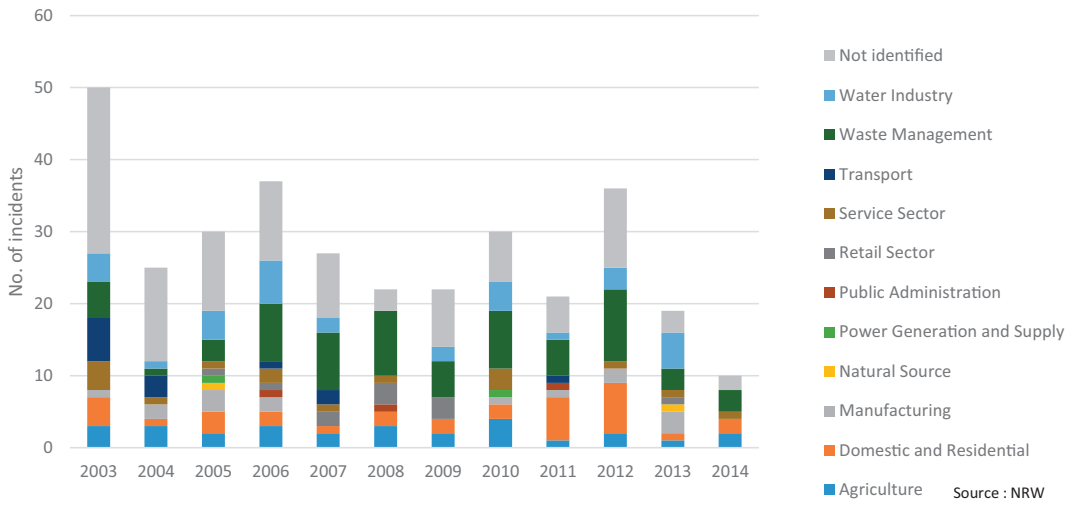
Big and Nasty Flytipping Incidents in Wales



Source Natural Resources Wales

Fly-tipping is a prominent pressure. Household rubbish is the most common form of waste that is fly-tipped (70% of all fly-tipping)[50]. The highest number of recorded flytipping incidences occur in Cardiff (approx. 20%). There were around 33,000 recorded incidents of fly tipping in Wales in 2013/14, although this has reduced since 2006. Only 19 of these were 'Big' or 'Nasty' i.e. incidents which NRW respond to and are defined as Significant/multiple loads (Big) and Chemical drums, oil or fuel (Nasty) (NRW NIRS)[51]. There were ten serious pollution incidents affecting land in 2014[52]. This is a reduction on previous years but still presents a pressure.

Category 1 & 2 Pollution incidents by source affecting land quality in Wales



Source Natural Resources Wales

Examples of Benefits and Risks to Benefits

Jobs and economy

The environment contributes over **8.8 billion** to the Welsh economy

BENEFITS: A 2001 study estimated that the environment contributed £8.8 billion of goods and services annually to the Welsh economy, 9% of Welsh GDP and one in six Welsh jobs, mainly in the leisure and tourism, agriculture and forestry, water abstraction, conservation and waste management sectors[4]. For example, forestry contributes £455.7 million to the Welsh economy and an estimated 8,500 to 11,300 jobs[5] and agriculture contributes 59,600 jobs[11]. The environment has been recognised as making a relatively greater contribution to the economy of Wales than to other UK countries[4].

In 2007, the annual value of wildlife-based activity to the Welsh economy was estimated to be £1.9 billion (2.9% of national output) (not the wider contribution of biodiversity to the full range of ecosystem service)[4].

Ecosystem Services

BENEFITS: The environment provides numerous supporting, regulating, provisioning and cultural services[4]. Supporting services include soil formation, the water cycle, primary production and decomposition; regulating services include ecological processes that influence pollination, climate regulation, severity and frequency of hazards (flooding and erosion protection for instance) and soil quality; provisioning services include food from agriculture, fibres (e.g. hemp and fleece) and timber; and cultural services include tourism, recreation, tradition, language and community development.

RISKS: Decreases in environmental quality can reduce the number of services provided. There are various risks to the services provided by the environment, particularly from human activities including development and poor management of land such as over-exploitation of resources[4]. Climate change is also a major factor that could affect the ability of the environment to provide a range of services.

Soils

BENEFITS: Soils provide a whole range of services including use in agricultural production of our food, storage of water, storage of carbon, foundations for urbanisation and woodlands, provision of minerals and metals and for biodiversity acting as both a habitat and a foundation for a range of habitats[4].

RISKS: There are various risks to soil formation including organic matter loss as a result of climate warming, inundation of coastal soils from sea level rise, erosion and compaction from agriculture and soil sealing from development[4]. Soil contamination is an additional threat posed by industry, urbanisation and mineral extraction which can affect biological processes of soil formation[4]. Degradation in soil structure can potentially be a factor in flooding as was found from survey work in the Upper Severn catchment[53]. Dissolved organic carbon (DOC) concentrations have increased in upland waters which suggests soil carbon stocks may be destabilising due to climate change[54].

Peatlands

Case Study

Peat, the un- or partially decomposed remains of plants, is mostly found in wetter sites. Accumulations of deep peat (≥0.5 m in depth) extend over 90,995 ha in Wales (4.3% of the Welsh land surface)[12]. Peatlands provide some of our most iconic Welsh landscapes and support a specialised but widely declining range of animals, plants and habitats[8]. Peatland soils also provide Wales' largest terrestrial ecosystem store of carbon, estimated at around 157 million tonnes[6]. Habitat degradation and/or the replacement of typical peatland vegetation by other forms of land-use results in the loss of biodiversity and can change peatlands to very significant sources of carbon, whilst also reducing their flood-risk management function. Soil erosion in upland areas can increase the amount of peat and carbon in drinking water causing discoloration and leading to high treatment costs[4].

Agriculture

BENEFITS: In addition to provisioning services (agriculture Gross Value Added (GVA) to the Welsh economy was £374.3 million in 2014[2]), agriculture also contributes to cultural ecosystem services such as landscape appreciation and tourism[4]. The Agrifood sector also supports the Welsh language – over a third (37 %) of employers reported all their staff used Welsh which is higher than the proportions seen in any other sector[3]. The environmental services provided by agriculture help in the maintenance of the many natural habitats on which many birds, mammals and insects depend. The Glastir land management scheme aims to deliver a broad range of environmental objectives detailed in the Wales Environment Strategy. Over 4,800 farms have entered the Glastir entry level schemes (Glastir

Agriculture Success Story

A 450 ha dairy/arable farm in south east Wales received advice from NRW on ways to improve the running of the farm from a financial and environmental perspective as current practices were causing problems[33]. To reduce pollution risks, new alarms were fitted and maintenance was carried out on the pumps of a reception pit (a pit used to collect slurry before storage) to reduce pollution risk, installed new guttering to reduce clean water falling into dirty yards and therefore reduce storage requirements, and improved targeting of nutrient application, spreading less during winter months. The benefits to the farm included savings of around £15,000 per annum through the use of a nutrient management plan, targeting of slurry and manure on arable fields, reduced pollution risks, reduced spreading pressures and improved uptake of nutrients.

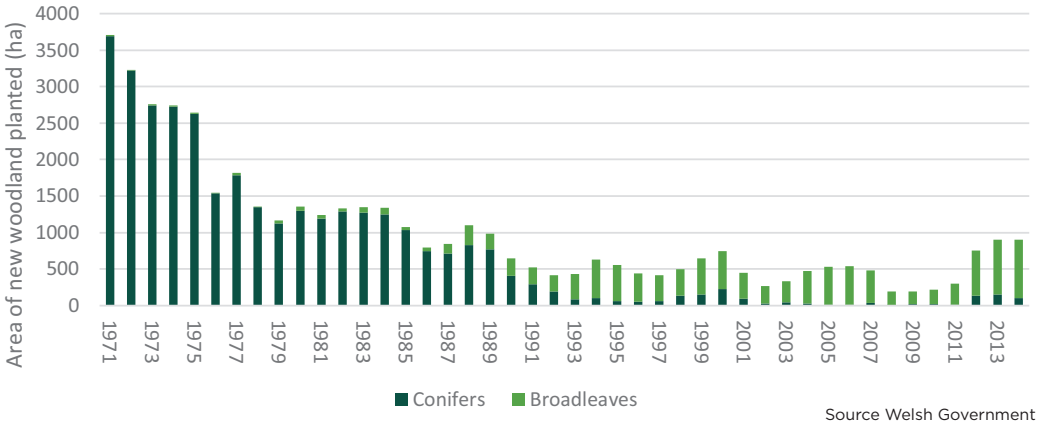
Entry and Glastir Commons), 1,600 of which have gone on to enter the more advanced scheme[55].

RISKS: Farmland provides significant ecosystem services, but there are also associated dis-benefits including greenhouse gas emissions, diffuse water pollution, biodiversity loss and possible increased flood risk[4]. The loss and degradation of topsoil can have high economic impacts for farmers. It takes over a century for 1 cm of topsoil to develop[33]; this is the most productive layer of the soil and its loss requires greater inputs of inorganic fertiliser and other management actions. The loss of soil, particularly where livestock are causing poaching on river banks, can have a substantial environmental impact on water courses creating turbidity and adding nutrients to the water. Water storage and damage to soil structure are also concerns to arable farmers.

Woodland

BENEFITS: Woodlands can deliver multiple ecosystem services, such as timber, soil protection, amenity and biodiversity[4]. These have increased as a result of the drive for sustainable forest management. Semi-natural (rather than plantation) woodland is less extensive but is an important component of Wales' biodiversity. The amount of broadleaves (as opposed to conifers) being planted has increased substantially which will help to improve biodiversity[5]. Welsh Government aim to plant 100,000 ha of woodland in Wales to increase woodland to 20% land cover[56]. This will provide 'continuous cover' which uses a mix of tree species of different ages to improve resilience against disease and climate change allowing selective felling to take place to encourage natural regeneration and reduce the use of pesticides.

Areas of new woodland planted per year by woodland type



Source Welsh Government

RISKS: The area of new woodland planting in Wales decreased significantly from 1971 to 2009[5] and many of the best examples of semi-natural woodland (on protected sites) are in poor condition[4]. Disease continues to be an increasing risk to the health of Wales' woodlands. The long term nature of woodlands means that future changes in climate will have an impact on the nature and composition of woodlands and the species they support.

Nutrient Cycling

BENEFITS: The nutrient status of soils is particularly important for regulating and provisioning services[4]. Many habitats and species play an important role in nutrient cycling, e.g. lichens containing cyanobacteria in natural woodlands[57], grassland fungi in natural grasslands[58] and microbes in soils[4]. Some species may also hold keys for reclaiming contaminated land, such as lichens, liverworts and mosses that are now restricted to areas of mine spoil due to their evolved metal-tolerance[59]. Although abandoned mines pose an environmental risk, several sites are designated as Sites of Special Scientific Interest (SSSIs) due to their unique ecosystems with these types of organisms[4].

RISKS: Some evidence suggests there may have been a widespread decline in the availability of phosphorus in terrestrial and aquatic ecosystems in recent years with extractable phosphorus in soils declining by approximately 25% between 1998 and 2007[4]. Most members of the cyanobacteria-containing lichens are currently declining due to various human impacts and increased growth of ivy and bramble[57], and there has been a >90% decline in semi-natural grasslands in Wales with grassland fungi showing declines of a similar scale[58]. This limits their distribution and therefore their nutrient cycling capabilities. The protection of metal-tolerant lichens, mosses and liverworts is in our interest but as they are restricted in distribution, this could be difficult to deliver. Degradation of soils in terms of structure and function from numerous impacts caused by humans will also contribute to reduced nutrient cycling and therefore reduced overall quality.

Climate Change

BENEFITS: Some areas under conifer plantations and improved grassland offer very significant opportunities for restoration, which would result in reduced soil emissions of green-house gases. Peatland and other habitats such as woodland are able to deliver carbon sequestration and storage, removal of emissions from the air and regulation of runoff to streams and rivers[60]. This all contributes to counteracting climate change.

RISKS: Our natural resources are vulnerable to the changing pressures with around a third of the services provided by ecosystems in the UK currently declining with many others in a reduced or degraded state[4]. Climate change poses a threat and emphasises the need for action. The two main consequences of climate change, that are also a threat to coastal habitats and species, are considered to be sea-level rise, currently thought to be accelerating, and changes to the condition of waves, with storminess thought to be increasing[61, 62]. Work is ongoing to improve understanding of vulnerability to climate change and to inform an adaptive approach. Increased storminess can mean severe storms and wetter summers and winters leading to increased flood risk. Welsh terrestrial environments and species are sensitive to extreme weather events and climate change. For example, peatlands[63], bats[22], breeding birds[64], mosses and liverworts[65] have all shown changes in their distribution and abundance according to the effects of climate change.

Cities, Towns and Greenspace

BENEFITS: The development of path networks, urban woodlands and other green infrastructure aimed at enhancing the quality and accessibility of the local environment can all play an important role in improving the health and well-being of people in Wales[25]. Passive contact with greenspace has been found to reduce blood pressure and stress levels for instance[66]. Health benefits from walking have been valued at £18.3 million per year[67,68] and improved tourism from this results in better local economy.

The Green Infrastructure approach attempts to bring together the built environment and the natural environment, improving the economy whilst protecting and enhancing the environment[69], and has been incorporated intosupplementary planning guidance by some local authorities including Bridgend and Monmouthshire. Urban trees contribute to increased recreational opportunities, and an enriched and balanced environment that ultimately boosts a town's image and prosperity. The i-Tree Eco Wrexham study[70] sought to quantify the benefits and risks of urban trees.

Wales Coast Path

Case Study

The 870 mile long Wales Coast Path was officially opened in May 2012[67.] It provides a continuous walking route around Wales from the outskirts of Chester to Chepstow. It is as near to the coast as legally and physically practicable, whilst taking health and safety, land management and conservation into account. The path was launched to encourage physical recreation and enjoyment of the coastline of Wales and encourage tourism bringing economic benefits.

Image ©VistWales

Projects such as Rainscape and Greener Grangetown are excellent examples of green infrastructure works and is currently being implemented.

RISKS: It is estimated that the cost of physical inactivity to Wales is around £650 million per year[71]. Even in our 'green' country, not everyone has access to the green space required to maintain physical health and mental well-being[25] and there is still a way to go with integrating the green infrastructure approach into development plans[69].

The accessibility of parks and open spaces still does not meet the national target. The percentage of people that considered they had very easy access to parks and open spaces reduced by almost 20% from 2005 to 2009/2010[26] so overall there was a large proportion of people who considered they did not have good access to greenspace. Only 56% of the population met standards for access to natural greenspace within a 300 m walk of home[25].

i-Tree Eco Wrexham

Natural Resources Wales, Forest Research and Wrexham County Borough Council piloted the first study in Wales to find the true value of urban trees. The i-Tree Eco study (2013)[70] found that Wrexham's trees save the local economy more than £1.2 million every year by:

- Intercepting 27 million litres of rainfall from entering the drainage system, equivalent of saving £460,000 in sewerage charges.
- Absorbing 1,329 tonnes of carbon dioxide from the atmosphere.
- Improving people's health by removing 60 tonnes of air pollution saving health services £700,000.

Oak disease and ash die back puts 11% of Wrexham's trees at risk. Only three species account for 42% of Wrexham's trees and 10 species form 70% of the total population. Greater diversity of trees are needed to reduce the risk of pests and diseases. A wholesale loss of Wrexham's trees would cost around £900 million.

Industry and Waste

BENEFITS: Waste can be a valuable resource when reused or recycled. The National waste strategy 'Towards Zero Waste'[72] has been implemented to shift our nations thinking towards waste as a resource. The aims of the strategy are for Wales to be a high recycling nation by 2025 and a zero waste nation by 2050. Through the strategy, Wales is working towards a 'circular economy' which means keeping resources in use for as long as possible (extract maximum value, recover and regenerate) rather than a 'linear economy' which makes, uses and disposes of materials and products. Wales has already made clear improvements in managing waste more sustainably over the last decade through increasing the amount sent for recycling and reducing the amount sent for disposal.

RISKS: Changes to the population, behaviour of people, consumption patterns and composition of waste are the main risks to reducing waste and achieving the 'circular economy' that Wales is currently working towards. As more complex products, e.g. Waste Electrical and Electronic Equipment (WEEE) and nano materials, are added to the waste stream, the waste industry will need to evolve and keep pace to deal with such waste and manufacturers will need to work on product and packaging designs to reduce the amount of waste and increase the amount that can be reused or recycled.

Land: Links with Air and Water

The activities on land can affect what goes on in our water resources (groundwaters, rivers, lakes, seas) and also the air around us.

Development, industry, agriculture and our ways of dealing with waste whilst providing benefits can also lead to challenges[4] such as greenhouse gas emissions, diffuse water pollution, biodiversity loss, increased flood risk and reduced baseflows in rivers and streams.

Mines in particular are a historic problem for water quality with a number of waterways failing Water Framework Directive (WFD) requirements as a result of pollutants entering the water from abandoned mines[48].

Agriculture presents issues such as compaction of soils[4,33], leading to increased surface run off which can increase flooding risk and the risk that fertilisers spread on land will run into nearby water courses[33] rather than infiltrating the soil leading to problems such as eutrophication.

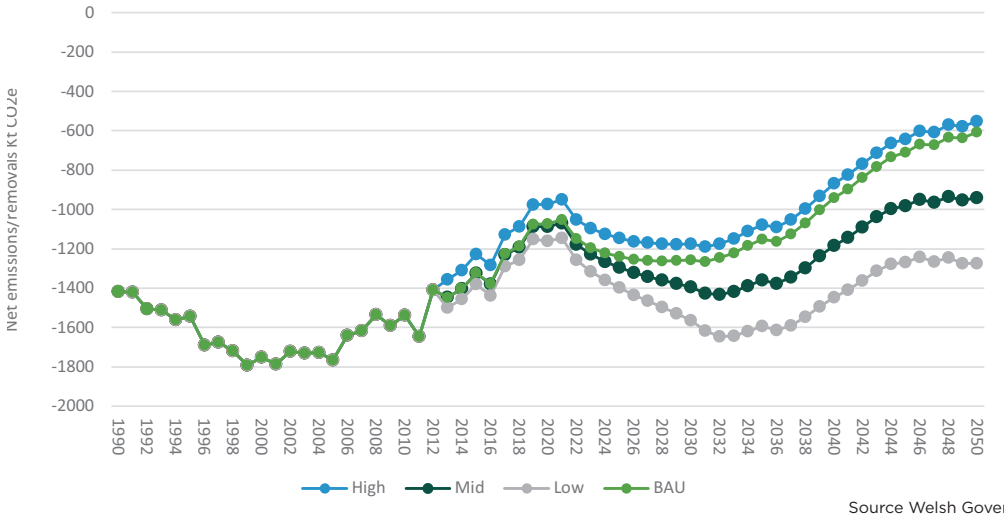
Soil erosion due to inappropriate land management during development, agriculture or other means has been a more prominent issue since the 1970s and has significant social, economic and environmental impacts. Soil erosion can reduce farm productivity as the soil quality is degraded and soil entering freshwater ecosystems can cause major damage, for example by covering spawning gravels used by fish. It can also block drainage systems leading to flooding and build up in reservoirs and port areas can result in high dredging and disposal costs[73]. Soil pollution can also increase the risk of eutrophication in freshwater and marine ecosystems due to the phosphate content in agricultural soil.

410 million
tonnes of carbon is thought to be stored in Welsh soils

Trees allow deeper infiltration of surface water from rain through breaking up the soil with their roots. This helps to create more carbon-rich soils (i.e. storage) which reduces the amount of carbon dioxide in the air. Forests, peatlands, grasslands and soils sequester (store) large amounts of carbon from the atmosphere. The amount of carbon in these natural habitats is equivalent to more than 10 times the annual emissions from industry and services[4]. Carbon sequestration by the land use, land use change and forestry (LULUCF) sector in the UK has been predicted to reduce by 2020, improve by 2034 and reduce again by 2046. In addition, the sequestration of harvested wood products has been modelled to improve by 2019, reduce by 2022, gradually improve by 2043 and reduce again. Under all scenarios forestland and harvested wood products remain net sinks (see graphs)[5]. A total of seven projects are currently registered under the Woodland Carbon Code in Wales covering 231 hectares of woodland and are projected to sequester 116,000 tonnes of carbon dioxide over their lifetime of up to 100 years[7].

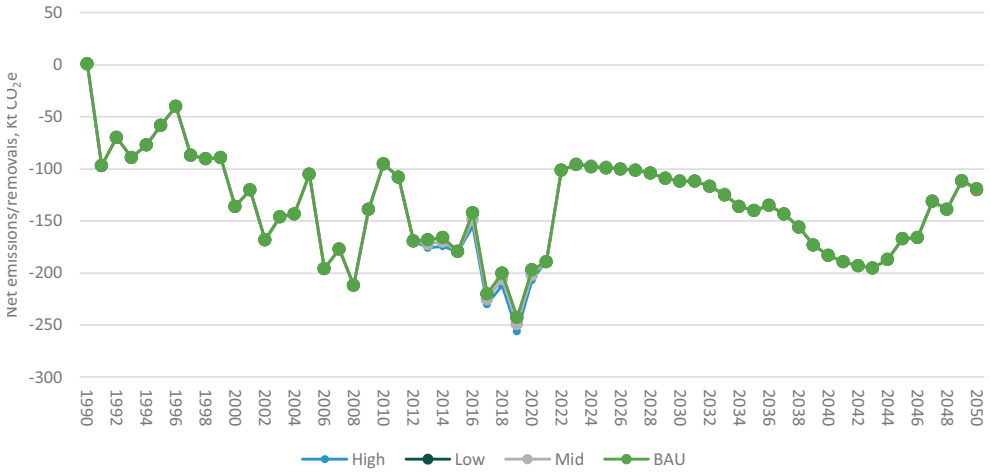
Welsh soils hold nine times the amount of carbon than is stored in all vegetation with much of it (80%) associated with upland and grassland soils. The amount of carbon that is stored in Welsh soils is thought to be around 410 million tonnes[4]. A 1% annual loss of stored carbon in soil would increase Welsh net carbon emissions by 25%[74].

Forestland CO_2 emissions and removals under four scenarios: high emissions, mid emissions, low emissions and business as usual (BAU) (i.e. without policies and measures)



Source Welsh Government

CO_2 emissions and removals from harvested wood products under four scenarios: high emissions, mid emissions, low emissions and business



Source Welsh Government

Higher carbon levels in soils also increase the amount of water that can be stored. Areas with woodlands and individual trees are better equipped to store higher rates of rainfall which aids in flood prevention and allows a slower release of water keeping groundwater levels more stable and maintains river flows during extended dry periods[4].

Upland soils have been adversely affected by climate change, land management and atmospheric pollution. Careful management of upland areas for their carbon stores is required to prevent these areas shifting from a carbon sink to a carbon source. The strength of the forest carbon sink is expected to decline as a result of reduced planting rates in recent years. If the existing carbon resource that is locked within organic and organo-mineral soils is lost, it will be difficult to mitigate against climate change in the Welsh uplands[4].

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Water story

Water is the basis of life on earth and used for drinking, washing, industry, food production or recreation. We can't avoid the impact that too little, too much or dirty water has on the people, the economy and the environment of Wales.

The quality of the water in Welsh rivers, lakes, and around the coast has been improving over the last 20 years, but there are still issues to resolve. Abandoned mines, contaminated land and acidification from Wales' Industrial past; Invasive non-native species; sewage discharges and misconnected pipes; man-made changes to water courses and the coast, land management practices and urban run-off; all affect the water environment from mountain to sea.

Life is for living

Visitors and locals alike expect high quality bathing waters and accessible waters for recreation and sport. Welsh Water spent £1.6 billion (capital expenditure) between 1990 and 2015 on water quality enhancements and plan to spend an additional £150 million over the next 5 years[1].

Water Water everywhere?

Wales is seen by many as being water rich, but in significant parts of Wales, there are no further reliable supplies of water available for new abstractions, which has implications for long term growth in these areas[2].

Climate Change projections indicate that the frequency of serious droughts and intense rainfall events will rise. This has implications for water supply, flood risk management and pollution control.

Case Study

The return of the otter – more than a conservation success story

The decline in otters is thought to have begun in the late 1950s, and was mainly caused by the introduction of the persistent organochlorine pesticides dieldrin and aldrin that were widely used as seed dressing and sheep dip. In 1978, there was no sign of Otters at 80% of the sites where they were looked for[3].

As well as clean water, a healthy otter population needs a sustainable fish population. Poor agricultural and forestry practice can result in nutrients and sediments affecting the water. Siltation reduces the oxygen content of gravel beds which is vital for fish egg development.

A repeat survey in 2010 found otters at 90% of the original sites[4]. As well as the ban on pesticides and legal protection for the otter, other issues were addressed in an integrated way. Pollution control, investment by the water industry and efforts by landowners and river managers to improve river and river bank habitat have all played a part. We expect a full recovery across Wales within the next decade. This is an excellent example of where land and water management has worked to improve the overall environmental health as well as saving an iconic species, providing benefits to all.

Water Evidence

The evidence that follows is a summary of the state of Wales' water environment as we currently understand it. Measures we use to describe the pressures affecting the water environment and benefits or risks identified are included at a high level. There are gaps in our knowledge and there will be other ways of showing how the economy, the environment and the people of Wales are reliant on each other to ensure a resilient Wales for the well-being of future generations. This will be explored further as we develop the State of Natural Resources Report, the first of which is to be published in Autumn 2016.

State of water

Water Framework Directive (WFD) Status – Surface water

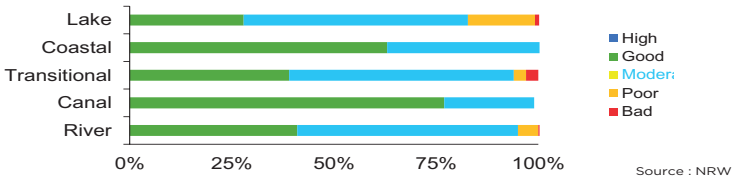
We use the term water bodies to help understand and manage the water environment. A water body is part, or the whole, of a river, lake, ground water or coastal water. Water bodies are reporting units and the quality of them are indicators of the health of the wider water environment. We assess the condition of these water bodies through monitoring which produces an annual classification. For rivers, lakes, canals, estuaries and coastal waters the classification is based on the ecological and chemical condition of the water body. We collect biological, chemical and physical data, which are combined to give an overall status of high, good, moderate, poor or bad, based on the lowest reported class from the different elements monitored.

WFD Ecological Status – Surface water

40.6%
of surface water bodies were in good or better ecological staus in 2014

Ecological status for surface waters is determined from a combination of data for biological, physico-chemical and specific pollutants.

Percentage of assessed water body by number Ecological Status (C1 2014)



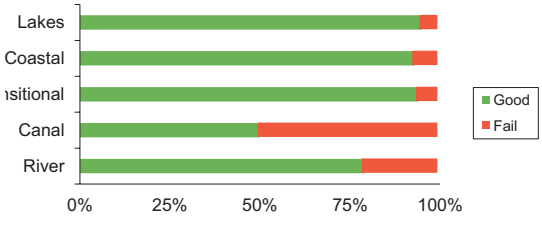
Source : NRW

Of the surface water bodies that have been assessed in Wales, 40.6% were good or better ecological status in 2014[5].

WFD Chemical status – Surface waters

There will be two surface water chemical status classes; Good and Not Good. Chemical status in 2014 was assessed by compliance with environmental standards for chemicals defined as priority substances or priority hazardous substances.

Percentage of assessed water body by number Chemical Status (C1 2014)



Source : NRW

83% surface water bodies were assessed as Good Chemical status in 2014 [5].

55%
of groundwater bodies were assessed as Good overall in 2014[5]

WFD overall status – Surface waters

To achieve the overall aim of "good status", a surface water will have to be at least good for ecological and chemical status. Overall, 40.4% of surface water were at good or better overall status in 2014.

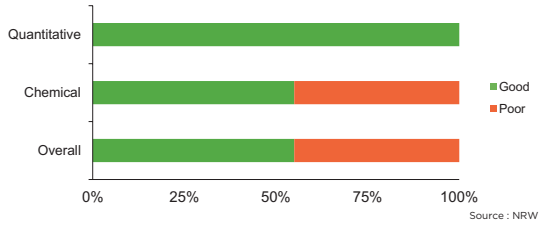
WFD status – groundwater status

Groundwater are required to achieve good quantitative status and good chemical status.

55% Groundwater bodies were assessed as Good Chemical status in 2014[5].

55% of Groundwater bodies were assessed as Good overall in 2014[5]

Percentage of assessed water body by number
Ecological Status (C1 2014)



Source : NRW

Status of Habitats and Species

Habitats Directive reporting provides information on the conservation status of specified individual habitats and species.

Within the Directive, favourable conservation status of a habitat is defined as when:

i. its natural range and areas it covers within that range are stable or increasing, and;
ii. the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and;

iii. the conservation status of its typical species is favourable

For species, favourable conservation status is defined as when:

i. population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and;
ii. the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and;
iii. there is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long term basis[6].

Freshwater habitats and species

Thirty eight out of 44 (86%) designated freshwater habitats and species[a] are classified as unfavourable status[7]. (see chart in land chapter)

Upland lakes are improving due to widespread recovery from acidification. Improved data quality and assessment methods have allowed us to demonstrate recovery[8,9,10].

All lowland lakes so far assessed are in unfavourable condition due to nutrient and / or invasive species impacts. These sites show no clear change in condition, although there are signs of small improvements at a few sites[8]. Current predictions suggest that ongoing climate change will cause a deterioration in lake ecological quality, although this pattern is not being observed so far in Wales.

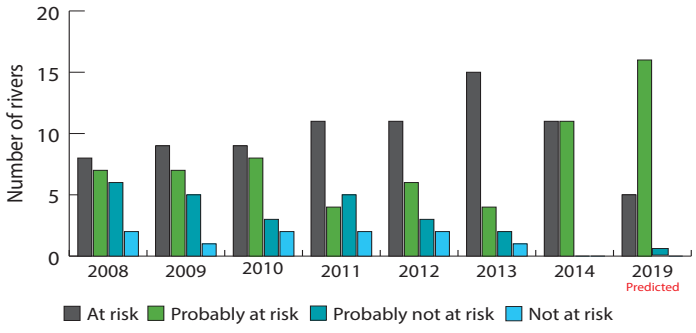
Freshwater Pearl Mussel, White-clawed Crayfish and southern damselfly populations are critically endangered in Wales[11].

Water vole populations are declining across Wales and the UK. Populations are strong on Anglesey and at upland sites in North and Mid Wales but scarce elsewhere. The population appears to be declining in South Wales[3].

Otters are continuing to increase in numbers and are considered to be at favourable conservation status in Wales[4].

The latest assessment of salmon stocks[12] indicates that most rivers in England and Wales are in a depleted state. Improvement is unlikely within the next five years.

Principal salmon rivers wholly or partly in Wales
Compliance against conservation limit management objectives



Source NRW

Based on recent angler catches we have concerns about sea trout stocks across Wales although a number of rivers, mainly in North Wales, have improved in recent years[13].

Stocks of European eel are in serious decline. NRW is aiming to improve eel stocks across Wales by implementing the England & Wales Eel Regulations (2009) and leading on delivering with stakeholders the Dee and West Wales Eel Management Plans1[4].

Marine habitats and species

Important Welsh marine natural resources have been lost or are in serious decline. The UK National Ecosystem Assessment (2011)[15] concluded that habitats within the marine environment exhibit the greatest deterioration, with continued or accelerated decline across 60% of marine habitats compared to only 8% for terrestrial habitats and 33% for freshwater habitats.

[a]Habitats Directive Special Areas of Conservation

Case Study

Honeycomb Worm reefs have returned to the North Wales coast after an absence of over 60 years[16]

Honeycomb Worm reefs have returned to the North Wales coast after an absence of over 60 years[16].

Reefs built by honeycomb worms (Sabellaria alveolata) are of nature conservation interest due to their restricted distribution, fragility and potential to increase local biodiversity. S.alveolata is listed as a BAP habitat due to its limited distribution in Britain and because it is vulnerable to damage from coastal defence work and trampling. S.alveolata historically occurred in the region of Llanddulas up until the 1950s, but had not been seen since, possibly due to a combination of poor survival during cold winters, lack of suitable substratum and larval supply.

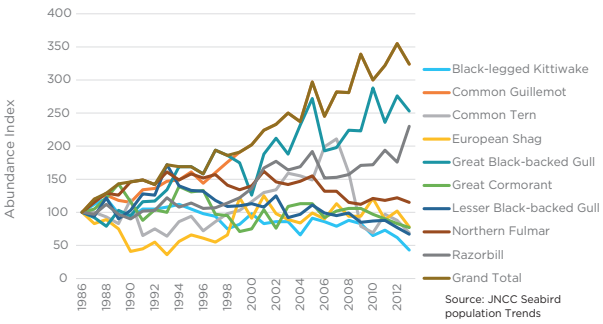
A new young reef was recorded in the winter of 2007/08. The reef has been revisited several times and new recruits have been seen each year. Hand removal of blue mussels in 2006 on the lower shore is thought to have aided the settlement of the worm larvae. For restoration of honeycomb reef elsewhere, multiple factors must be considered, including the presence of substratum, sand flow and larval flow.

In 2013 two thirds of designated coastal, estuarine and marine habitats[b] were classified as unfavourable status[8] (see chart in land chapter).

Seagrass beds in Wales appear to be recovering[17] from the wasting disease that was prevalent in the 1920s and 30s[18] but there are gaps in our understanding about why this is and whether it is sustainable.

Wales' estuaries are important for wintering wildfowl and waders.

Welsh seabird abundance index



Welsh seabirds populations are of international conservation importance. Most seabird populations are doing well, with the exception of Kittiwake and Lesser black-backed gull, which are experiencing the same decline as across the rest of the UK. Half of the world's population of Manx shearwaters breed on the Islands of Skomer and Skokholm[13].

Cardigan Bay is home to the largest of the two coastal UK populations of Bottlenose dolphins, a species of international conservation importance (European Protected Species). Bottlenose dolphin population is considered favourable at present with around 300 individuals, although there are some recent indications of a declining trend[13].

Cardigan Bay is home to the largest of the two coastal UK populations of **bottlenose dolphins**

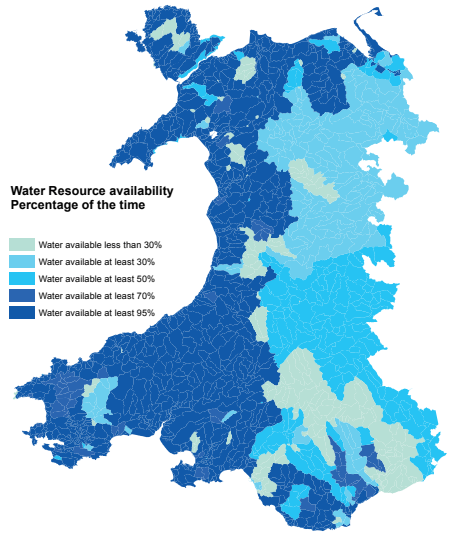
Wales is also home to several other commonly occurring marine mammals of international importance, including common dolphin, Risso's dolphin, Minke whale and the grey seal. The grey seal is experiencing a marked increase in population numbers (>5000). The UK holds around 50% (at least 115,000) of the harbour porpoise population in Europe. There are key areas around Wales for the species that have been identified as suitable for new possible Special Areas of Conservation[13].

[b] Habitats Directive Special Areas of Conservation"

Water resource availability

About 60 per cent of water bodies in Wales can provide a reliable source of water for new abstractions for at least 95 per cent of the time. About ten per cent of water bodies in Wales can only provide water for new abstractions thirty per cent or less of the time (less than 100 days a year)[19]

Water resource availability (% of the time) in Wales



Contains Natural Resources Wales information © Natural Resources Wales and database right

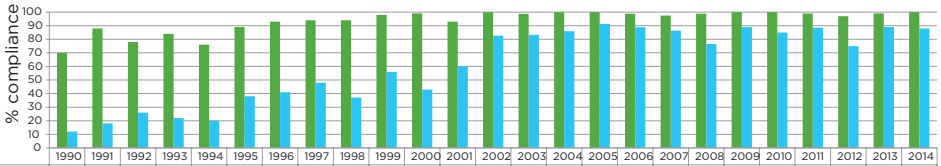
All 102
bathing waters complied with the minimiium requirements of the EC Bathing Water Directive in 2014[20]

Bathing water quality

All 102 bathing waters complied with the minimum requirements of the EC Bathing Waters Directive in 2014. 90 met the stricter Guidelines standards[20].

The new Bathing water directive brings in stricter standards to protect the public. 2015 will be the first time we report under these standards. Projected classifications against the new standards have been calculated using the 2011-2014 data. Of the 102 designated bathing waters all 102 met at least the Sufficient standard, 97 were at least Good and 79 achieved the toughest of the new standards, Excellent.

EC Identified Bathing Water compliance



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
% passing Mandatory	70	88	78	84	76	89	93	94	94	98	99	93	100	98.7	100	100	98.8	97.5	98.8	100	100	98.9	97	99	100
% passing Guideline	12	18	26	22	20	38	41	48	37	56	43	60	82.6	83.3	85.9	91.3	88.8	86.3	76.5	88.9	85	88.6	75	89	88

Source : NRW

The shellfish industry in Wales is valued at approximately
£10million
per year

Shellfish waters

All Shellfish Water Protected Areas (SWPAs) met the mandatory standards for water quality in 2013 ensuring support for the shellfish industry in Wales valued at approximately £10 million per year. Only a third of Shellfish protected areas met the more stringent guideline standard for E Coli within the shellfish flesh[13].

Pressures on Water

Pressures on the water environment are many and varied[21, 22]

Physical modifications. Human development can lead directly to habitat loss and also impact natural processes, such as movement of sediment and the migration of species. Modifications include coastal and flood defences, weirs and impoundments, land drainage and navigation structures, and shellfisheries on estuaries and in coastal waters.

Exploitation. A survey in Milford Haven recorded over 30,000 bait dug holes in sheltered muddy gravel and mudflat habitat as a result of cockling or bait digging[23]

Pollution from sewage and waste water. Waste water can contain large amounts of nutrients (such as phosphorus and nitrates), ammonia, bacteria and other damaging substances.

NRW regulates discharges into the water environment from industrial sources (installations such as factories) and sewage treatment works through a strict environmental permitting regime that places strict discharge limits on industrial operators that must be met.

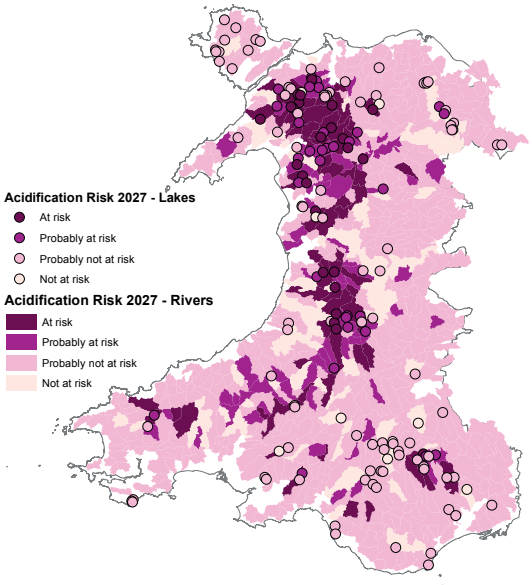
Pollution from towns, cities and transport. Rainwater running over manmade surfaces and carrying pollutants into waters, toxic substances from contaminated land, atmospheric pollution causing acidification and sewage from houses 'misconnected' to surface water drains rather than sewers.

Concentrations of chemicals such as Mercury and Brominated Flame Retardants fail stringent European standards in a wide range of marine estuarine environments.

Legacy pollution from acid deposition during the 20th Century.

'Acid rain', caused primarily by acid gas emissions from heavy industry and power generation during the 20th Century, resulted in severe acid pollution in many soft water rivers and lakes in Wales, especially in upland areas (see map). These pressures are largely under control (see the Air Pollution document), but recovery is slow and there is still ecological evidence of impact in many waters. Nevertheless, natural chemical and biological recovery is clear[24]. Data from the Uplands Waters Monitoring Network shows that since 1990, these waters are around 10x less acid, are able to support fish populations and have

Acid sensitive areas of Wales as assessed by WFD risk assessment Cycle 2



just under twice as many invertebrate species[25]. We expect this recovery trend to continue.

Marine litter has economic, environmental and aesthetic impacts in the UK. The 2014 winter storms resulted in large volumes of material being deposited on Welsh beaches. This generated considerable public interest and effort to clean the beaches after the events[26].

Pollution from rural areas. Poor agricultural and forestry practices can result in nutrients, sediment, organic matter, and chemicals affecting the water environment. Sources are often diffuse in nature.

Nitrate Vulnerable Zones

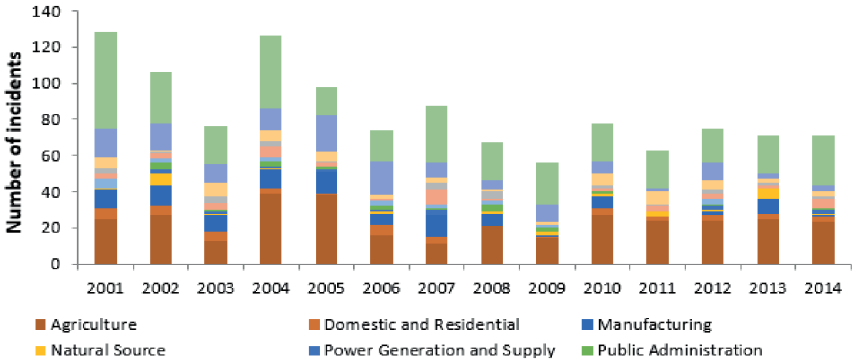
The Nitrates Directive (91/676/EEC) is designed to protect waters against nitrate pollution from agricultural sources. It requires European member states who do not opt for a whole territory approach to identify waters which are, or could become, polluted by nitrates. The member states are also required to designate as Nitrate Vulnerable Zones (NVZs) all land that drains to those waters and which contributes, as a result, to nitrate pollution.

Nitrate Vulnerable Zones currently cover 2.4% of Wales[27], there are around 1000 holdings with land within a Nitrate Vulnerable Zone. On these farms, fertiliser applications are limited (both in terms of the amount that can be applied as well as location) in order to reduce the impact of nitrates into adjacent water bodies. NRW is currently collating relevant evidence in support of the statutory 5-yearly NVZ review process.

Pollution incidents affecting water quality – by source

Agriculture regularly causes a high proportion of significant pollution incidents, although the cause of many is often not identified[28].

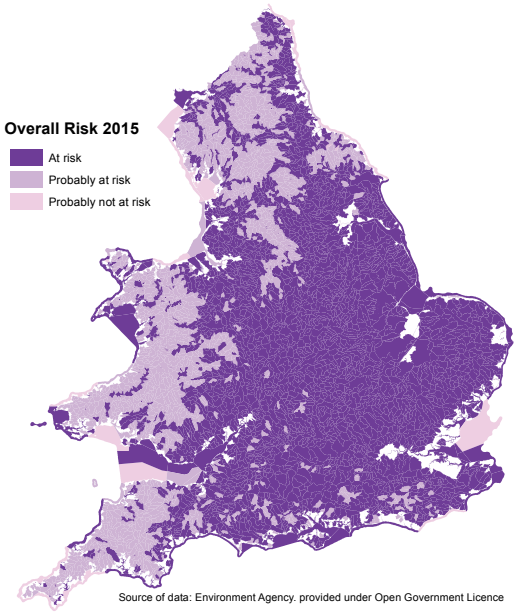
Category 1 & 2 Pollution incidents by source affecting land quality in Wales



Pollution from mines. Contaminated water draining from mines, most of which are now abandoned, add heavy metals to rivers and lakes, and in some cases cause acidification.

Invasive Non-Native Species (INNS). The presence of invasive non-native plants and animals in our rivers, lakes and seas poses a threat to biodiversity and our protected sites, increases flood risk, affects the state of our water environment and costs the economy billions of pounds per year. Aquatic species are often particularly difficult to manage, because they can spread via several pathways such as recreational activities, shellfish movements and shipping. Riparian species can also be spread via bulk material transport, and there are often few, if any effective control methods. NRW is working with UK partners, especially the GB Non-native Species Secretariat[29], to implement the GB Non-Native Species Framework Strategy. More than a third of Wales' waterbodies are at immediate risk of failing Good Ecological status as a result of aquatic INNS[30].

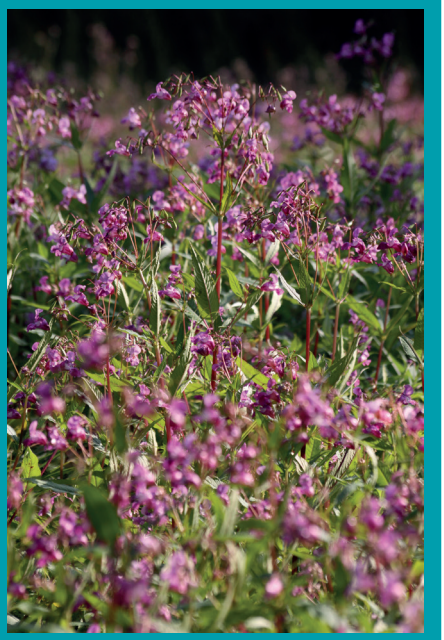
Aquatic Non Native Species Risk Assessment 2015 Cycle 2



Invasive non-native species

Invasive aquatic plants such as Canadian pondweed (*Elodea Canadensis*) and Himalayan balsam (*Impatiens glandulifera*) and aquatic invertebrates such as the invasive shrimp (*Dikerogammarus villosus*) from Eastern Europe and the signal crayfish (*Pacifastacus leniusculus*) affect or threaten freshwater ecosystems in Wales. Chinese mitten crab (*Eriocheir sinensis*) has recently been found in the Dee catchment where they pose a threat to biodiversity, riverbank stability and flood risk management and marine and freshwater fisheries. The invasive Carpet Seasquirt (*Didemnum vexillum*) was found in Holyhead harbour in 2007. The species is known to threaten native species and aquaculture by rapidly overgrowing fauna and flora and smothering them.

The quagga mussel (*Dreissena bugensis*) and two freshwater shrimps have recently been found in England and are likely to spread to Wales in the near future.



Water temperature

UK river temperature increased over the second half of the twentieth century, broadly in line with changes in air temperature. Changes have not been directly attributed to climate change as the processes (energy exchanges and flow) that control water temperature are complex. River water temperature is expected to increase across the UK through the twenty-first century, mainly as a response to increased energy inputs. The rate and pattern of change is not clear. Increases in water temperature will be modified by hydrological

changes, which may either magnify or reduce the impact of changes in energy input.

There is some evidence that freshwater ecosystems may be responding to changes in water temperature, for example with reductions in some fish species in some catchments. Increased water temperatures may threaten cold-water fish species, with invasive and non-native fish species finding conditions more favourable. Future conditions are expected to be more favourable to invasive species[31].

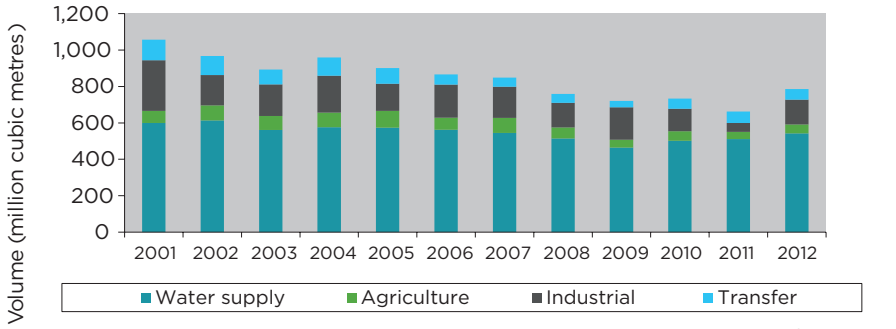
Water abstracted from the environment

There are around 1,100 abstraction licences in Wales and another 500 abstractions taking more than 20 cubic metres per day but are currently exempt from licensing. There are an additional 400 licences within the Dee, Wye and Severn catchments which serve both England and Wales. In addition to supplying approximately 3 million people in Wales, water from Wales supplies approximately 6 million people in England, predominantly in the West Midlands, Cheshire and Merseyside.

In 2012, 786 million cubic metres of water was abstracted from the Welsh environment[c], a decrease of 26% since 2001[32].

The main users of water in Wales are public water supply, agriculture and industry. Hydropower is also a dominant user of water, but like fish farming it is largely non-consumptive as the water is returned to the river. Any potential impact on the environment between the point where the water is abstracted and the downstream point where it is returned to the river is considered as part of the licence application process[33].

Volume of water abstracted from the environment in Wales per annum by purpose



Source : NRW

[c] Excluding that used for electricity generation

Climate Change and extreme weather impacts

Climate projections

As a result of climate change we may expect to see changes in seasonal water availability; greater risk of flooding from rivers and the sea and periods of poor river water quality, associated with low river flows during prolonged dry periods (reduced dilution for effluents) and with intense rainfall events (storm runoff and discharging of sewers).

The UKCP09 projections[34] of the annual average rainfall in Wales show only very limited changes over time. Projections of summer rainfall show significant progressive decreases and winter rainfall shows increases over time. Under the medium emissions scenario, for example, summer rainfall is projected to fall by 7% by the 2020s, and winter rainfall to rise by 7%. It is expected that the increases in winter rainfall will be as a result of increased storminess leading to intense, but short-lived, rainfall events. Looking longer term, across different parts of Wales the summer average rainfall is projected to decrease between 10 and 40% by the 2080s, and winter average rainfall to increase between 0 and 30%. The biggest changes will be in South West Wales.

The relative sea level rise around Wales (taking into account land level changes) is predicted to be 31, 36 and 43 cm for the low, medium and high emissions scenarios respectively by the 2080s. By 2040 the estimated sea level rise for all emissions scenarios is around 15cm.

Cost of flooding

Flood protection in 2035 may require

3 times

the level of investment

The cost of the winter storms of 2013/14 in Wales exceeded £40m. Significant damage and costs, estimated at £3billion, were avoided as a result of investment in new and existing flood defences[35]. The standard of protection afforded by flood defences will gradually decrease as a result of climate change unless continued investment is made to maintain the defences to a particular standard. It is estimated that to maintain the same level of flood protection in 2035 as today may require around 3 times the current level of investment. The Future flooding in Wales Report (2010)[36] concluded that the likelihood of climate change increases the risk of flooding over time; sea level rise, increased rainfall events & intensities, means more locations will be at risk of flooding and those that currently flood may experience more frequent flooding and that the flooding will be deeper and faster flowing.

Water resources

Many Welsh rivers are vulnerable to climate change because their flows rise and fall quickly in response to rainfall. The geology of Wales is such that there is relatively little natural storage of water in aquifers to support and maintain river flow in drier periods. A refresh of the Case for Change in 2013[19], to support abstraction licensing reform proposals, assessed how the effects of UKCP09 climate change scenarios, combined with environmental and socio economic scenarios, could affect the availability of water resources in Wales by 2050. The work shows that catchments across Wales are expected to experience significant unmet demand under many of the scenario combinations. There are significant risks of less water being available to people, business and the environment. The climate change scenarios showed that river flows in the summer and early autumn could reduce by over 50 percent, and as much as 80 percent in some places.

Effects on freshwater environments

The likely effects of climate change on our freshwater habitats are becoming increasingly well understood. In general, climate change is predicted to aggravate existing pressures, especially those related to nutrients, invasive species and acidity[37,38,39,40]. Probable impacts of climate change include more extreme floods and droughts, lower dissolved oxygen concentrations, increased growth of nuisance algae and toxic algal blooms, decline or loss of high value cold water species such as trout and salmon, and spread of invasive non-native species. However, for the short to medium term, climate change effects in freshwaters are predicted to be much smaller than from existing pressures. If we meet our Water Framework Directive targets by the 2027 deadline, our environment will be resilient to future climate change[41].

Although climate change needs to be tackled at a wider scale, mitigation measures such as tightening nutrient targets, managing river corridors to encourage trees and other vegetation, and ensuring that adequate environmental flows are maintained are very effective for maintaining ecological quality in rivers, as well as having other socioeconomic benefits[41].

Effects on marine and coastal environments

Coastal saltmarsh, intertidal mudflats, littoral seagrass beds and saline lagoons are considered some of the most vulnerable to climate change impacts[42 43]

Three month shifts in the reproductive activity of toothed topshell (*Osilinus lineatus)* have been seen since the 1960s and 1970s and appear to be linked to warmer winter and spring temperatures[44].

There have been changes in Welsh wintering distribution of estuarine birds[22].

The seabird wreck[d] in early 2014 resulted in over 30,000 birds estimated to have died on the Western European seaboard, including many birds from

[d] Dozens of dead seabirds washed up on beaches with no obvious cause of death, like oiling, are often referred to as 'wrecks'.

Welsh colonies. This event was exceptional in Wales, as reflected in the results of the RSPB Welsh Beached Birds Survey[45] , and it may be reflected in future seabird numbers for many years. Although vulnerable, there was no largescale evidence of fish or marine mammal mortality but individual Welsh born seal pups may have been displaced and suffered deterioration in condition[13].

By maintaining hard sea defences to protect properties and infrastructure, coastal habitats and species are predicted to be lost due to Coastal squeeze (habitat being squeezed between hard defences and rising sea-levels)[46]

Examples of Benefits and Risks to Benefits

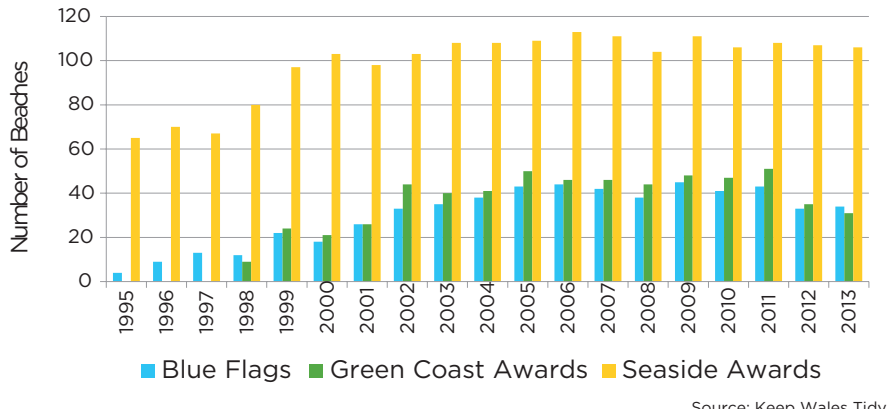
Use of water for recreation

Benefits. According to the 2011 Wales Outdoor Recreation Survey (WORS), 7% welsh adults participate in angling, 4% in non-motorised watersport and 7% in outdoor swimming[47].

Economic benefits of cleaner bathing waters can be seen around the coast. Last year, Keep Wales tidy awarded 34 Blue Flags and 31 green Coast Awards, recognizing the quality of Welsh Beaches

Risks. With the introduction of more stringent bathing water standards, further investment will be needed to reduce the impact of diffuse pollution from poor land management and mis-connections on bathing waters across Wales.

Welsh beach awards



Source: Keep Wales Tidy

Sustainable energy generation

Benefits. In 2014 hydropower in Wales produced 315 Gigawatt hours of electricity, 10% of the total electricity generated by renewables. Hydropower is the second largest contributor to renewable energy generation in Wales after wind. Whilst the majority of electricity is generated by a small number of large hydropower schemes, the micro-hydro industry has expanded rapidly in the last three years since the introduction of the Feed in Tariff. This has provided valuable opportunities for farmers and landowners to make use of their natural resources for small scale renewable energy generation and to generate new incomes in rural communities. There are now about 250 licenced hydropower schemes in Wales[48].

Risks. With the rapid development of micro-hydropower in Wales, new schemes need to be carefully designed and operated to ensure that they have a low risk of impact on the river environment. Poor schemes can have quite adverse, long term ecological impacts at a local and catchment scale particularly for migratory fish species such as salmon and sea trout. Through

our abstraction and impoundment licensing process we ensure that new hydropower schemes are carefully sited and designed to prevent them from creating barriers to fish migration and to minimise their effect on movement of sediment. We also ensure that there is enough water left in the river to protect the flora and fauna between the points of abstraction and discharge. By requiring environmentally considerate design and operation our aim is for the hydropower industry to have a long term and sustainable future in Wales.

Wildlife-related economic activites are estimated to be worth

£1.9billion

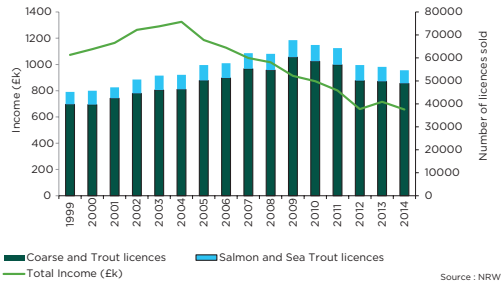
in any one year[49]

Links to the Welsh economy

Benefits. A 2001 study estimated that the environment contributed £8.8 billion of goods and services annually to the Welsh economy, 9% of Welsh GDP and one in six Welsh jobs, mainly in the leisure and tourism, agriculture and forestry, water abstraction, conservation and waste management sectors[15].

In 2007, the 'Wildlife Economy Wales: An Economic Scoping Study estimated wildlife-related economic activities to be worth around £1.9 billion in any one year and comprise around 3% of Wales' national output[49].

Rod licence sales in Wales



The number of people fishing and buying a licence is declining. In 2009 we sold nearly 67,700 rod licences. By 2014 this had fallen to 54,600 rod licences generating a total income of £1.07million.

Risks. Important Welsh marine natural resources have been lost or are in serious decline[50]

Native oyster, Skates and rays, Herring and other commercial stocks have all declined significantly.

The marine crawfish fishery in Wales that was thriving up to the 1980s has almost disappeared[51].

Subtidal sediment habitats are affected in varying degrees by dredging and trawling for fishing and other activities[15]:

There have been successful convictions for illegal scallop dredging and trawling adjacent to protected horse mussel reefs off the Llyn Peninsula.

In Tremadog Bay illegal fishing impacted 77ha of muddy gravel that was rich in invertebrate species.

Water: Link with land and air

Flooding of land, from rivers, the sea and surface water impacts on properties and business. Not just from the presence of water where it isn't wanted, but from the change it causes through soil and coastal erosion.

Changes in the quality of freshwater can lead to effects in the marine environment, as water moves from source to sink. Development, land use change and erosion cause impacts on habitats in coastal regions which can lead to changes in the intertidal and marine environment.

Almost 28% of the coast has some form of artificial protection but 23.1% of the Welsh coast is still eroding[52]. Both erosion and coastal protection have the potential to affect designated sites, although natural change is usually positive. Over the next 100 years, 2,126 properties are at risk from erosion. If shoreline management plan (SMP) policies, which integrate the protection of habitats and people, are implemented this will significantly reduce to 145[53].

Rising sea-level and increased storminess are significant threats to coastal habitats and species, and work is ongoing to improve understanding of vulnerability to climate change and to inform an adaptive approach.

Shoreline Management Plans for Wales[54],[55],[56] aim to identify the most appropriate and sustainable policy options for management of the Welsh shoreline over the next 100 years, taking account of sea-level rise. Policy options are: 'No active Intervention', 'Managed Realignment', 'Hold the Line' and 'Advance the Line'. No active intervention and managed realignment policies are intended to enable the coast to respond to the changes in sea-level and for habitats to migrate landwards where possible. Implementation of 'Hold the Line' policies will cause loss of designated habitat features due to coastal squeeze (habitat being squeezed between hard defences and rising sea-levels, leading to loss of extent). These habitat losses or 'adverse effects' will require compensatory habitat to be delivered to ensure that the integrity

Designated Natura 2000 sites	Intertidal losses (Ha) in Wales			
	by 2025	Between 2025 and 2055	Between 2055 and 2015	Total by 2015
Severn Estuary SAC/SPA (England and Wales combined – approximately 1/3 of habitat loss is within Wales)	679	1388	3670	5737
Burry Inlet and /Carmarthen Bay SAC/SPA	59	163	411	633
Pembrokeshire Marine SAC	2	4	5	11
Lleyn Peninsula and the Sarnau SAC	40	150	111	301
Anglesey Coast Saltmarsh SAC	1	4	11	16
Menai Strait and Conwy Bay SAC	3	12	1	16
Dee Estuary SPA	0	140	454	594
Total	**784**	**1861**	**4663**	**7308**

Note: SAC = Special Area of Conservation; SPA = Special Protection Are

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Annex 2 - Proposition for the development of State of Natural Resources Reporting (SoNaRR)

Purpose

The purpose of this document is to set out Natural Resources Wales' (NRW) proposition for the development of the State of Natural Resource Report (SoNaRR) and the principles and approach we will adopt to deliver it. It describes our ambition to move from our current functionally aligned data and evidence, to a fully integrated approach – one that enables us to understand the opportunities and threats in ensuring resilient ecosystems and the sustainable management of natural resources in Wales. It will also allow us to understand the global context of natural resource management in Wales.

Background

The objective of the sustainable management of natural resources is to maintain and enhance the resilience of ecosystems and the benefits they provide, and in so doing, meet the needs of present generations of people without compromising the ability of future generations to meet their own needs.

The sustainable management of natural resources depends on having appropriate information available to support decision making at all stages, from policy development to implementation of action plans.

SoNaRR will provide a credible, evidence base for policy on how natural resources are managed and sustainably used to secure their long term capacity to deliver benefits. It will make available the information needed for Welsh Ministers to set priorities for action at the national level.

NRW will have a statutory duty to prepare and publish SoNaRR including its assessment of the extent to which sustainable management of natural resources is being achieved. The first SoNaRR will be published in accordance with the legislative timeframe provided in the Environment Bill.

Principles

SoNaRR will:

Set the scene by–

- Improving knowledge of the state of natural resources in Wales and the pressures on them.
- Helping us to better understand our dependence on natural resources, ecosystems and the services and benefits they provide.
- Assessing trends in the condition of our natural resources.
- Illustrating the condition and trends spatially at a known level of confidence.

Look ahead to–

- Identify the opportunities and improve understanding of the challenges, including gaps in evidence, for sustainable natural resource management.
- Help us to respond to the opportunities and challenges through scenario planning and option assessment.

Prompt change through-

- Clearly stating what the priority issues are for natural resources in Wales
- Providing decision-makers with timely information that they can use to learn from successes and failures
- Providing a seamless link between local and national data that truly informs and guides the whole community on how we care for the natural resources of Wales.
- Presenting open, accessible, easily understood information, relevant for all parts of society with responsibility for the sustainable management of natural resources in Wales.
- Recognising the role of independent oversight.

Catalyst for change

SoNaRR will:

- Inform the programme for Government, the National Natural Resource Policy (NNRP), and the National wellbeing goals.
- Inform Area Statements, which will provide the operational interpretation of the NNRP. Area Statements will translate the high level strategic priorities while taking account of local need, opportunities and pressures, leading to clearly identifiable local actions.
- Inform continuous response and adaption, or replacement of policies, strategies, programmes, plans, actions and investment decisions so that goals are realistic and natural resource management outcomes are continuously improved.
- Provide a common baseline of evidence to be used throughout Wales to inform decisions made by a range of stakeholders across society such as: businesses, social groups, the third sector and communities.
- Help members of society understand how their actions impact upon the natural resources of Wales and the benefits that they provide so even individuals can identify and prioritise the opportunities where they can make a real difference to shape the future for Wales.

Challenges

Natural Resource Management -

- Natural systems are very complex,highly variable and therefore unpredictable.
- The condition of natural resources is often slow to respond to management actions, taking many years to reverse negative trends.
- Interventions operate at different, spatial, temporal and institutional scales, with many organisations contributing.

Evidence and data -

- Currently our evidence and data relates to specific duties and responsibilities, largely to report to European Directives and therefore does not cover all relevant natural resources in Wales.
- Currently our evidence and data and the way we present it does not provide a full picture of Wales' ecosystems and the social and economic benefits we gain from them.

Approach to preparing SoNaRR

Collaboration:

- Developing collaborative partnerships across sectors and building robust mechanisms that facilitate the acquisition, management and sharing of data on natural resources and their benefits.
- Using an engagement plan to achieve an inclusive approach

Co-production:

- Build a consensus about the state of natural resources and the need for action from a range of stakeholders
- Develop a common analytical framework
- Public bodies will have a duty under the Environment Bill to provide information and assistance to NRW to produce SoNaRR, if requested.
- Work with stakeholders and partners to present the appropriate evidence and data in a relevant format for decision–making at various levels across society.

Evidence:

- Use the best available existing data,from NRW and other organisations.
- Recognise the gaps in our data.
- Take account of the various framework directives and the move in Europe to join data up in a better way, particularly through the EEA State and Outlook Report
- As new evidence comes to light, SoNaRR will be updated at the end of the year before each Assembly election, to allow every new Welsh Government to use the most up to date information.

The Journey

We are at the start of a journey on a route to integration, transforming the way we present and use our data and evidence over time. To manage this progression, there will be a staged approach to the development of SoNaRR.

Where we are now – what will the first statutory SoNaRR look like?

The first statutory SoNaRR will be prepared in 2016. It will present a clear statement on the state and trends of natural resources in Wales, based on the most up to date information in existing data sets. It will identify the gaps in data, which may need to be resolved through future evidence capture programmes. It will highlight the current, biggest pressures on natural resources in Wales. The first SoNaRR will be a report published on NRW's website.

Where we want to be in the longer term:

Our aim in the long term is to provide reports that will detail the changes in the state of natural resources over time. We will describe the outcome of work we and others have carried out to manage the environment in an integrated way, to ensure our ecosystems are resilient and that our natural resources are used wisely. It is expected the challenges facing Wales will evolve over time and the SoNaRR will provide the information to enable adaptation for this. Key action points and potential areas for change will be highlighted.

We will improve the way we present the evidence and data so that we clearly demonstrate the links between resources, benefits, opportunities, threats and actions. We will learn and adopt good practice identified through a review of approaches adopted by other countries and by the European Environment Agency.

We will develop SoNaRR so that in the future it is an accessible, recognised tool for a wider range of users, not only to assist in decision making at a range of scales but for communication and education about the sustainable management of the natural resources of Wales.

It is our aim to set-up a website to enable updates and introduce an interactive element to the reporting. It is hoped the website will, in time, become more interactive and allow automated updates of data from a range of sources, including the public, to give a real-time view of the current state of natural resources in Wales between the statutory reports.

Who will we need to work with?

Customer	Action or Change
Welsh Government Officials	• Use the evidence and information to help challenge policy and legislative "barriers"; identify new legislation; review, modify and improve policy and deliver integrated sustainable management of natural resources.
Ministers and Politicians	• To influence political, policy priorities and embed environmental measures into manifestos and the Programme for Government
UK Government, Treasury, Departments and Agencies	• To understand how the actions of others impact on Wales; to value the contribution of Wales and to provide more money for environmental issues in Wales.
Public Sector Bodies	• To better understand the dependencies on and benefits of ecosystem services, to enable more sustainable decisions based on environmental as well as socio-economic data; to deliver better informed local plans and planning and deliver their contributions to environmental outcomes.
Public Service Boards	• To inform the wellbeing needs assessment; to set wellbeing objectives and inform the Public Service Board plans.
Welsh Business including utilities	• To understand where they need to challenge and change their activities or identify opportunities for investment in actions that can contribute to the sustainable management of natural resources of Wales and beyond; help identify and drive opportunities to address market failures through sustainable management and operations.
Land Managers / Owners	• To understand they have a role to play to enact change across sectors and that they can save money through managing land sustainably.
NRW	• To inform management decision that focus on and prioritise development and investment in strategies, plans, delivery programmes and actions to deliver natural resource management outcomes.
Future Generations Commissioner	• To make recommendations for delivery of integrated public services (Well-Being goals) and to inform recommendations to public bodies and to inform the future generations report.
General public Anyone in position to effect change (environment, economic and social outcomes)	• To understand: the wide range of benefits and opportunities that resilient ecosystems provide; the big picture problems and how they relate to the issues and priorities in their community; how their actions impact on the state of natural resources and empower them to get

	involved and take personal responsibility to do something about it; where a change in their behaviour or their activity can play a part.
NGOs and Third sector organisations	• Help them identify where and how they can contribute; to prioritise and identify opportunities where their actions can make a real difference and where they need to work together or develop new integrated ways of working; identify additional evidence they can provide or collect to improve the evidence base for sustainable management of natural resources; influence the political and policy landscape in Wales.
Media	• Using the right information to get the right messages across that the environment is good for people
Children / young people	• Data and information to be used to engage, inform and educate so they can identify how their actions impact on state of natural resources and to engender enthusiasm to get involved.
Community councils	• To understand where and how they can deliver on the national priorities for sustainable management of natural resources as they address the issues and priorities in their local community.
Wales Audit Office	• To inform audit of NRW
Academia and Research Institutes	• To identify where they can provide evidence and fill gaps in data, provide advice and share knowledge and expertise.

Annex 3: Proposition for developing Area Statements

Purpose

The purpose of this document is to set out Natural Resources Wales' (NRW) vision for the development and implementation of Area Statements, and the principles and approach we will adopt.

Area Statements will be a key to driving decision-making in a local place, helping to integrate delivery and build more resilient ecosystems. This document describes the elements we need to consider to achieve this aspiration, drawing upon the strategic priorities and opportunities set out in the proposed National Natural Resources Policy (NNRP) produced by WG after publication of the first statutory SoNaRR.

Background

The objective of the sustainable management of natural resources is *to maintain and enhance the resilience of ecosystems and the benefits they provide, and in so doing, meet the needs of present generations of people without compromising the ability of future generations to meet their needs.*

The Environment (Wales) Bill sets the framework within which Area Statements sit. Driving forward meaningful change will depend on discussing and agreeing upon the ability of our natural resources to continue to deliver long-term benefits for the wellbeing of people and communities in Wales. This will need to draw conclusions on prioritised and targeted actions at the appropriate scale of intervention, and use evidence to support decision-making at all levels.

NRW will have a statutory duty to prepare, publish and implement Area Statements and to keep them under review. However, the sustainable management of natural resources is a shared responsibility and we are committed to working in collaboration with others from the outset in developing our approach.

The first Area Statements will be published after the publication of the NNRP, in accordance with the legislative timeframe provided in the Environment (Wales) Bill. In preparing Area Statements we will be mindful of the evidence needs of other planning processes, such as needs assessments under the Wellbeing of Future Generations Act, and land use plans (both Strategic and Local Development Plans).

Our Principles

Area Statements will:

1. **Capture the evidence base**

- Draw together the evidence we hold about that place to describe the key natural resources and the benefits they are currently providing.
- Describe how the natural resources in that place support the well-being goals.
- Identify the issues and opportunities in the area
- Identify any gaps in our evidence and work with other public bodies and partners to share information

2. **Look ahead**

- Consider potential threats and risks to wellbeing posed through likely future trends, scenarios and unpredictable events.
- Working with local stakeholders and partners think about the challenges this poses to current decision-making and opportunities that natural resource management provides to address these risks and threats.

3. **Prompt change and innovation**

- Provide decision-makers with timely information that they can use, learning from successes and failures of the past.
- Provide a link between local and national data that informs and guides the whole community on how we care for the natural resources of Wales.
- Recognise the role of different sectors, exploring their different perspective on issues and opportunities
- Develop innovative solutions to tackling environmental issues that deal with trade-offs and deliver multiple benefits.

4. **Drive delivery**

- Translate the high level strategic priorities while taking account of local need, opportunities, risks and pressures, leading to clearly identifiable local actions.
- Inform the priority for NRW's operational work at a local level, and be clear about the contributions that others can make.
- Provide a common baseline of evidence to be used throughout the wider public sector as well as informing decisions made by a range of stakeholders such as: businesses, social groups, charities and communities.
- Feed evidence back up to the National level, on the ongoing challenges, opportunities and priorities for the sustainable management of natural resources from the local perspective.

Challenges

- Managing expectations on the speed of change, as well as capacity and capability of NRW to lead – this must be a shared approach.
- Getting the key stakeholders on board and influencing decision-makers at the right scale and at the right times.
- Ensuring that national incentives and funding programmes align to meet the priorities identified through the development of Area Statements.

Our approach to preparing Area Statements

We are at the start of a journey, and we are committed to working and learning from others as we develop the approach.

Area Statements and scale:

- **Collaboration** - We will need to engage with stakeholders to help us decide on the right scale at which Area Statements should be developed.
- **Good practice** - We will draw on learning in Wales and the UK from catchment approaches to managing the water environment, as these have already begun to consider landscape scale solutions to tackle difficult issues such as diffuse pollution.

- **Form follows function** - It is important that we retain flexibility to focus on the appropriate scale for addressing the priorities identified in the National Natural Resource Management Policy.
- **Adapting our evidence -** We recognise that the underpinning environmental evidence used to prepare Area Statements will often be at a catchment or a landscape scale as this reflects the monitoring data we hold. But we accept we will need to translate this to different spatial scales to make it more meaningful and compelling for the people, communities and decision makers who we need to work with when implementing NRM.

Learning from the trials:

Drawing on the learning from our three area trials we will need to consider:

- Who we need to work with and who we are trying to influence.
- How ecosystems function in complex ways – ensure that interventions at the right scale provide the maximum benefits to environment, cultural, social and economic considerations. This will very much depend on the particular issues or opportunities being considered.
- Reflect places that are relevant and meaningful to people – the relationship between people and the land and sea will be crucial to building understanding, trust, and valuing the benefits.
- Consider the resources available to both NRW and key stakeholders to deliver Area Statements in an efficient and effective manner.

Once areas have been agreed, we will:

- Identify key stakeholders and establish an engagement plan to help us achieve an inclusive, deliberative approach
- Undertake a review of existing plans, programmes and strategies – to identify current actions and opportunities for integration
- Use the best available existing data and evidence, including that held by other organisations. Recognise the gaps in our data and where other sources of evidence can help address those, including stakeholder opinion and local knowledge.
- Produce, with others, an assessment of the options for addressing the relevant key priorities and opportunities identified in the National natural resources policy, working with public service boards to include local well-being needs, and shape well-being plans.
- Co-produce a document that prioritises actions and opportunities that delivers within this context

We envisage that the final document will be clear on the priority actions, risks to, and opportunities for enhancing natural resources, the resilience of ecosystems, and securing their long-term benefits, as well as who needs to be involved in their management.

We will continue to work with others to ensure this information is provided in a format that is best suited to its purpose.

Who will we need to work with?

Customer	Action or Change
WG Officials	• Use Area Statements to refine Wales' priorities / context • Inform policy from learning about local issues. Support the process • Consider changes to policy if necessary • Reflect who national issues manifest themselves at a local scale to inform policy implementation options (in second cycle) • Produce a policy framework that enables delivery – align incentives
NRW	• Facilitate the process • Inform decision making, priority setting and resource allocation, drawing on both NRW's & partners knowledge • Reflect the local context to enable integrated action • Look for multiple benefits in all work areas • Drive alignment of other plans with NNRP and AS • See the big picture – manage and regulate for priorities that drive resilience and wellbeing rather than one or two narrow environmental outcomes • Bring experience and skills to the table • Deliver the outcomes – both ourselves and with others
NRW Board Members	• Help to act as ambassadors of the area statements – build relationships with business and other sectors
Public Service Boards	• To inform the wellbeing needs assessment and to set wellbeing objectives within PSB plan • Influence public service delivery plans and our plans (two way)
Local Planning Authorities	• Help them to set out the constraints and opportunities for land use planning (and the acceptable conditions for development – i.e. well designed) • Influence planning decisions
Local Authorities	• Help them to work more collaboratively and provide the evidence needed to consider the multiple benefits • To influence local authorities to deliver more with the natural resources within their control. Refer to area statements in their own plans. Recognise the long-term financial benefits of better natural resource management.
Land Managers / Owners – reflecting the differences (e.g. agriculture, forestry)	• Understanding they have a key role to play, work with their interests at the heart of the sustainable management of natural resources • Change land management to move towards better ecosystem resilience, economic and social resilience too, in a way that continues to support agriculture and forestry.

Business, industry, utilities companies and renewable energy sectors	• To identify opportunities to support and develop green local economy, value added, closed loops. • Being specific about opportunities and constraints
Health Sector / Health Boards	• Help target interventions to pool resources and maximise mental and physical health benefits. • Actively use the environment as a resource for improving well-being – for example, to consider outdoor spaces as part of exercise referral process. Recognise the benefits of good quality green space to health and wellbeing.
Local Communities (being clear about who we mean in each case)	• Get a better understanding of their place and what makes it tick • Gain buy in and support & understand trade offs – demonstrate that they have a stake and interest • Reflect their needs, what they consider important and inspire engagement / desire to get involved • Influence them to recognise the benefits of a better managed environment, and inspire them to get involved • Help communities to achieve wellbeing through appropriate sustainable use of local natural resources
NGOs Third sector organisations	• Identify opportunities where their actions can make a real difference, help them prioritise • Raise awareness of local issues and opportunities • Be involved in the process, in delivery, and bring in expertise and experience • Focus attention and resources where it will have most benefit • Influence work programmes and direct effort towards the local priorities and issues. Encourage them to look for multiple benefits & recognise the need for trade offs.
Recreation users	• Help understand resources available to them. • Help to better manage conflicts between users
Local education authority / higher education / outdoor education providers	• To provide the place based context for environmental education • To help understand the interactions between local environment, social and economic factors – e.g. where money is unnecessarily leaking from the local economy – to drive behaviour change
Academic and Research institutions	• To help target gaps in knowledge
Funders	• Influence future investment